TINA RIVER HYDROPOWER DEVELOPMENT PROJECT

Environmental and Social Impact Assessment

Annexures and Appendices

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Annexures

APPENDICES

ANNEXURES

This report includes all Annexures to the ESIA Main Report. It contains valuable information such as minutes of meeting, photoplates of fishes, list of aquatic insects, etc. Annexure sequence in this report is classified in a chronological order and reflect the time at which information was gathered or obtained.

Station A1	**Voraha/Becho river**	05/08/2013

Location

Coordinates: S9°35.713 - E160°01.676

River : Voraha River (= Becho river)

Kp: 38.1km from the river mouth

Elevation: approx. 300m asl

River section: Upper Tina river

Nearest village: no village in the vicinity

Location: Station A1 is located on the Voraha/Becho river approx. 200m upstream of the confluence with the Mbembea river and 1km upstream of the TRHDP gauging station

The river seems to be designated either as Voraha or Becho (= Bicho, Mbicho) which are the two main tributaries.

The confluence with Mbembea river forms the Tina river.

Access: helicopter drop at Gauging station + upstream walk

Physical environment

Valley geomorphology : at station A1, the valley is oriented East to West. The valley is quite narrow upstream of the Voraha/Becho confluence, with gorges along the two tributaries. It becomes progressively wider downstream, from the Voraha/Becho confluence to the Mbeambea confluence.

River system: At station A1, the Voraha/Becho river drains approximately two third of the gauging station watershed. Two main tributaries, Vohana river, from the East and Becho river from the South, collect a dense fanlike network of fast flowing streams on the nortern slope of the Popomanaseu ridge oriented NW to SE (Mt Mbutohaina, 1649m, to Mt Turipukumlani, 1636m) and covered with cloud forest.

Banks & river bed: At station A1, the river bed is 15m in width. The right bank (bedrock) is very steep with a waterfall, whereas the left bank (boulders and cobbles) presents a slope of about 20% The substrate is dominated with cobbles from different origins. Presence of wood detritus.

Flow pattern: Sloppy river with high velocity. The river upstream of the confluence shows a long ladder of pools and running/riffle waters on a bed of pebbles. The velocity of the station, observed on a 10m radius, is 0,6-2,5m/s on running and riffle areas.

Water depth: ranging 0 to 1m during the visit. High water marks were observed 4m above the river.

Water quality: the water was clear (0,61NTU) although there was rain the day before. No source of pollution on the watershed. Conductivity was low (166,3µS/cm).

Biological environment

Riparian vegetation: Rain forest on the slopes with giant ferns. Large deposit areas with regrowth (trees and shrubs). Banks are shadowed with a dense cover of riparian trees.

Aquatic vegetation: no aquatic plants or development of green algae.

Fish: rheophilic gobies are dominant with 5 species observed: *Stiphodon semoni* & *S. rutilaureus*, *Awaous sp1 & sp2,* and *Sicyopterus sp*. Large specimen of other species are likely to be found in pools, due to considerable distance from communities.

Human activities

The area in uninhabited (no domestic use & associated pollution) and beyond every day reach of Tina river communities. Though people from Tina occasionally access the place for hunting and fisheries (snorkeling and pole line fishing). No evidence of logging activities in the area.

Potential impacts of the project on river ecology & resources

The Voraha/Becho river at station A1 is situated upstream of the future reservoir and dam construction work area, whatever the selected final option. The river physical conditions (flow pattern, velocity, water quality …) should not be affected by construction and exploitation.

Impact on fish migration: amphihaline fish juveniles will encounter difficulties to pass upstream of the hydropower facilities and colonize the upper watershed, depending on their specific migrating abilities and on the implementation of an efficient fishpass system. Combined with an increased fishing pressure due to an easier access, a significant impoverishment of aquatic live is expected in the Voraha & Becho rivers.

Station A1	Voraha/Becho river	05/08/2013

1A. Waterfall on the right bank of station A1

1B. Pool at the waterfall upstream station A1

1C. Fish sighting at station A1

1D. View of the substrate at station A1

1E. Rapids immediately downstream of stat.A1

1F. Detail of the bank (bedrock)

1G. Voraha river upstream of the confluence

1H. Voraha-Mbembea confluence

Station A2	**Mbembea river**	05/08/2013

Location

Coordinates: S9°35.751 - E160°01.842

River : Mbembea

Kp: 37.96km from the river mouth

Elevation : approx 300m asl

River section : Upper Tina river

Nearest village: no village in the vicinity

Location:

Station A2 is located on the Mbembea river approx. 100m upstream of the confluence with the Voraha/Becho river and 800m upstream of the TRHDP gauging station

The confluence with Voraha/Becho river forms the Tina river.

Access: helicopter drop at Gauging station + upstream walk

Physical environment

Valley geomorphology : the Mbembea valley, oriented South to North, is quite narrow upstream of station A2 and becomes larger at the confluence area.

River system: At station A2, the Mbembea river drains approximately one third of the Tina watershed at the gauging station. The river collects a dense network of fast flowing streams from the western part of the ridge (Mt Turipukumahi, 1636m to Mt Popomanaseu 2310m), covered with cloud forest.

Banks & river bed: At station A2, the river bed is estimated 7m in width. Big boulders (5m high) are dominants. The substrate is made of cobbles, pebbles and coarse sands, with some detritus of wood and leaflet from upper reach of the river. Banks are very steep on both sides ("V" shaped valley).

Flow pattern: Sloppy section with high velocity (estimated to more than 2m/s). Succession of fast running sections and pools due to the boulder arrangement. The flow is less important than in the Voraha/Becho river.

Water depth: up to 3m in pools. High water marks were observed 4m above the river level.

Water quality: the water was clear (1,07NTU) although there was rain the day before. No source of pollution on the watershed. Conductivity was low (135,7µS/cm).

Biological environment

Riparian vegetation: Rain forest on the slopes. The river is partially shadowed with a dense cover of riparian trees. Creeping plants on the gorges. Regrowth trees and shrubs on lateral deposits.

Aquatic vegetation: No aquatic plants. Development of green algae from natural dissolved nutrients have been observed in shallow & calm places along the bank.

Fish: rheophilic gobies are dominant with 2 species observed: *Stiphodon semoni* & and *Sicyopterus lagocephalus*. Large specimen of other species are likely to be found in pools, due to considerable distance from communities.

Human activities

The area in uninhabited (no domestic use & associated pollution) and beyond every day reach of Tina river communities. Though people from Tina occasionally access the place for hunting and fisheries (snorkeling and pole line fishing). A shelter has been built on the left bank, between the confluence and the gauging station.

No evidence of logging activities in the area.

Potential impacts of the project on river ecology & resources

The Mbembea river at station A2 is situated upstream of the future reservoir and dam construction work area, whatever the selected option (6E or 6F). The river physical conditions (flow pattern, velocity, water quality …) should not be affected by the project construction and exploitation.

Impact on fish migration: amphihaline fish juveniles will encounter difficulties to pass upstream of the hydropower facilities and colonize the upper watershed, depending on their specific migrating abilities and on the implementation of an efficient fishpass system. Combined with an increased fishing pressure due to an easier access, a significant impoverishment of aquatic live is expected in the Mbembea river.

Station A2	Mbembea river	05/08/2013

2A. Rapids on a bed of boulders

2B. Crossing a pool

2C. Ferns growing on cobble deposit

2D.Green algaes in a pool near the shore

2E. Fast flowing section, pebbles & bedrock

2F. Becho-Mbembea confluence (aerial view)

2G. Shelter on the left bank near the confluence.

2H. Becho-Mbembea confluence

Station A3	**TRHDP gauging station**	05/08/2013

Location

Coordinates: S9°35.698 - E160°02.036

River: Tina

Kp: 37.14km from the river mouth

Elevation: 267m asl

River section: Upper Tina river

Nearest village: no village in the vicinity

Location:

Station A3 is located on Tina river at the TRHDP gauging station, approximately 1 km downstream from the confluence of the two tributaries Voraha/Bocho and Mbembea which forms the Tina river.

Access: helicopter drop just near the station

Physical environment

Valley geomorphology: downstream of the Voraha/Mbembea confluence, the Tina valley, first oriented E-W, enlarges at the gauging station, forms a horse-shoe meander immediately downstream, and turns to a N/N-E direction, entering into a very steep and deep section of gorges for about 5km.

River system: At the gauging station, the Tina river drains a watershed of 115km2 and collects a dense fan-like network of fast flowing streams from the Mt Mbutohaina-Mt Popomanaseu ridge (cloud forest).The station is situated 20m from the Njarimbisu waterfall into the Tina river.

Banks & river bed: At station A3, the width of the river is approx. 40m. The substrate is dominated by gravels and coarse sand, plus cobbles and pebbles. Upstream of the gauging station, the right is made of bedrock, whereas the left bank presents an accumulation of boulders with regrowth vegetation, forming a flood channel. A pond of stagnant water isolated from the river was observed in the middle of this channel (6m in length and 0,8m in width).

Flow pattern: At the gauging station, the river forms at large and long pool with a frange of coarse sand deposit, framed upstream and downstream by rapid sections on a bed of small boulders. The average velocity was estimated 1-2 m/s. At the gauging station, TRHDP monitoring 2010-2012 gives an average flow of 13,2m3/s.

Water depth: up to 3m in the external side of fast flowing sections.

Water quality: the water was clear (0,98NTU) although there was rain the day before. No source of pollution on the watershed. Conductivity was low (154,7µS/cm).

Biological environment

Riparian vegetation: Rain forest on the slopes. The vast area clear of vegetation, with sunlight allows a drop zone. Steep gorges are cover with trees and creepy vegetation. Regrowth trees, shrubs and ferns on deposits.

Aquatic vegetation :No aquatic plants. Development of green algae from natural dissolved nutrients have been observed in localized puddles among boulder accumulations.

Fish: rheophilic gobies are dominant with 4 species observed: *Stiphodon semoni, Redigobius sp* and *Stenogobius sp. Kuhlia rupestris* was observed in deep waters. Large specimen of other species are likely to be found in pools, due to considerable distance from communities. The isolated pond among boulders showed an important biodiversity, with an eel (30cm) and 2 species of prawns – rarely observed by day - freshwater shrimps, *semoni* and other gobiids (*Glossogibius*, *Stenogobius ...)*

Human activities

The area in uninhabited (no domestic use & associated pollution) and beyond every day reach of Tina river communities .The area is occasionally accessed by the project office to collect hydrology data from the gauging station, and by local people for hunting and fishing. No evidence of logging activities.

Potential impacts of the project on river ecology & resources

The Tina river at station A3 is situated upstream of the future dam construction work areas (option 6E or 6F) and the water quality will remain undisturbed during implementation phase. The end of reservoir is expected to extend at a short distance downstream of the gauging station, but no disturbance on water level and hydrology is expected.

Impact on fish migration: amphihaline fish juveniles will encounter difficulties to pass upstream of the hydropower facilities and colonize the upper watershed, depending on their specific migrating abilities and on the implementation of an efficient fishpass system. Combined with an increased fishing pressure due to an easier access, a significant impoverishment of aquatic live is expected in the rivers upstream of the dam.

Station A3	TRHDP gauging station	05/08/2013

3A & 3B. Tina river downstream of the Voraha- Mbembea confluence (boulders and rapids)

3C. Upstream of gauging station – large pool

3D. The gorges upstream of gauging station

3E. Gauging station – limnimetric scale

3F Gauging station – solar panels

3G. Tina river downstream of gauging station

3H. View of the gorges downstream of A3

New Station	7C Dam site	26/02/2014

Location

Coordinates: S 09°33'32.01"-E 160°03'28.01"

River: Tina

Kp: 30 km from the river mouth

Elevation: approx. 230m asl

River section: Middle Tina river

Nearest village: Choro

Weather condition: The weather was fine with few isolated showers during the late afternoons. Cloud cover was 40% with winds blowing SSE direction.

Location:

New Station is located on Tina river about 0.8 kilometer from Choro hamlet.

Access: by car up to the village of Mangakiki, then by walk upstream following the river or by chopper from Henderson Airport.

Physical environment

Valley geomorphology: The new station is upper Choro hamlet. It has a gorge from 160 meter (asl) to about 300 meters on either side of the river. From Njaribisu (gauging station) there is a terrain of 4-5 kilometers contour of high region (300-500 meters), stretching north east towards the Koropa and Senge gorge identified as 6E and 6F dam site options.

River system: No streams confluences with Tina River in this station.

Banks & river bed: The width of the river is approximately 10m. The banks have a 80% slope on each side with bedrock at 45° to the river, 20%pebbles/cobles deposit and10% of boulders.The substrate is of cobbles, pebbles, coarse and fine sands. There is absents of silt and mud at the station

Flow pattern: runs and riffle on a bed of cobbles, with deep water (2-3m) on the external side of meanders. Velocity is estimated 0,5 to 1m/s.

Water quality: the water was clear. Water temperature range estimated to 20-25°C

Biological environment

Riparian vegetation: The forest is defined undisturbed due less people accessing the area. The vegetation is disturbed in between the gorges (about 1-2 meters either sides). Along the 80% slope there potential large *Pometiasp*, *Callophylumsp*, that were used as commercial trees also ginger plants, shrubs and ferns..The station is partially covered canopy.

Aquatic vegetation: No aquatic plants. No pollution from anthropogenic activities, however few on the sides due to the influence of the terrain and vascular plants i.e. localized runoffs.

Fish: the observed biodiversity was high (10 species), with observations by day and night. *Khulia rupestris* and *Stiphodon birdsong* were dominant. Other gobiids are present (*Redigobiusbikolanus, Redigobiussp, Awaousocellarus, Glossogobius sp.*) as well as *Mesopristisspp, Khulia rupestris. Anguilla marmorata*.

Human activities

There were less people accessing the area unless for hunting and fishing (spear fishing). Such activities were done twice maybe in a month, depending on community activity demands for freshwater foods and bush foods. There were no any other usages of the vegetation since then.

Potential impacts of the project on river ecology & resources

The station is the dam site and operations may affect the riverine system. This includes, heavy machineries, labor personals, cutting of trees which will increase sedimentation in rainy times. This will happen during the construction and exploitation stage.

Once the dam will be built, the hydrological conditions in this area will be completely modified (reservoir upstream, artificial outflow downstream). This applied to several kilometers from up and downstream of the dam.

Water quality before at and after the dam will deteriorated in the first months and years of construction and during exploitation stage (organic matter in the reservoir (high nutrients) , deoxygenated water at the bottom of the reservoir, possible release of NH4, As, Hg, CH3…).

Significant impacts are expected on aquatic biodiversity especial the migration fish upstream and downstream for feeding and spawning and resources for subsistence fishing. Though, a new fishery resource should develop in the reservoir.

New Station	7C Dam site	26/02/2014

1. View from top

2. View from Chopper

3. Viewing boulders from upstream

4. Right bank cobbles and pebbles. The mid reach of the 7C.

Station A4	**Koropa**	01/08/2013

Location

Coordinates: S9°33.184 - E160°04.868

River: Tina

Kp: 28.29km from the river mouth

Elevation: approx. 140m asl

River section: Middle Tina river

Nearest village: Koropa

Location:

Station A4 is located on Tina river at the village of Koropa

Access: by car up to the village of Mangakiki, then by walk down to the river

Physical environment

Valley geomorphology: Upstream of Choro, the valley has leaved the long section of deep and steep gorges extending on 5km from the gauging station. The Chorro to Habusi section, oriented in a general N-E direction, forms important meanders with gorge passages identified as potential dam sites (options 6E and 6F), in alternance with open sections with vegetated deposits.

River system: In the vicinity of station A4, the Tina river receives two secondary tributaries (Koropa and Pihu)

Banks & river bed: The width of the river is approximately 15m. The banks have a 50% slope on each side with bedrock, pebbles/cobles deposit and a few boulders.The substrate is of cobbles, pebbles, coarse and fine sands. Locally silt and muddy areas at the confluence of the two tributaries.

Flow pattern: runs and riffle on a bed of cobbles, with deep water (2-3m) on the external side of meanders. Velocity is estimated 0,5 to 1m/s.

Water quality: the water was clear. Water temperature range estimated to 20-28°C

Biological environment

Riparian vegetation: The forest is defined disturbed due to people accessing the area for timber extraction and gardening. The vegetation along the river is dominated with regrowth trees, ginger plants and shrubs. An endemic piper tree was observed in the area. The sampling station had an open canopy cover.

Aquatic vegetation: No aquatic plants. Evidence of pollution with green algae possibly due to timber mills and localized runoff.

Fish: the observed biodiversity was high (10 species), with observations by day and night. *Khulia rupestris* and *Stiphodon birdsong* were dominant. Other gobiids are present (*Redigobius bikolanus, Redigobius sp, Awaous ocellarus, Glossogobius sp.*) as well as *Mesopristis spp. Anguilla marmorata*, and *Gymnothorax sp.*

Human activities

Excepted an isolated house at Choro (2km upstream) Koropa is the most upstream inhabited village along the Tina river, with two families (43 members). The village is situated on the right bank

Local people use the river for bathing, fishing, crossing point, water collection and recreational,

Small scale logging using chain saw. The timbers from Koropa were transported using the river to the nearly road at Tina village

Potential impacts of the project on river ecology & resources

Koropa, situated in the immediate vicinity of the dam site (option 6E or 6F), will be heavily affected both during construction and exploitation phases.

Once the dam will be built, the hydrological conditions in this area will be completely modified (reservoir upstream, artificial outflow downstream)

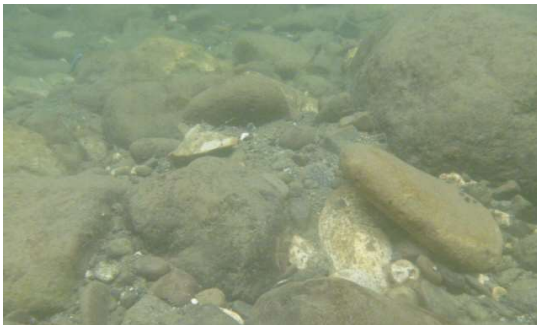
Water quality at the dam foot is likely to decrease both at construction stage (increase of suspended matter due to works on the slopes and in the river ; risk of pollution due to oil spill, cement leaching, wastewaters from workers camp…) and during exploitation, especially in the first years (degradation of organic matter in the reservoir, desoxygenated water at the bottom of the reservoir, possible release of NH4 …).

Significant impacts are expected on aquatic biodiversity and resources for subsistence fishing. Though, a new fishery resource should develop in the reservoir

Station A4	Koropa	01/08/2013

4A. The Tina river at Koropa (station A4)

4C. View of the banks (bedrock/ cobble deposit)



4D. View of the substrate at station A4

4E. View of the river at station A4

4F. Riffle on a bed of cobbles

4G. Riparian gardens near Koropa

4H. House near Koropa

Station A5	**Senge**	01/08/2013

Location

Coordinates: S9°32.964 - E160°04.904

River : Tina

Kp: 27.69km from the river mouth

Elevation : 133m asl

River section : Middle Tina river

Nearest village: Senge

Location:
Station A5 is located on the Tina river, at the village of Senge

Access: by car up to the village of Mangakiki, then by walk down to the river on a very steep slope.

Physical environment

Valley geomorphology: Upstream of Choro, the valley has leaved the long section of deep and steep gorges extending on 5km from the gauging station. The Chorro to Habusi section, oriented to a general N-E direction, forms important meanders with gorge passage identified as potential dam sites (options 6E and 6F)

River system: In the vicinity of station A5, the Tina river receives the Senge, a secondary tributary on the left bank. Senge is also the name of the village.

Banks & river bed: The width of the river is approximately 15m. The side slopes are 40% on the left bank (were the village is located) including boulders and 10% slope on the right bank, The substrate is dominated by large deposits of cobbles and pebbles, with locally coarse sand and vegetal detritus (leaflet and tree branches).

Flow pattern: During the survey, the velocity ranged approx. 0,5 to 2m/s. During floods and wet season, the water overflows towards Senge village which is 2m above.

Water depth : cross sectional depth in front of Senge ranges 0,2 to 3m.

Water quality: the water was clear.

Biological environment

Riparian vegetation: The forest is defined disturbed due to people accessing the area for timber extraction and gardening. The regrowth vegetation on the flat area is of *Saccharum sp*. The sampling station had an open canopy cover.

Aquatic vegetation :No aquatic plants. Film of brown algae on the rocks.

Fish: the biodiversity was high (about 15 species observed or mentioned by local fishermen) with dominance of *Stiphodon semoni*. Other species were gobiids (*Stiphodon rutilaureus, Sicyopus sp., Lentipes*, *Awaous ocellarus, Redigobius sp., Glossogobius sp.*), *Ophielotris sp., Anguilla marmorata, Kuhlia rupestris, Mesopristes cancellatus* and prawns (*Macrobrachium lar)*.

Human activities

Senge, situated on the left bank, approx. 500m downstream of Koropa, is occupied by more than 10 peoples (4 houses). A shelter has been installed fo ecotourists. The village use the river for drinking water, bathing, fishing, crossing point and washing.

Logs from timber extraction upstream (Choro/Koropa area) are lying on the flat area. Evidence of small scale logging using chain saw.

Potential impacts of the project on river ecology & resources

Senge, situated in the immediate vicinity of the dam site (option 6E or 6F), will be heavily affected both during construction and exploitation phases.

Once the dam will be built, the hydrological conditions in this area will be completely modified (reservoir upstream, artificial outflow downstream)

Water quality at the dam foot is likely to decrease both at construction stage (increase of suspended matter due to works on the slopes and in the river ; risk of pollution due to oil spill, cement leaching, wastewaters from workers camp…) and during exploitation, especially in the first years (degradation of organic matter in the reservoir, desoxygenated water at the bottom of the reservoir, possible release of NH4 …).

Significant impacts are expected on aquatic biodiversity and resources for subsistence fishing. Though, a new fishery resource should develop in the reservoir.

Station A5	Senge	01/08/2013

5A. The Tina river downstream of Senge

5B. The Tina river upstream of Senge

5C. Riffle on a bed of cobbles

5D. Fish survey at station A5

5E. Evidence of logging along the path to Senge

5F. Large deposit of pebbles in front of Senge

5G. Option 6 dam site between Senge & Habusi

5H. Idem 5G, downstream view

Station A6	**Toni river at Kathihana**	30/07/2013

Location

Coordinates: S9°31.419 - E160°07.449

River : Toni

Kp : 19.81km from the river mouth

Elevation : approx 90m asl

River section : Lower Tina/Toni

Nearest village: Kathihana

Location:

Station A6 is located approx. 800m upstream of Tina-Toni confluence and 12km upstream of Ngalimbiu bridge (same place as station D ; Entura, 2010)

Access: by car up to Horohutu, then by walk along the river

Physical environment

Valley geomorphology: The Toni river valley, approximately 15km long between Chupu Kama Mounts and the confluence, is located between the Tina valley and the Matepoto watershed where Goldridge mining facilities are implemented.

River system: the Toni river is the major tributary of the Tina river. Both rivers flow parallel and converge to form the Ngalimbiu river.

Banks & river bed: The width of the river at station A6 was not more than 5m. The right bank is 10% whereas the left bank has a 70% slope, used as access point by the village of Kathihana. The confluence is an area of important deposit with a dominance of cobbles/pebbles of diverse geological origin, gravels and coarse sand. At station 6, evidence of vegetal detritus (leaves, branches and logs) from past weeks flood were observed.

Flow pattern: the lower course of Toni river presents pool and riffle with a velocity estimated to 0,1-0,6m/s. High water marks were estimated 2-3m above the river level.

Water depth: ranging 0,2 to 1m across the section.

Water quality: the water was slightly turbid (9,7NTU) due to rain on the last day of survey. Conductivity was significantly higher than in Tina river (243,8µS/cm).

Biological environment

Riparian vegetation: the sampling station was partially covered with vegetation (riparian forest with shrubs grasses and ferns).

Aquatic vegetation :No aquatic plants. Algal development observed locally among cobbles at the confluence (probably associated with domestic uses).

Fish: about 10 species were observed underwater (*Stiphodon semoni*, other sicyaniid gobies, pipe fish *Microphis lepsis*, *Kuhlia rupestris, Mesopristes cancellatus*) or in fisherman catches (mullet *Liza vaigensis* + 2 rock-sucker gobies: *Hypostomus plecostomus* & *Glossogobius sp*.).

Human activities

The village of Kathihana is located on the left bank of the Tina/Toni confluence

People form Kathihana use the river for bathing, washing, fishing, crossing point, water collection (observation of small pits dug into the gravel bank) and recreation. A fisherman, using spear and goggles, was met on the river.

Though Goldridge mining perimeter officially encompasses a part of the upper Toni watershed, there is no mining activities in this area.

Floating boards observed on the bank are an evidence of logging activity on the watershed. Presence of pig-rearing in the area.

Potential impacts of the project on river ecology & resources

This main tributary will not be affected by the project (no direct impact of the hydroelectric facilities, either on water quality or hydrology).

The Toni river will remain free of obstacle from the upper reach to the mouth and might represent a refuge for amphihaline species colonizing the upper watershed.

Station A6	Toni River at Kathihana	30/07/2013

6A. Toni river upstream of station A6

6B. The banks near station A6

6C. Riparian gardens near Kathihana

6D. Floating boards from logging activity

6E. Erosion cliff on the right bank

6F. Detail of the vegetation on the cliff

6G. Algal development at the confluence

6H. Drinking water pit dug in the gravels

Station A7	**Horohutu**	30/07/2013

Location

Coordinates: S9°30.546 - E160°07.160

River: Ngalimbiu

Kp: 16.12km from the river mouth

Elevation: 35m asl

River section : Upper Ngalimbiu

Nearest village: Horohutu & Vuramali

Location:

Station A7 is located in front of the village of Horohutu, approximately 1km downstream of the Tina-Toni confluence and 10km upstream of Ngalimbiu bridge

Access: by car

Physical environment

Valley geomorphology: Downstream of Senge, the Tina valley, oriented to the N-E direction, enlarges progressively until reaching the coastal plain at Ngalimbiu. The large meander at the Toni/Tina confluence (Valekotcha-Horohutu section) is filled with material deposit (cobbles and gravels).

River system: the Ngalimbiu resulting from the junction of Tina river and Toni river, has a length of about 19km from the confluence to the sea.

Banks & river bed: The river is approximately 100m in width.The banks with a 10% slope on each side are made of cobbles, pebbles, coarse and fine sand, with locally muck mud and detritus from nearby gardens. Extended cobble deposit on the right bank. Substrate in the river bed is dominated by cobbles, lying on gravels and coarse sand. The width has small billabong areas which defined unstable movement of the waterway. Since 2010, it has shift twice as mentioned by local communities.

Flow pattern: pool and riffle areas on a bed of cobbles. The velocity is estimated to 0,5-1m/s. High water mark observed at 1,5m above the river level.

Water depth: ranging 0,3 to 1m across the section.

Water quality: the water was clear during the field work. Conductivity was 173µS/cm. The water was slightly turbid (6,87NTU). In late afternoon, following a heavy rain, the river level raised for more than 20cm, and a stripe of very turbid water, 3m in width was visible along the shore.

Biological environment

Riparian vegetation: Gardens and vegetation (grass and trees) on the banks. No canopy cover on the river.

Aquatic vegetation :No aquatic plants. The film of algae on the cobbles was the evidence of nutrients input from domestic or natural origin.

Fish: the diversity of fish was poor compared to the previous stations. *Stiphodon semoni* was dominant and *S. rutilaureus* was present. Evidence of high fishing pressure.

Human activities

The two villages at station A7 are Horohutu on the left bank and Vuramali on the right bank People use the river for bathing, fishing, crossing point, water collection and recreation.

Farming activities increasing along the upper Ngalimbiu river (pig rearing and gardening).

Potential impacts of the project on river ecology & resources

Horohutu being located approximately 10km downstream from the dam site (option 6E or 6F), impacts will be less important than in Senge/Habusi area, located close to construction area, immediately at the dam foot. The distance from the dam site will contribute to mitigate water quality degradation to a certain extent, with auto-purification / oxygenation of outflow waters from the dam and waste waters from the worker camp, plus dilution with Toni river discharge.

Though, the risk of significant TSS increase, oil spills and fecal contamination is likely to occur during construction, with possible impacts on aquatic biodiversity, subsistence fisheries and domestic uses of the river.

The artificial flow pattern (daily variations, flush outflow) might have incidence on human activities and security if no mitigation measure ins implemented.

Station A7	Horohutu	30/07/2013

7A. Ngalimbiu river upstream of Horohutu

7B. Ngalimbiu river downstream of Horohutu

7C. View of the right bank in front of Horohutu

7D. View of the left bank – vehicle access

7E. Houses along the bank at Horohutu

7F. Domestic use of the river

Station A8	**Ngalimbiu bridge**	02/08/2013

Location

Coordinates: S9°27.439 - E160°08.747 River: Ngalimbiu Kp: 7.76km from the river mouth Elevation: 33m asl River section: Lower Ngalimbiu Nearest village: Ngalimbiu	Location: Station A8 is located at Ngalimbiu bridge, crossing point of the main road, approx. 20km West of Honiara Access: main road

Physical environment

Valley geomorphology: The river flows and forms meanders across the lowland plain. The general N/N-E direction turns to a North direction after the bridge.

River system: no visible tributary in the area - the river channel is probably connected to the alluvial aquifer and to a network of agricultural drainage ditches (drainage of plantations)

Banks & river bed: The width of the river is approximately 15m. The side slope were 20% on the left bank and 30% on the left bank. The observed granulometry is far smaller than on the upper reaches of the river. Substrate is dominated by sands and gravels, accumulating on the right bank (very few cobbles). Presence of trunks downstream of the bridge.

Flow pattern: running waters & riffle. Velocity is estimated to 0,7m/s. Near the bridge, pools of stagnant water separated from the main channel were visible, due to piles and accumulation of wood detritus.

Water depth: ranging 0,1 to 1,5m across the section. High water marks were observed 2m above the river level.

Water quality: the water was slightly turbid during the field work (5,1NTU) due the “spiral effect” (development of primary productivity in the lower reaches of river from degradation of organic matter further upstream) and/or to the number of human settlements downstream of the Tina Toni confluence. Conductivity (186µS/cm) was not very different than those at the gauging station.

Biological environment

Riparian vegetation: Dominant riparian vegetation are the paper mulberry tree and *Saccharum sp* (grass) with fern also. The sampling station had no canopy cover. Aquatic vegetation: No aquatic plants.

Fish: 5 observed species: 3 Gobidae (*Stiphodon semoni, S. birdsong* and *Awaous sp.*), *Eleotris sp. and Opheleotris sp.* Tadpoles in the pool (probably cane toad). Tilapias and eels were mentioned as present by local people.

Human activities

The Ngalimbiu bridge, crossing point of the Ngalimbiu river by the main road, was destroyed by the cyclone Namu. A new bridge was built in 1986 and rehabilitated in the late 90’s by Ross mining.

The area is accessible for most people of Honiara and Guadalcanal and used for washing of trucks and clothes, bathing, recreation, etc.

Important accumulation of logs and tree branches upstream of the bridge piles.

The village, located upstream of the bridge, is rather important with several houses along the banks. Approx. 20 m from the left bank is the Ngalimbiu Guadalcanal sub-station.

Potential impacts of the project on river ecology & resources

Ngalimbiu bridge being located approximately 25km downstream from the dam site (option 6E or 6F), impacts of the dam will be less important than immediately at the dam foot, due to auto-purification and dilution by discharge of Toni river and small tributaries.

Though, the risk of significant TSS increase, oil spills and fecal contamination increase during construction remains, with possible impacts on aquatic biodiversity, subsistence fisheries and domestic uses of the river.

The artificial flow pattern (daily variations, flush outflow …) might have significant incidence on human activities that should be further assessed, e.g. change in lateral erosion with consequences for houses built on the banks.

Station A8	Ngalimbiu bridge	02/08/2013

8A. Ngalimbiu river upstream of the bridge

8B. Sand deposit & lateral erosion

8C. Sand deposit on right bank – old pile

8D. Accumulation of wood at the bridge pile

8E. Ngalimbiu bridge, viewed from upstream

8F. Detail of the vegetation on the left bank

8G. Ngalimbiu river downstream of the bridge

8H. Ngalimbiu river, further downstream

Station A9	**Saele**	06/08/2013

Location

Coordinates: S9°25.351 - E160°09.242

River: Ngalimbiu

Kp : 2.62km from the river mouth

Elevation: 11m asl

River section : Lower Ngalimbiu

Nearest village: Saele

Location:

Station A9 is located at the village of Saele, 5km downstream of the Ngalimbiu bridge and 2,6km upstream from the mouth.

The station was chosen to characterize the saline intrusion into Tina River.

Access: by car to the village

Physical environment

Valley geomorphology: In Saele area, the river flows to the North, straight across the lowland plain.

River system: no visible tributary in the area – probable connection with the alluvial aquifer.

Banks & river bed: The width of the river is approximately 50m. The slope is 40% on both banks. Substrate is dominated with sand, silt and muck mud, with presence of wooden detritus. Sans deposit along the banks far upstream of the station.

Flow pattern: velocity is uniform across the section and estimated to 0,7m/s.

Water depth: 1,5m uniformly across the section. High water marks were observed 2m above the river level.

Water quality: the water was slightly turbid during the field work (9,6NTU), due to the “spiral effect” (development of primary productivity in the lower reaches of river from degradation of organic matter further upstream), and/or to Palm oil plantation and agriculture drainage waters, or wastewaters from riparian human settlements. Conductivity (215µS/cm) was not significantly higher than on the upper reach stations, showing no saline intrusion at 2.6km from the mouth.

Biological environment

Riparian vegetation: The natural vegetation in the plain has been cleared for plantation, agriculture and gardening. Riparian vegetation is dominated with paper mulberry trees, *Saccharum s*p. (grass), para-grass, banana plants and sago palms (used for housing construction).

Aquatic vegetation :No aquatic plants.

Fish: no direct observation because of turbidity

Human activities

Saele is a small village of about ten houses, on the right bank, with gardening activities. It is located in the most important plain of Guadalcanal and SI, devoted to palm oil plantations, intensive agriculture and gardening (taro, yam, cassava, bananas, sweet potatoes …).

The river is used for washing, bathing, recreation and fishing.

Potential impacts of the project on river ecology & resources

Saele being located very far from the project area, the incidence of the dam on a section of river already impacted by human activities are likely to be low or insignificant due to the distance, auto-purification processes, sedimentation, etc..

Station A9	Saele	06/08/2013

9A. The left bank at Saele

9B. The Ngalimubiu riv. downstream of Saele

9C. The Ngalimbiu river, upstream of Saele

9D. View of the vegetation on the bank

9E. Coconut plantation in the coastal plain,

9F. Coastal plain landscape near Saele

9G. Crops in the coastal plain

9H. The village of Komporo, near the Mouth

Station A10	**Ngalimbiu mouth area**	02/08/201

Location

Coordinates: A10a : S9°24.543 - E160°08.881
A10b : S9°24.242 - E160°09.387

River: Ngalimbiu

Kp: 0

Elevation: 0m asl

River section: Lower Ngalimbiu

Nearest village: Komporo

Location:
The East and West mouths are located approx. 1km and 1,5km West of the village of Komporo

Access: car access to Komporo + walk along the shore

Physical environment

River system: It was confirmed by local people that the river course to the sea has changed several times since the cyclone Namu. The new mouth (station A10a) now considered as the main mouth, was formed mid last year in a lateral position of the delta, about 500m West of the old mouth, as a result of high flood of the river and obstruction of the main channel by logs. The old mouth (station A10b), occupying a central position, is still in activity, though the outflow is much smaller.

Banks & river bed: Substrate is dominated with sand. Presence of logs and wooden detritus are observed along the sea and mouth shore.

Flow pattern: outflow velocity at the main river mouth was estimated 1,5m/s at the contact between the river and the sea.

Water quality: the level of turbidity at the mouth was rather high (12 to 13NTU) compared to other stations upstream in the river. Conductivity was measured at different places of the main mouth (on the Western bank, in the middle of the pass, upstream and downstream) in order to approach spatial distribution of salinity. Conductivity was in a range of 191 to 319µS/cm, showing a very limited salt intrusion in the river mouth. No longitudinal gradient of brackish water was observed: the river seems to discharge directly into the sea (no brackish water estuary).

Biological environment

Riparian vegetation: The back-swamp vegetation in the vicinity of the mouth is dominated by *Pandanus,* coconut trees, pines, marsh plants and *Saccharum sp,* that can tolerate wind. Presence of rushes growing on on sand deposit around the main mouth is an evidence of freshwater conditions in superficial groundwater.

Fish: a diversity of fish species was observed in the fishermen captures, with two categories: marine forms entering into the mouth (mullet, trevally, Jacks, *Caranx, Apogon, Mesopristis*, *Lichia*…,) and shoals of sicydiine goby larvae (probably *Stiphodon sp.* or *Sicyopterus sp.*) captured in large amount, using mosquito nets.

Other animals : traces of a marine crocodile were sighted on the sand around the back-swamps. The specimen was supposed to be approximately 2m long. Crocodiles are frequent in the swamps, though large specimen (up to 7m) are becoming rare because of over-hunting. Concentration of tadpoles (probably cane toad) were observed along the bank of the main mouth, another evidence of freshwater conditions in the river mouth.

Human activities

The mouth area is a very bountiful fishing spot along the shore, due to the concentration of adult and juvenile fish of different species entering into the lower river.

About 30 fishermen from Komporo and other coastal villages are working at day time and night time, either for subsistence and commercial fishing, using canoe, gill nets, and mosquito seine nets. According to interviewed fisherman, they can make a single day market of SBD 1,500. Goby larvae are very appreciated and cost SDB 5 per cup. The area is also used for recreation and communication/crossing of the river.

Potential impacts of the project on river ecology & resources

The mouth being located very far from the dam site, impacts of the project should be low or insignificant with a possible effect on water quality mitigated with the distance (auto-purification process, sedimentation, etc..) but likely to impact aquatic ecology and induce possible changes in hydro-sedimentary dynamic (a monitoring might be required).

Station A10	Ngalimbiu mouth	02/08/2013

10A. View of the mouth area with backswamp vegetation and sand deposit

10C. Coconut trees and back-swamp vegetation

10D. Ngalimbiu river upstream of the mouth

10E. Fishermen preparing for seine fishing

10F. Herbaceous vegetation on the banks

10G. Views of the old mouth (station 10B). The discharge is limited to a narrow channel

The following table is a compilation of freshwater & brackish water fish species recorded in the SI, in Guadalcanal and in the Ngalimbiu/Tina river system from the different existing sources since 1974, both scientific reports and EIS baseline reports.

The phylogenetic sequence of families follows Eschmeyer 1990. Subfamilies, genera and species are arranged alphabetically within each family.

*Legend: **X** : recorded in Tina/Ngalimbiu river system ; X: recorded in Guadalcanal ; x: observed in other Solomon islands ; ( ): reported present by local people but not seen.*

Note : species name from the same family/genus might be synonymous due to changes in the taxonomy and/or wrong determination.

	Source	Gray, 1974	Polhemus et al, 2008		Golder Asso 2009.		Jenkins & Boseto,	Entura, 2011	BRLi, RS Hevalao current	
	Sampled area	Guadalcana	SI	SI	Ngalim-biu	Matepono	Tete-pare	Tina.	Tina	Tina
	Year	1974	Nov 2004 March 2005	July Aug 2005	1998 to 2006	1998 to 2006	Sept 2006	Sept 2010	July 2013	July 201
Family	Species									
Megalopidae	*Megalops cyprinoides*	X					X			
Anguillidae	*Anguilla marmorata*	X	x	X	**X**	x	X		**X**	X
	Anguilla megastoma				**X**	x	X			
	Anguilla reinhardti					x				
Muraenidae	*Gymnothorax polyuranodon*	X	x		**X**	x	X	**(X)**	**(X)**	X
	Muraenichthys macropterus	X							**X**	X
Chaniidae	*Chanos chanos*	X					X			
Apoginidae	*Apogon hyalosoma*	X					X		**X**	**X**
	Apogon lateralis						X			X
	Apogon sp.			X				**(X)**		X
Hemiramphidae	*Zenarchopterus dispar*		x							X
	Zenarchopterus sp.						X			X
	Rhyncorhamphus georgi	X								
	Hemirhamphus commersoni	X								
Syngnathidae	*Microphis (Oosthetus) manadensis*	X			**X**	x				X
	Microphis (Oosthetus) brachyurus	X	x					**(X)**		
	Hippicthys (Bombonia) spicifer	X								
	Hippicthys (Bombonia) djarong	X								
	Microphis leiaspis		X		**X**	x			**X**	**X**
	Microphis(Doryichtys) retzi	X	x		**X**	x			**X**	**X**
	Microphis mento				**X**					
	Microphis spinachoides				**X**	x				
	Doryicthtys brevidorsalis	X								
	Microphis sp			X			X			
Ambassidae	*Ambassis buruensis*				**X**	x				
	Ambassis gymnocephalus	X				x				
	Ambassis interruptus	X	x				X		**X**	**X**
	Ambassis macracanthus	X				x				
	Ambassis miops		x	X		x	X		**X**	**X**
	Ambassis urotaenia					x				
Terrapontidae	*Mesopristes argenteus*	X	x	X			X		**X**	**X**

	Source	Gray, 1974	Polhemus et al, 2008		Golder Asso 2009.		Jenkins & Boseto,	Entura, 2011	BRLi, RS Hevalao current	
	Sampled area	Guadalcana	SI	SI	Ngalim-biu	Matepono	Tete-pare	Tina.	Tina	Tina
	Year	1974	Nov 2004 March 2005	July Aug 2005	1998 to 2006	1998 to 2006	Sept 2006	Sept 2010	July 2013	July 201
	Mesopristes cancellatus		x	X	**X**	x	X		**X**	**X**
	Terapon jarbua	X		X			X			**X**
	Amphitherapon caudavittatus	X								
Kuhliidae	*Kuhlia marginata*	X	x	X	**X**	x	X	**(X)**	**X**	**X**
	Kuhlia rupestris		X	X	**X**		X	**X**	**X**	**X**
Carangidae	*Caranx papuensis*		X				X	**(X)**		
	Caranx sexfasciatus			X		x			**X**	**X**
	Caranx ignobilis	X								
	Caranx sp.								**(X)**	**(X)**
	Carangoides malabaricus								**X**	**X**
	Decapterus cf macarellus						X			
	Scomberoides sp.						X		**X**	**X**
Lutjanidae	*Lutjanus argentimaculatus*	X	X	X		x	X			**X**
	Lutjanis monostigma	X								
	Lutjanus fuscescens		X	X				**(X)**	**X**	**X**
	Lutjanus fulvus						X			
	Lutjanus vitta								**X**	**X**
Gerreidae	*Gerres sp.*								**X**	**X**
Polynemidae	*Polydactylus sp.*						X		**X**	
Monodactylidae	*Monodactylus argenteus*	X					X			
Mugilidae	*Crenimugil heterochellius*		x		**X**	x				
	Crenimugil crenilabrus						X			
	Liza tade				**X**	x				**X**
	Liza vaigiensis						X	**X**		**X**
	Vagamugil buchanini				**X**	x				
Cichlidae	*Oreochromis mossambicus*									
Poecillidae	*Poecilia reticulata*					x				
	Gambusia holbrooki					x	X			**(X)**
Toxotidae	*Toxotes jaculatrix*	X	X		**X**					
Cichlidae	*Oreochromis mossambicus*				**X**	x				**X**
Serranidae	*Epinephelus polystigma*						X			
Scorpaenidae	*Tetraroge sp.*						X			
Rhyacichthyidae	*Rhyacichthys aspro*		(X)	X	**X**	x	X		**X**	**X**
Eleotridae	*Belobranchus belobranchus*		X		**X**	x	X		**X**	**X**
	Butis amboinensis		X			x			**X**	**X**
	Butis butis	X		X			X			
	Eleotris fusca	X	X	X	**X**	x	X		**X**	**X**
	Eleotris melanosoma						X			
	Hypseleotris guentheri	X			**X**	x	X			
	Hypseleotris sp		X	X						
	Ophieleleotris (Giurus) hoedti		X	X			X	**X**	**X**	

	Source	Gray, 1974	Polhemus et al, 2008		Golder Asso 2009.		Jenkins & Boseto,	Entura, 2011	BRLi, RS Hevalao current	
	Sampled area	Guadalcana	SI	SI	Ngali m-biu	Mate pono	Tete-pare	Tina.	Tina	Tina
	Year	1974	Nov 2004 March 2005	July Aug 2005	1998 to 2006	1998 to 2006	Sept 2006	Sept 2010	July 2013	July 201
	Ophieleotris (Giurus) margaritacea						X		**(X)**	**X**
	Ophieleotris (Ophiocara) aporos	X			**X**	x				**(X)**
	Ophiocera porocephala						X			X
	Oxyeleotris gyrinoides				**X**	x				X
Gobiidae	*Glossogobius celebius*				**X**	x			**X**	
/ Gobinae	*Glossogobius sp. 1*		X	X			X		**(X)**	**X**
	Glossogobius sp 2		X							**(X)**
Gobiidae	*Awaous grammepomus*					x				**X**
/ Gobinellidae	*Awaous guamensis*			X					**X**	
	Awaous melanocephalus				**X**	x				**X**
	Awaous ocellaris				**X**	x	X		**X**	
	Awaous sp		X	X				**X**		**X**
	Redigobius chrysosoma					x	X			
	Redigobius bikolanus		X				X	**(X)**	**X**	
	Redigobius leptochilus		X					**(X)**		
	Redigobius tambujon								**X**	**(X)**
	Redigobius sp			X					**X**	
	Schismatogobius marmoratus[1]		X						**X**	
	Schismatogobius ampluviculus[2]								**X**	
	Schismatogobius sp.						X		**X**	**X**
	Schismatogobius roxasi[3]								**X**	
	Schizogobius bruynis				**X**	x				
	Stenogobius hoesei		X						**X**	
	Stenogobius cf beauforti				**X**	x				
	Stenogobius sp.			X						**X**
	Bathygobius andrei[4]								**X**	
Gobiidae	*Lentipes multiradiatus*		X	X					**X**	**X**
/ Sicydiinae	*Lentipes sp.*		X					**X**	**X**	**X**
	Sicyopterus cf hageni				**X**	x				
	Sicyopterus lagocephalus		X	X			X	**X**	**X**	**X**
	Sicyopterus longifilis		X		**X**	x	X		**X**	**X**
	Sicyopterus ouwensi				**X**	x				**X**
	Sicyopterus sp		X	X			X			
	Sicyopus mystax		X					**X**	**X**	

1 This identification is questionable, based on known range and current understanding of Schismatogobius biogeography. Records are pending further identification.

2 Ibid.

3 Ibid.

4 Ibid.

	Source	Gray, 1974	Polhemus et al, 2008		Golder Asso 2009.		Jenkins & Boseto,	Entura, 2011	BRLi, RS Hevalao current	
	Sampled area	Guadalcana	SI	SI	Ngalim-biu	Matepono	Tete-pare	Tina.	Tina	Tina
	Year	1974	Nov 2004 March 2005	July Aug 2005	1998 to 2006	1998 to 2006	Sept 2006	Sept 2010	July 2013	July 201
	Sicyopus zosterophorum		X	X		x			**X**	**X**
	Sicyopus discordipinnis		X					**X**	**(X)**	**X**
	Sicyopus sp.		X						**X**	**(X)**
	Stiphodon atratus		X					**X**	**X**	**X**
	Stiphodon autopurpureus[5]								**X**	**X**
	Stiphodon birdsong		X					**X**	**X**	**X**
	Stiphodon multisquamis[6]								**X**	
	Stiphodon ornatus[7]								**X**	**X**
	Stiphodon rutilaureus		X	X			X	**X**	**X**	**X**
	Stiphodon semoni		X	X	**X**	x		**X**	**X**	**X**
	Stiphodon sp				**X**	x	X			**X**
Scatophagidae	*Scatophagus argus*	X		X		x	X			
Siganidae	*Siganus vermiculatus*	X							**(X)**	
Tetraodonidae	*Arothron immaculatus*	X								
	Arothron reticularis	X								
	Chelonodon potoca	X								
Anthenaridae	*Anthenarius notophtlamus*	X								
	Number of species	**36**	**43**	**29**	**32**	**45**	**60**	**20**	**55**	**59**

[5] Ibid.
[6] Ibid.
[7] Ibid.

Plate 11 Fish survey methodology

11A. Direct visual observations & camera

11B. Aquatic ecology team during survey

11C.Direct observation in Upper Tina river

11D. Spear used for subsistence fishing in the Tina river

11E. Fishermen spear capture in the river

11F Sicyadiinae larvae fishing at the mouth

Photo L. Trebaol

11G. Gill net fishing at Ngalimbiu mouth

Photo G Pahin

11H. Determination of captured specie

Photo L.Trebaol

Plate 12 Gobiidae / Sicydiinae (Savutu / Vosu in local language)

12A. Different species of *sicydiins* *Photo RS Hevalao*

12B. *Stiphodon semoni* (male) *Photo RS Hevalao*

12C. *Stiphodon rutilaureus* (male) *Photo RS Hevalao*

12D. Sicydinnae spawn *Photo RS Hevalao*

12E. *Sicyopterus sp.* *Polhemus et al*

12F *Sicyopus mystax* *Polhemus et al, 2008*

12G. *Lentipes sp.* *Polhemus et al, 2008*

12H *Lentipes solomonensis* *Photo RS Hevalao*

Plate 13 Sicydiinae juveniles & other Gobiidae

13A. Gobiidae/Sicyadiinae larvae captured at Ngalimbiu mouth Photo L. Trebaol

13B. Shoal of Sicydiinae juveniles moving upstream along Ngalimbiu river Photo L. Trebaol

13C. *Awaous guamensis* *Photo RS Hevalao*

13D. *Awaous sp.* *Polhemus et al, 2008*

13E. *Photo RS Hevalao*

13F *Photo RS Hevalao*

13G. *Belobranchus belobranchus*

13H. *Eleotris fusca*

Plate 14 Non-gobioids fish - inland river

14A. *Anguilla marmorata (Giant Eel)* fishbase

14B. *Gymnothorax polyuranodon (Moray eel)*
www .australianmuseum.net.au

14C. *Microphis sp*.(Pipefish) *Photo RS Hevalao*

14D. *Liza vaigiensis (*Mullet) calphotos.berkeley.edu

14E. *Mesopristes argentus* (juvenile)

14F *Mesopristes cancellatus* (juvenile)

14G. *Kuhlia marginata* (Jungle perch) fishbase

14H. *Ambassis interruptus*

Plate 15 Non-gobioid species – Mouth Area

15A. *Gerres sp.*

15B. *Apogon sp.*

15C. *Polydactylus sp.*

15D. Flatfish

15E. *Chub Mackerels*

15F. Flatfish

15G.

15H. *Muraenichthys macropterus (Worm Eel)*

MINUTES OF 1ST MEETING HELD AT THE MINISTRY OF AGRICULTURE AND LIVESTOCK WITH PERMANENT SECRETARY, MR. FRANK WICKHAM

Date: 1st August 2013
Time: 8.30 am
Venue: Permanent Secretary's Office
Min. of Agriculture & Livestock
Mud Alley

Present:
Mr. Frank Wickham - Permanent Secretary/MAL
Mr. Gilles Pahin - Team Leader
Mr. Fred S Patison - Regulatory Expert & Coordinator of National Experts
Mr. Lawrence Foana'ota - Social and Cultural Expert

Mr. Gilles Pahin

- Thanked the PS for availing himself to meet with us
- Explained the purpose of our visit and meeting
- Informed the PS of his position as the team leader from BRLi, a company in France, Fred Patison, the Coordinator of the local experts and Lawrence Foana'ota is the Social and Cultural Expert in the team
- Pointed out that the ESIA team consists of six local (6) and four (4) outside experts totaling to ten (10)
- Asked if any information is available regarding future plans for agricultural activities in the area earmarked for the Tina Hydropower Development Project
- Enquired re-compiling any information on the agricultural activities

PS-Mr. Frank Wickham's Response

1. ***Large Scale Farming in Food Production:***

- Lee Kwok Kuen is involved with large scale farming in food production
- Sweet potato or kumara farming is one of the main crops the Company is producing
- Plans are underway for the farming of other crops and food stuff

2. ***Guadalcanal Plains Palm Oil Limited Plans:***

- As far as other agricultural activities are concerned, Guadalcanal Plains Palm Oil Limited plans to extend eastward
- Suggest Mr. Gilles and team should meet with Officials from GPPOL in order to know more about their operations and any expansion plans in the future

3. ***Adjacent Land To Tina River Area:***

- SI Government is interested in purchasing land owned by RIPEL
- So far no concrete agreement has been reached as yet on the issue of government purchasing the land

- Present challenges included the fact that Government owns cocoa farms and cattle in the area but people are serving themselves with them

4. Gold Ridge Situation:

- Three main groups have been formed to take care of the concerns of the communities
- Dam tailing group
- Mid-stream group
- Down-stream group

5. Some Suggestions and Issues of Concern for the Tina Hydropower Development Area:

- If communities are planning to engage in farming, they would need some form of irrigation system to be built such as a small dam
- One major effect the dam would have during the construction period and probably two years after its completion is that the quality of the water might be low
- It is important that some form of monitoring system should be considered
- The concern is that people might start to ask compensation when this happens just like the Gold Ridge Mining where people have been demanding compensation payments for the Metabona River. This could also happen for the Tina River when the dam is constructed
- There should be baseline assessment of the down stream area of the Ngalibiu River carried out first before the dam is constructed to avoid such problem of demanding compensation arising in the future

6. Some Points for Consideration:

- Benefit and Profit sharing between the communities, government and landowner
- Commissioner of Lands should release some part of the RIPEL land for recreation activities and sporting facilities
- PS indicated that he will be leaving the government soon

7. Meeting closed at 9am

MINUTES OF 2ND MEETING HELD AT THE MINISTRY OF ENVIRONMENT & CONSERVATION WITH STAFF

Date: 1st August 2013
Time: 11.15 am
Venue: Environment & Conservation Office
Old Public Service Training Center Building at Vavae Ridge

Present:
Ms. Rosemary Ata - Environment Safeguarding and Monitoring Officer
Ms. Rose Papaua - Conservation Officer
Mr. Edward Danitofea - Rep from the Government on the ESIA Team
Mr. Melvin Zama - Environment Officer
Mr. Gilles Pahin - Team Leader
Mr. Fred S Patison - Regulatory Expert & Coordinator of National Experts
Mr. Lawrence Foana'ota - Social and Cultural Expert

1. **Introduction:**

- Fred S Patison thanked the Officers and introduced Mr. Gilles stating that he is the overall leader for the ESIA or Environmental and Social Impact Assessment Team as well as the Project Manager
- He is the Regulatory Expert and the Coordinator of the National Experts and
- Lawrence is the Social and Cultural Heritage Expert.
- The ESIA team consists of 10 members, 4 foreigners and 6 nationals

2. **After that the officers from the Ministry introduced themselves.**

3. **Then Mr. Gilles Pahin explained the purpose of the meeting which was mainly to**

- get officers' views and any concerns they may have on the Environment before the Tina Hydropower Development Project starts
- find out if they have any information available on any Conserved areas within the propose hydro site
- let them know that general survey for the baseline report will be carried out
- inform them that major works will be mainly in the downstream area from any protected sites upstream above the main reservoir
- inform them that four foreign experts are in the country for two weeks
- that the members of the ESIA team have already visited the proposed area of the Project
- while he and the two nationals accompanying him for the meetings with other government agencies and stakeholders, Mr. Eric Deneut who is the Assistant Team Leader is already with those national experts looking at the fish, wild life and other environmental issues within the proposed hydro project site

4. **The Officers then spoke on some issues they wanted the ESIA team members to consider and take note of as follows:**

- In December this year (2013) experts from USA will carry out wildlife study of the Popomanisiu in the upstream area
- It was also important to have some protected areas downstream
- It was suggested that may be one protected area should be in the downstream for gravel extraction
- There needs to be social impact assessment carried out in the downstream areas to include some baseline study
- Ministry staff will not involve in any social impact assessment but will participate in the environment impact assessment under government's cost.
- Water quality should be tested during the construction period
- Review should be covered by the Tina Hydropower Development Project Office
- The Ministry is in the process of reviewing the Environment Act
- Noise pollution will have temporary impact on the flora and fauna in the hydro project area
- Baseline study indicated people claim that Guadalcanal Plains Palm Oil Limited (GPPOL) caused hardship on water downstream

5. It was confirmed to the officers that

- Socioeconomic impact will also be taken into consideration and
- Health issues too will be looked into by the Social Impact Assessment team

6. **The meeting closed at about 12 noon**.

MINUTES OF 3RD MEETING HELD AT THE NATIONAL STATISTIC DIVISION

Date: 1st August 2013

Introduction:

- Presentation of BRLi – Gilles P., Fred P. and Lawrence F.
- Gilles P. introduced the BRLi team and the important of getting accurate data for the Tina Hydro national project. In particular data on population and other social data of community within the Tina hydro site.
- The statistician expressed the fact that the data is available and will be provided to them as requested. He further noted that social issues will be of particular importance for the project.
- The statistics office agreed to provide all the information for the Tina Hydro project area. This will be collected by Mr Lawrence Fonoaota, the national social and cultural expert.

MINUITS OF 4TH MEETING HELD AT THE STATISTIC DIVISION, MINISTRY OF FINANCE & TREASURY WITH JOSEPH NAESOL, GOVERNMENT STATISTICIAN

Date: 1st August 2013

Time: 2 pm

Venue: Statistic Office
Old Government Printers Building
Central Honiara

Present:
Mr. Joseph Naesol - Government Statistician/Ministry of Finance & Treasury
Mr. Gilles Pahin - Team Leader
Mr. Fred S Patison - Regulatory Expert & Coordinator of National Experts
Mr. Lawrence Foana'ota - Social and Cultural Heritage Expert

The meeting was held in the Conference room at about 2.15 pm.

1. **As usual, Mr. Gilles Pahin introduced the members of his team before he explained the purpose of the meeting as follows:-**

- Find out if any recent census documents on the population for the Tina area are available
- Seek advise from this particular Government Division regarding any issues that may be useful to know about before carrying out the Environment and Social Impact Assessment work
- Since Mr. Joseph Naesol is from the Tina area he should know if there are any specific cultural or social issues that the ESIA team should watch out for or consider in order to avoid any misunderstandings that might affect the progress of the Hydro Project

2. **In response to the points raised above Mr. Naesol provided the following:-**

- The last census was carried out in 2009
- The national census is carried out after every ten (10) years
- So far only the census data is available
- The complete census report is still not completed
- Migration is basically internal
- GPS map showing the village locations within the area will be provided
- Lawrence Foana'ota will pick up the documents from Joseph on Monday 5th in the afternoon
- The documents he will provide will include tables with associated data of population of some of the villages within the catchment of the Tina River
- Any reports should be independent
- Important to hear directly from communities regarding their views and concerns

3. The Social Impact Assessment will be carried out by Mr. Gerard Fitzgerald, a Social Key Expert from New Zealand with the assistance of

- Kellington Simeon and
- Lawrence Foana'ota

4. There being no other matters the meeting closed at about 3.45 pm

MINUTES OF 5TH MEETING HELD AT THE DEPARTMENT OF ENERGY, MINISTRY OF ENERGY, MINES AND RURAL ELECTRIFICATION WITH MR. GABRIEL AIMAE

Date: 5th August 2013

Time: 10 am

Venue: Department of Energy Meeting Room
Lingakiki
Central Honiara

Present:
Mr. Gilles Pahin - Team Leader
Mr. Fred S Patison - Regulatory Expert & Coordinator of National Experts
Mr. Gabriel Aimae - Representative Energy Division
Mr. Lawrence Foana'ota - Social & Cultural Heritage Expert

1. The original arrangement made on Thursday 31st July when Lawrence Foana'ota went around meeting various government officials and stakeholders informing them of the planned meetings was supposed to be with the Director of Energy Mr. John Korihona.

2. Mr. Gabriel Aimae was met instead of the Director.

3. Mr. Gilles Pahin explained the purpose of the meeting with a brief introduction

4. Mr. Gabriel Aimae informed the team of the following:-

- Government's main focus at this time is to provide power to communities and schools in the country by using solar
- Currently the Government is looking into developing geothermal power from Savo Island
- Ground work had already started with
  (a) visits to the island and
  (b) initial negotiations with the local population
- Government's present need is for Environment Specialists to assist in the Project
- Government through the Energy Division are working closely with Kenta Co. in the USA
- Compiling a document on a National Energy Policy in collaboration with South Pacific Community (SPC), United Nations Development Program (UNDP) and World Bank (WB)
- The Plan is once completed, it will form the National Energy Policy
- Government's view regarding power/benefit sharing from the Tina Hydropower Development Project is that whiles it is still not yet developed; the communities around the Tina area will be provided with Solar Panels for lighting
- The Energy Division does not have enough staff but when the Social Impact Assessment work starts in three weeks time, a staff will be made available

5. The briefing by Mr. Gabriel Aimae was noted by the three members of the ESIA team

6. Mr. Gilles Pahin informed Mr. Aimae of the following:

- Field survey has already started by the Environmental Expert team
- The main focus at this time is on the flora and fauna
- Most of the survey work is conducted specifically within the area expected to have much of the impact from the proposed Tina Hydropower Development Project when it is constructed

7. There being no other business, the meeting closed at 10.55 am

MINUTES OF 6TH MEETING HELD AT WATER RESOURCE DIVISION, MINISTRY OF MINES, ENERGY AND RURAL ELECTRIFICATION WITH THE DIRECTOR MR. ISAAC LEKELALU

Date: 5th August 2013

Time: 11 am

Venue: Water Resource Division Office
Min. of MERE, Lingakiki

Present:
Mr. Gilles Pahin - Team Leader
Mr. Fred S Patison - Regulatory Expert & Coordinator of National Experts
Mr. Isaac Lekelalu - Director Water Resource Division/MMERE
Mr. Lawrence Foana'ota - Social and Cultural Expert

1. Mr. Gilles Pahin started the meeting with following remarks:

- Thanked the Director for availing himself to meet the team members
- Briefed him of the purpose of the visit and meeting
- Informed him that work had already started by the Environment Expert team
- Field survey focuses mainly on the flora and fauna as well as collected water sample for testing from the Tina River
- A brief visit to the downstream communities revealed that people do not use the Tina River instead they use rain water collected into tanks

2. The following points were put forward to the Director for consideration:

- Request the Director to inform the ESIA team of what plans are in place by the government as far as water resource management is concerned when work starts on the Tina Hydropower Development Project
- There are plans to provide water supply so the Water Division need to assist in identifying possible sources
- Water tanks need to be provided and wells dug to help communities get clean water during construction and possibly a two year period after the completion of the dam when vegetation might start falling into the reservoir affecting the quality of the water
- The Water Division is need to recommend to the Social Impact Assessment team the best sites for placing water tanks, wells and possibly identifying tributaries that the people could use

3. The Director, Mr. Isaac Lekelalu responses as follows:

- He is the Government's representative on the Tina Hydropower Development Project Committee and so he can look into these issues
- The problem in the area as far as the use of water tanks is concerned is the low rainfall

- During the first six months of the year, the rainfall in the area is limited and so using tanks for storing water will not ease the problem of water shortage
- But during the second half of the year there is always very heavy rainfall, constructing and use of water storage dams might be a possibility
- The problem with using dams that do not have covering over them to store water is that the quality of the water might not be good
- He mentioned the fact that the rainfall in the area is measured by using a rain-gauge they have installed at the Rate Community High School within the Tina area
- He also suggested the other option is to develop facilities to extract ground water or use water tanks to capture rainwater during the rainy season in the area for the communities
- He also raised the point that once the dam is completed conditions needed to be in place on the use of the water from it. This could be discussed with the people to get their views
- Use of water purifiers should be looked into and communities should be encouraged to take care of such facilities and equipments once they are installed.
- He expressed the concern that it is a well known fact in many places throughout the country where the majority always reluctant to contribute to the maintenance of water supplies once they are installed
- The Water Division also has other Water Policies that are currently being developed with outside assistance
- One other Policy that will be developed soon with the help of an expert from the Australian National University (ANU) in Canberra, Australia and is funded by the European Union is a Sanitation Policy
- Apart from these policies, a number of legal instruments or laws are also being drafted
- One such law is the "Water Resource Legislation" which is currently in draft form
- The Water Resource Unit/Division's main operation is on Hydrological Assessment and Development in the country

4. There being no other matters to discuss the meeting closed at 12 pm

MINUTES OF 7TH MEETING HELD AT THE SOLOMON ISLANDS NATIONAL MUSEUM, MINISTRY OF CULTURE AND TOURISM WITH MR. TONY HEORAKE,
DIRECTOR OF MUSEUM & MR. JOHN TAHINAO, DIRECTOR OF CULTURE

Date: 5th August 2013

Time: 2 pm
Venue: Director's Office
National Museum Division Building
Coronation Garden
Central Honiara
Present:
Mr. Gilles Pahin - Team Leader
Mr. Tony Heorake - Director of Museum
Mr. John Tahinao - Director of Culture
Mr. Lawrence Foana'ota - Social and Cultural Heritage Expert

1. **Since not much research work was carried out or written materials available for this specific area of Guadalcanal Province, the meeting was very brief**

2. **Mr. Gilles Pahin briefed the two Directors about the Tina Hydropower Development Project and he wanted to find out the best way to carry out the cultural heritage work in the area that will be affected**

3. **During his briefing he used his laptop computer to show the following to both Directors:**

- A map of the area to be covered by the project and the villages within the project site
- He also pointed out the location of the reservoir which will be near the Senge Village in the upstream of the Tina river
- He also pointed out that 5 weeks will be spent in discussing the project with the people
- Studies by the various national and overseas experts will continue until March 2014
- The main requirements which the Directors are requested to look into were (i) whether any documents on cultural heritage sites in the area and (ii) any written documents which may be worth looking at are available or not

4. **The former Director of Museum, Lawrence Foana'ota, who is a member of the ESIA team responsible specifically for the Social and Cultural Heritage Impact Assessment, pointed out during the brief discussions the following:**

- This is a new area so much of the data on the Social and Cultural Heritage will be collected from the people in the communities during the initial field survey
- The only written information available so far is on ***"The fresh and brackish water fishes of Guadalcanal"***, by Noel Gray published in one of the volumes of the Solomon Islands National Museum Association Journals in **1974:45**

- There may be documents or reports that may have been produced on the surrounding areas regarding other development projects which would involve literature research in the libraries or other institutions
- Since this is going to require more work, with limited time given to carryout the baseline field survey it will not be possible

5. The meeting which lasted only for about half an hour ended at 2.30 pm

MINUTES OF 8TH MEETING HELD AT THE GUADALCANAL PLAINS PALM OIL LIMITED WITH MR. ANDREW KERR, SUSTAINABILITY MANAGER, MS. REGINA GATU, COMMUNITY RELATIONS OFFICER & MR. ERNES KOLLY, SUSTAINABILITY OFFICER

Date: 6th August 2013

Time: 8.45 am

Venue: GPPOL Conference Room
Tetere Complex
Northeast Guadalcanal

Present:
Mr. Andrew Kerr - Sustainability Manager
Ms. Regina Gatu - Community Relations Officer
Mr. Ernest Kolly - Sustainability Officer
Mr. Gilles Pahin - Team Leader
Mr. Fred S Patison - Regulatory Expert & Coordinator of National Experts
Mr. Lawrence Foana'ota - Social and Cultural Heritage Expert

1. **Since it was a long way to drive from Honiara to the Guadalcanal Plains Palm Oil Limited Complex for the meeting, the team has to left the Mendana Hotel around 7.30 am. The trip took about one hour and fifteen minutes**

2. **The three member team used Mr. Fred Patison's vehicle while the Environment Impact Assessment team members used the hired vehicle from Budget.**

3. **Mr. Andrew Kerr met the team and went straight for the meeting into the Conference Room**

4. **After a brief introduction and Mr. Gilles informed Mr. Kerr of the purpose of the visit and meeting the Sustainability Manager went straight into his presentation**

5. **During his talk he cover a lot of areas which highlighted the processes they apply right from the beginning when they first established the company until now including the following:**

- They started with zero dollar
- The land is being leased for a period of 99 years
- Local Contractors were hired to do all construction jobs
- Negotiation was done first with Contractors before they purchase any trucks
- The Company decided to employ local laborers to prevent social problems
- Whenever any problems arise, they use the custom to sort them out
- Encouraged the five main tribes including small holders to be members of the Land Association
- So far the Land Association has a total of about 1,000 members
- When deploying contractors 40% should be local

- Currently GPPOL has1,600 plus workers and only 14 are expatriates
- The company employ people in the area to run the Security service
- They have three Memorandum of Understanding or MOU in place with SI Government, Guadalcanal Province and the Land Association
- They pay diffidence to Local Land Association and not to individuals
- Pay royalties
- Pay land rentals
- The company provides 4,500 houses for its workers
- Provide own power and medical free for their employees
- The company generates its own power

6. Apart from providing the above information Mr. Kerr also made some suggestions for consideration by the Tina Hydropower Development Project as follows:

- When deploying Contractors make sure 40% should be local
- Make sure expatriate employees are limited in number
- Laborers should be of people from the local area
- Use the communities to involve in the construction
- GPPOL needs to involve with the Tina Hydropower Development Project
- Watch out for new tribes coming up as the project develops because they have already experienced this social development when the company started operating
- Recommend to the Tina people to form their own Land Association and avoid using middlemen to involve in the project on their behalf
- Warned to watch out for Chief Benedict Garamane and Sam who lives downstream of the Tina River
- The area earmarked for possible expansion of the oil palm plantation is at Malatoha, apart from that there is no plans for expansion westward

7. When the issue about compensation came up he brought in two of his staff who are directly involve with this area in the communities

- The staff who is directly responsible for handling of any issues relating to compensation or other community matters is Ms. Regina Gatu who deals directly with the community leaders and chiefs on behalf of the company
- One of the main issues that she sometimes deal with in consultation with the chiefs and community leaders is compensation
- Any incidents between any members of the local communities and the company such as compensation payments or security problems are dealt with by the members of the local staff who are directly responsible for these areas.

8. The former Director of the SI National Museum, Mr. Lawrence Foana'ota provided the following information to those present:

- He had done some research work on the abusing of compensation payment in contemporary Solomon Islands society
- What he found was that people use this custom or cultural practice mainly to demand money from other people
- When someone pays or gives compensation, it is mainly to mend broken relationships, bring people together and to show that the perpetrator is sorry for the wrong he or she has done to the victim
- Today some people use this custom or cultural practice as an excuse to get what they want and instead of solving the problem, they create more hardship. It is one way of getting easy money from vulnerable victims
- He suggested paying or giving compensation should be made using the appropriate and acceptable custom and traditional materials instead of cash

9. This was the last issue that was raised and discussed before the meeting closed at about

10.15 am

MEETING WITH THE BAHOMEA TRIBAL CHIEFS – TINA HYDRO PROJECT SITE

Compiled by Zimri Launi

Project Office:
Eric Gorapava
Brally Tavalia
Julian Maka'a
Daniel Una
ESIA Team:
Eric Deneut
Fred Patison Siho

The meeting was to inform the leaders about a Baseline Study on the Flora and Fauna of Tina River by BRLi.

Brally thanked and welcomed all present and introduced his team then asked Eric Deneut to do his presentation, assisted by his local counterpart Fred Siho.

The presentation basically touched on why the study was necessary in terms of understanding direct and indirect effects on communities who depended on the river. It wants to establish the relations of the people with the river and also investigate social issues and people must say what they want, what they don't want etc. about the project.

Social Assessments will address what livelihoods there are of the people in the Tina River. The Social Assessment group will also provide a baseline report after its work.

They said the study is to assess what sorts of impacts the hydro will have on the environment and their livelihoods so that mitigation measures can be addressed before, during and after construction.

They stressed that BRLi is an independent group that is neutral and is carrying out the work in line with World Bank Safeguard Policies and IFC Performance Standards.

A Mitigation Workshop is earmarked for November this year. After the workshop, mitigation plans will be in place on how to address potential impacts.

They stressed the report will be a big one which will cover all the information gathered from the communities.

Eric and Jefferson assured the leaders that the government has embraced their work and recognized it so they should feel good about their effort. The work they'd carried out is not for the government or the Project Office. It is their business and they have done well.

Comments from leaders were varied.

Zimri stressed that in case BRLi encounters any disturbances during their work, they shouldn't panic as these are considered normal in the community. Such disturbances shouldn't be seen as from the communities but more as personal ones and shouldn't be taken to represent the community.

One tribal chief wants the involvement of the older people in the ESIA and SIA and someone suggested that in focus group discussions during the studies, chiefs should have one by themselves.

One question asked whether or not BRLi had involved in similar studies anywhere in the world to which Eric said he'd worked in Africa, Asia and the Caribbean so he has a vast experience. Fred also gave examples of his work with mining companies in Choiseul and Isabel Provinces.

Eric also clarified the social assessments will concentrate on communities in the proposed dam area down to the confluence of the Toni River.

Pastor Kedimiel asked whether or not BRLi would support them during in a Development Agreement but the response was no, but the information gathered in the studies would be of help.

Oscar Billy Pego said he saw the BLIC group as a model that should have been used in the early stages of the project, saying going through other bodies as was the case, created a lot of personal interests. He said land on Guadalcanal is the number on livelihood of the people and so they should talk about it, not anybody else. So the BLIC make up is the right make up. He said the HOC is merely responsible for harmony and peace in the communities, not land issues. Tribes own land not chiefs. He also wanted a copy of the ESIA report to be available for communities of Bahomea before the Mitigation Workshop.

Daniel Una said he saw the model as the best and the disturbances are internal. They are something they can sort out. As long as the government appreciates the process about the land id, that's it because the disturbances are minor and can be sorted.

Zimri added that the inclusion of three former LOC members is a good move. The fact that misinformation is going around the communities is because the BLIC group is yet to go around communities to clarify things. He said if this happened, there would be wide support among all communities.

Dohlan Gisi suggested that if all tribal chiefs were part of the BLIC process, it would strengthen the body and become a positive move for Bahomea in the long run. Right now, he said, only a few of them who attended sessions of the process and understood what it is and how good it is have already signed. But other tribal chiefs should become party to the process – very important for the future of Bahomea.

Chief Mahlon Maeni suggested that those disturbing the process have lost their power base and hence their actions. He said they are their sons but don't know what's going to happen – they only know how to harvest but not how to plant, he said.

Community awareness will be held in Bahomea on Wednesday and Thursday next week, Antioch, Marava, Tina and Horohotu, funded by the Project Office. Those included for this are PO and some senior members of the BLIC process.

Paramount Chief Peter Rocky thanked everyone for the positive messages conveyed by those who presented. He said the disturbances created a few worries for the Bahomea people but the messages of today's discussions were heartening. Tribal chiefs and the communities of Bahomea aren't interested in media stories. It's normal in life that every positive thing will always have negative ones. But Bahomea people are not interested in the disturbances – it is their heart that the project materializes for their future. He stressed all the people of Bahomea like the project. He suggested that those disturbing were worried about power but that is not the interest of the communities of Bahomea. When they have power, there's a place they gain something. But he said such things can be sorted. He said they were very happy about the messages about the environment studies today. He was happy that the messages have encouraged them because the findings would give them ammunition for a future agreement about the project. He thanked the government for its recognition of their work; they took up the task because they valued the traditions handed down by their ancestors. They believe in peace and harmony. He said when they presented their work to the World Bank reps recently; they were greatly encouraged by their comments. He apologised about the venue but said venue quality is not important, it's what's discussed and gained is more important. He also thanked the Project Office for organising the meeting.

The Paramount chief also acknowledged the comments already made by others but the issues being raised currently by some opponents are internal and they can sort them out.

WEEK 1-DAY 1: Monday 2nd September 2013

SIA Team Visit to-

I. **Marava** – the main center where the meeting was held

II. **Targeted Communities were:** Marava, Vatupaua; Ngongoti; and Rate Community High School

III. **Attendance:**
- **(a)** Twenty males & twelve females
- **(b)** Total 32

IV. **Program:**
- **(a)** Opening Prayer- Zimri Laoni
- **(b)** Welcome by- Zimri Laoni
- **(c)** He also explained to those representatives from the other communities who attended the purpose of the meeting and told them to give the right information concerning the proposed Tina Hydro Project when they are asked questions.

V. Introduction of each of the Team Members by Gerard Fitzgerald the SIA Team Leader.

VI. **Presentations:**
- **(a) Marava:** The presentations began by providing information about Marava Village which was first established in 1962. Before that families used to live in settlement up in the mountains.
- **(b)** Families moved to Marava and other nearby villages because of easy access to work in Honiara town, transportation and health facilities.
- **(c)** They moved during the time of the Colonial Government's administration. Marava and the other places were chosen because the areas are good for gardening and also it is safer than in the mountains where landslides sometimes occur.
- **(d)** There are 28 households in Marava. The biggest family has 8 children while the smallest family consists of 3 children. The total number of families is 168.
- **(e) Vatupaua:** 3 households with five families consisting of 50 members.
- **(f) Ngongoti:** 1 household consisting of 20 family members.

VII. **Language:** The main language spoken by people of the area is called "Teha"

VIII. **Family Ties:** All the family members belong to the two main moieties known as ***Garave or Manukama*** and ***Manukiki***. The people of Tina area belong to sub-tribe of the Malango tribe known as **Bahomea** in Central Guadalcanal. They originally moved from their bush settlements in the early 1960s. There are about 21 sub-tribes or ***vuvuga*** in the Tina area. According to the culture of the people, members of ***Garave*** sub-tribes are not allowed to marry each other. It also applies to members of

Manukiki sub-tribes**.** But if any members of ***Garave*** sub-tribes want to marry any members of ***Manukiki***sub-tribes or verse-versa it is allowed. When it comes to any members of the two main tribes wanting to marry, there is no problem,

IX. Community Groups/Organizations: In these communities, there are women, youth and chief's groups. These groups form a Central Board that has committees responsible for the following areas-

(a) Education & Training
(b) Women, Youth & Children
(c) Culture & Tourism
(d) Health & Sanitation
(e) Project Development
(f) Religion

X. The Main Churches are:

(a) South Sea Evangelical Church or SSEC
(b) Seventh Day Adventist or SDA
(c) Bible Way Church or BWC
(d) Roman Catholic Church or RCC and recently
(e) Assembly of God or AOG

XI. Church Groups/Organizations are:

(a) Roman Catholic Women's Group
(b) Sports Group-Soccer, Volleyball & Futsal
(c) Youth Singing Band and
(d) Church Outreach groups

XII. Livelihood: People in the communities earn a living by:

(a) Marketing at the Honiara Central Market;
(b) Going sometimes to the Market at Gold Ridge to sell betel nut;
(c) Working at Gold Ridge Mining Company;
(d) Farming for marketing and family use;
(e) Milling timber for sale and own use;
(f) Selling firewood bundles;
(g) Harvesting cocoa including coconuts and selling them to local buyers;
(h) Plans are underway for raising cattle;
(i) Operating small canteens; and
(j) Receiving royalties from Gold Ridge Mining Company

XIII. Women's Roles:

(a) Weaving baskets;
(b) Sewing calico and children's school uniforms;
(c) Baking cakes & bans;
(d) Planting vegetables like slippery cabbage, tomato, beans and egg plants;
(e) Cultivating root crops such as potato or kumara, cassava;
(f) Looking after the children;
(g) Taking the children when they are sick to the clinic or school;
(h) Cooking for the family using fire;
(i) Fetching drinking and cooking water from the main Tina River;

(j) Collecting firewood for cooking;
(k) Feeding the pigs and other domestic animals;
(l) Going to the markets in Honiara and Gold Ridge to sell or buy goods for the family;
(m) Washing the clothes & dishes; and
(n) Cleaning in and around the home

XIV. Health Issues: The most common diseases are-

(a) Malaria caused by parasites transmitted from person to person by mosquitoes;
(b) Pneumonia affects the lungs and is caused by very bad cold from diving in the river at night or working in the rain;
(c) Diarrhea affects both young and old people and is caused by germs carried by flies, rats and cockroaches contaminating water for drinking or food.
(d) Measles often affects young children;
(e) Influencer or flu is also a common sickness affects both old and young; and
(f) Stress affecting women due to pressure from overworking, husband's un-control behavior when they get drunk and youth people involving in drugs.

XV. Health Concerns:

(a) 8 cases of malaria have been recorded in these communities early this year (2013);
(b) Long distances to the Clinics is a major health concern to the people;
(c) Rove, Mataniko and Kukum Clinics are all located in Honiara;
(d) Lack of transportation when there is an emergency is great concern to families;
(e) Worry about youths taking drugs can cause hypertension or high blood pressure;
(f) Unhealthy habits like no proper toilets but mainly pit latrines;
(g) Heavy alcohol drinking causing accidents;
(h) Suffering from high blood pressure and diabetic;
(i) Husbands involving in extra marital affairs with other women causing stress;
(j) Women over working themselves without husbands helping;
(k) No. 9 Central Referral Hospital is often overcrowded;
(l) Fear of witchcraft known as Vele which has symptoms like malaria; and
(m) Currently buses only operate four trips per day and each trip costs $20.00 a person.

XVI. Communities' Needs:

(a) A health clinic near the communities is urgently needed;
(b) Frequent transportation between Honiara and the communities;
(c) Going to town only once a week and too expensive;
(d) Canteens operating in these communities to sell small basic goods are limited;
(e) Police Posts are at Henderson and Tetere so need for one at a nearby community;
(f) Reliable lighting is needed because solar is only good during sunny days;
(g) The need to establish a few more Primary Schools to carter for youths in the area;
(h) More young people need to attend school up to secondary and even to tertiary levels;
(i) There is a need to setup an internet café at Rate Community High School; and

(j) Rate Community High School computer is not reliable so need a reliable computer.

XVII. Education:

(a) The only Primary and Community High School in the area is at Rate;
(b) Two Early Childhood Education or ECE schools at Marava and Ngongoti;
(c) Rate School is both Primary and Community High School;
(d) At the Secondary level, students undertake their studies from Forms 1 to 3 only;
(e) Parents see educating their children as important and a priority;
(f) Currently only 1 student studying at the University of the South Pacific in Suva, Fiji;
(g) 1 student is studying at the USP Honiara Center.

XVIII. Sports Facilities and Activities:

(a) 1 playing field for local sports at Rate Community High School;
(b) Main sports are soccer, volleyball and futsal;
(c) Sometimes organize 7 aside soccer knockout competition; and
(d) Play grounds for children at Marava and Ngongoti.

XIX. Gardening Techniques:

(a) Different gardening areas for different crops;
(b) Before planting the crops, they burn the grasslands;
(c) Rotation of crops plant cassava first followed by the planting of bananas;
(d) Each household is responsible for making their own garden;
(e) They always plant a mixture of crops in one garden in some instances;
(f) Return to the same gardening area after 2 to 3 years;
(g) Gardens are either 1 km or a few meters away from residential houses; and
(h) Garden sizes may be 20m x 30m depending on individuals.

XX. Varieties of Crops and Wild Plants:

(a) Cassava, potato or kumara, yam, taro;
(b) Banana, mango, Malaya apples, pineapple, pawpaw, breadfruit, coconut, nali nuts, oranges, lemon, pomelo, mandarin, betel nut and cut nut;
(c) Melon, cucumber, egg plants, tomatoes;
(d) Slippery cabbage and beans;
(e) Right now Cassava, banana and tomatoes are being harvested;
(f) Wild yam is called Uvikambe;
(g) Wild taro is known as Kai chui; and
(h) Picho is a kind of local ice-cream.

XXI. During Disasters:

(a) Seek government aid like in 1986 when Cyclone Namu struck;
(b) Seek help from Guadalcanal Disaster Management Committee in 2010's flooding; and
(c) People eat swamp taro or kakake and banana during times of disasters.

XXII. Hunting and Fishing:

1. Are carried out at their old settlement sites at Malukula and Tulotrea;
2. Always go in 2 or 3 groups of 8 to 10 men;

3. Accompanied by women because of fear of witchcraft known as vele;
4. Usually spend between three to four days in the mountains while hunting and fishing;
5. Women accompanied the men to cook and help carry the catch back home; and
6. Used guns to hunt for animals, mammals and birds and spears to fish for the following but now they only use spears:

(a) Pigs;
(b) Opossums;
(c) Fly foxes;
(d) Pigeons or kurukuru;
(e) Eels or tapurara;
(f) Fish known as helu;
(g) Valu;
(h) Kola; and
(i) Tilapia found only in Betisasanga stream

1. Diving and fishing done without hunting;
2. Choro and upstream of the river fish mainly for eel and scrimp;
3. From Antioch to Senge, Marava people usually spent the weekends fishing for small fish and eel using spear guns;
4. Area upstream of the river, fishing is usually done for important occasion only;
5. Hunting for wild pigs is also carried out only when they are organizing a big feast or fund-raising events.

XXIII. Building Materials:

(a) Timber used for flooring, rafters, studs and knockings, cross beams and beams;
(b) Loya cane is used for tying, sewing sago leaves together and weaving;
(c) Bamboo use for building, cooking and as light when it is dry;
(d) Palm- bark for walling, planks for sewing sago leaves along;
(e) All these materials are collected from the bushes upstream of the river;
(f) Both men and women help to collect the building materials; and
(g) Only the men build and carry out maintenance of buildings.

XXIV. Land Boundaries:

1. From Vuramali to Birao, the land belongs to another tribe.
2. From Birao to Senge the land belongs to the tribes in the Malango area or Bahomea people which include Marava communities.
3. Land boundaries sometimes are not clearly demarcated.
4. In some cases streams, special trees and plants or natural objects like big stone boulders are sometimes used as boundary markers.

XXV. Cultural and Religious Sites:

1. In these three communities, no archaeological or historical sites exist.
2. About 13 cemeteries are within the area.
3. Six of these cemeteries may be in the way of the road to the Dam Site
4. Seven are in areas still in question

XXVI. Concerns Regarding the Impacts of the Hydro Project:

(a) The Hydro Project will affect the people's fishing activities along the Tina River.
(b) They want free access to continue to their fishing and hunting grounds.
(c) The quantity of gravel might be less than at present once the dam is constructed,
(d) Tina, Vuramali and Antioch are the places where they normally get their gravel.
(e) Recreational areas on the river banks will be affected, especially in the Vuramali area where the children and their parents use for picnicking.
(f) The environment will no longer be safe for the women and children.
(g) Quality of water will be affected especially during the construction of the dam.
(h) Water will no longer be safe for drinking, cooking or washing.
(i) Marava get water from a Stream which they run the water through a pipe for about 1 emeter and collect it into containers.
(j) They use this stream when the Tina River floods.
(k) Cemeteries may have to be relocated if they are in the way of the road.
(l) Downstream water quality will no longer be the same.
(m) Fish stock and their habitat will be greatly reduced.
(n) Disturbance to social lifestyle by outsiders.
(o) Disturbance during construction with heavy machineries going up and down the road.
(p) Abuse and inappropriate behavior by outsiders like at Gold Ridge will happen.
(q) Traffic and safety are of great concern to families.
(r) Peaceful lifestyle currently enjoy by everyone will no longer be the same.
(s) Disturbance and damage of important sites and gardens.
(t) Problems of relocation will greatly affect people's lives.
(u) Fear of increasing social problems once money started following into the communities

XXVIII. Electricity: Current Situation-

(a) Families use solar for lighting but only when the sun is bright during the day.
(b) Generators for lighting, charging mobile phones & screening videos
(c) They need fuel for the generators which is currently very expensive

XXIX: Expected Benefits from the Hydropower Project-

(a) If have power they would use refrigerators for preserving food
(b) Operate workshops & joinery shops using electrical tools
(c) If work on the project and earn money would build permanent houses
(d) Start income generating businesses
(e) Operate transportation services using cars for taxis and buses
(f) Set up canteens
(g) Own and Sell fuel
(h) Women want to generate income by operating businesses, catering and home-stay
(i) Men and women want to involve in contracts, road construction and driving heavy machineries
(j) Provide accommodation for visitors
(k) Employment opportunities for local skillful workers

(l) Training on the jobs offered by the Hydro Project for locals
(m) Government to grantee loans from banks for capital needed to start a business
(n) Establish good partnership between the communities, government and stakeholders
(o) Want a government that has concerns for the people (lesson learnt from Gold Ridge)
(p) Mainly looking forward for improvement of their standard of living
(q) Easy access to power, better services and equal opportunities in the employment sector
(r) Long term benefit will depend on the landowners and trustees.
(s) Looking forward to involving in contract work with the Hydro Project.

XXIX. Some Final Issues Worth Taking Into Serious Consideration:

1) Marava Community is located on registered land owned by the Government through the Commissioner of Lands in the Ministry of Lands and Housing.
2) As far as the communities at Marava, Ngongoti and Vatupaua are concerned, the main destructions that may affect some of their grave sites and probably parts of their gardening areas would be from the construction of the road to the main dam and the power station sites.
3) In such cases, some forms of compensation payments need to be negotiated with the owners to assist them move the graves and gardens to new sites. Some houses may have to be relocated especially in Ngongoti. These issues will become clearer when the surveyors and engineers decide on the plans for the roads and the power-lines.
4) For the time being the general feeling is that everyone within these three communities supported plans for the Tina Hydropower Development Project.

WEEK 1-DATE 2: Tuesday 3rd September 2013

SIA Team Visit to-

I. Vuramali-The main Center for the meeting

II. Targeted Communities were-Vuramali, Horohotu (1 & 2) Katihana and Haimane

III. Attendance: 44 persons

IV. Program-

(a) The program started with a prayer and a welcome
(b) Vuramali was not possible to get to because it meant crossing the river
(c) It was decided to hold the meeting at Haimane.
(d) The Paramount Chief of Vuramali, David Tabea was present
(e) Zimri Laoni gave the introductory remarks in the local language
(f) He also encouraged those present to talk openly and share their views about the Hydro Project
(g) Gerard Fitzgerald, the SIA Team Leader introduced himself and explained that he is an independent researcher.
(h) He then explained the main purpose of the visit is to-

All the villages along the Tina River

Talk about the areas the Hydro Project might affect in people's lives

Find out the views of the people regarding this Project

(i) All the information was translated by Kellington Simeon, the Assistant Sociologist

V. Discussions: Chief Alfred Ilala expressed his views as follows-

(a) Up until now major projects like the Gold Ridge Mining, Guadalcanal Plains Plantation Oil Limited and Logging operating in the country are implemented in Central Guadalcanal and yet they still have not benefited.

(b) So he questioned "if the Tina Hydro Project is built would they receive any benefits"?

(c) He expressed these issues basically because this is another new huge undertaking which has not been done anywhere else before in the country.

Penuel Pore, a Church Elder (SSEC) and Chief also spoke about the need to-

(a) Build and relocate them

(b) Have their lives built up and improved

Zimri told those present that the SIA team is not an awareness group

Sarah Estela (a lady) then asked what will happen to the information the team collects.

Gerard Fitzgerald responded as follows-

(a) First all the data is collected

(b) Second the data is put together or compiled into a report

(c) Third the report is then presented to the Government and the Project Developer

(d) Fourth depending on the data provided, they then decide whether to go ahead with the Project or not

VI. Movement of People:

The next lot of information collected was about the movement of people from one place to another. According to the data they provided they used to live in the following places before moving to where they are today:

(a) Belana

(b) Railoto

(c) Chipukiki

VII. The Reasons for Moving:

People Move because of the need for-

(a) Easy access to employment

(b) Better living standards

(c) Better and easy access to services like health, transport, market, schools and Church

(d) Natural disasters like flooding, cyclone, landslides, etc.

VIII. Years of Settlement:

(a) Horohotu(2) -c1960

(b) Horohotu (1) -1970

(c) Haimane -1970

(d) Vuramali -c1990

(e) Katihana -No information available

IX. Attendance at the Meeting:

Not everyone turned up for the meeting

(a) Horohotu(1) - Nil

(b) Horohotu(2) - 2

(c) Haimane -12
(d) Vuramali -10
(e) Katihana -Nil

X. Community Church Groups:

(a) Haemane-Baptist Church Women's and Youth Groups
(b) Vuramali-South Sea Evangelical Church Women's Fellowship and Youth Groups
(c) Horohotu-Seventh Day Adventist Church Women and Youth Groups

XI. Livelihood:

In Haemane 11 men and 4 women involve in paid employment in the following:

(a) Gold Ridge Mining Co.
(b) Ministry of Finance & Treasury-SIG
(c) Ministry of Fisheries-SIG
(d) Solomon Islands Ports Authority
(e) Teaching Services
(f) Royalties from Gold Ridge Mining

Formal Employment:

(a) Vuramali 6 men and women
(b) Horohotu 5 men and 1 woman
(c) Katihana no information

Other activities which they also involve with for their livelihood are-

(a) Milling timber
(b) Gardening/Marketing
(c) Fishing/Hunting
(d) Cutting Copra/Selling Cocoa
(e) Operating Canteen
(f) Sewing School uniforms
(g) Weaving baskets for sale

The kinds of crop, fruit and veges which they sell in the markets are;

(a) Slippery cabbage
(b) Paw paw
(c) Cassava
(d) Kumara/Potato
(e) Ferns-Kasume

No one in either Haemane or the other communities involved in any tourism projects but some of them are signatories to the Gold Ridge Mining Company and Paramount Chief David Tabea is one of them.

XII. Fishing and Hunting:

Both men and women go diving and hunting up to Pachuki and all the way up the riverand in the bush following bush road, and the valley looking for

(a) Ura & eel in the river; and
(b) Pigs in the bush

XIII. Historical & Sacred Sites:

(a) Tulahi is an ancestral sacrificial site
(b) Namuloha is a sacred pool

(c) Aho is a stream with a half Eel living in it and since everything else in it is all half no one is allowed to eat anything in it
(d) Pela is also a tabu site
(e) Naukotiti is a historical place of worship with a stone and a sacred tree known as vaovao still standing in it today. It is located in the area between Senge and Choro
(f) Vuho which literally means to catch in a net is a sacred site at Vuramali

XII. Currently People Use the Water from the River for:

(a) Cooking
(b) Washing
(c) Drinking
(d) Swimming
(e) Watering cabbages, egg plants, beans and other vegetables
(f) Boiling and making tea
(g) Transportation

XIII. Main Concerns if the Dam is built:

(a) Their hunting grounds will be affected because the pigs resting place will be under water
(b) Fishing will be affected, especially diving because the best spots will become so deep that no one will be able to dive
(c) Quality of the water will no longer be the same
(d) It will no longer be safe for the children to play freely in the river
(e) Drinking the water directly from the river will become a health problem
(f) Fear of the dam breaking and destroying everything in its path including lives of people

XIV. Health Issues and Concerns:

Currently the most common diseases or sicknesses that often affect people in these communitiesand their concernsare-

(a) Malaria
(b) Pneumonia
(c) Influenza
(d) Diarrhea
(e) Measles
(f) Clinics very far
(g) Lack of transport in emergence cases

XV. The first things people buy when they have money:

(a) Rice- because easy to cook
(b) Soap
(c) School fees
(d) Generator for lighting, video show (3-4 hrs a day)

XVI. Benefit they see if Hydro is Constructed:

(a) Provide lighting
(b) Refrigerator for preserving food/cold water
(c) Good communication
(d) Clinics

(e) Permanent School/Church buildings with lights for night programs
(f) Employment opportunities for women
(g) Electric sewing machines
(h) Men will be employed
(i) Operate small income generating businesses

XVII. People's general feeling toward the Tina Hydro Project:

(a) Generally those present at the meeting seemed to appreciate the discussions
(b) They were happy to express their feelings freely but still not sure since hydro development of this magnitude is a new undertaking by the SIG in this country
(c) Since this huge development project will be on their land, fairness in the benefit sharingmust be taken seriously and they need to fully participate as equal partners
(d) They do not want the situations they already experienced with Gold Ridge Mining Company and Guadalcanal Plains Palm Oil Limited repeated
(e) Therefore, SIG, the financier of the Project and all stakeholders must take on board seriously the people's concerns.

WEEK 1-DAY 3: Wednesday 4th September 2013

SIA Team visit to-

I. Tina: The main center for the Meeting

II. Targeted Communities: Tina, Valebebe, Valebarik, Valemaota&Tahurasa

III. In attendance: 38

IV. Program:

(a) Met on arrival by the founding father of Tina Community, Chief Gabriel Gi.
(b) Meeting was held at the Church Community Hall
(c) Welcomed by the Village Chief Asher Wini
(d) Opening Prayer by Jeremiah
(e) Opening remarks by Zimri Laoni who was one of the three Field Guides
(f) Kellington Simeon and Gerard Fitzgerald explained the purpose of the visit and told those who attended that the SIA team consists of independent Scientists and not from the SI Government or the Tina Hydropower Development Project Office.
(g) The SIA team's visit is paid for by the World Bank

V. History of the Communities/Villages:

(a) Tina started by Chief Gabriel Gi, his wife and father in the 1950s after WWII
(b) Before that they were living in Belana and Vurutolu
(c) He converted to Christianity through the teaching of a Missionary from North Malaita by the name of Gideon Fangalea who used to accompany him as a young man to get things from the American Soldiers and carry them back to mountain settlements.
(d) Gabriel Gi's wife attended Afio Girls Bible School in South Malaita before they got married

(e) Current population is between 400 to 500
(f) Main religion is South Sea Evangelical Church
(g) From Tina the others move to settle in the other communities such as
(h) Valebarik started in 1980
(i) Valebebe started in 1998
(j) Tahurasa started in 1999
(k) Valemaota started in 2006

VI. Main Reasons for moving from the mountains and later spreading to establish other communities include:

(a) Escaping from the Moro Movement in the 1950s when it was very strong
(b) Need easy access to medical services
(c) Close to Honiara for other services such as market, shops and main Church Head Office
(d) Employment opportunities
(e) Natural disaster such as the Cyclone Namu in 1986

VII. Church and Social Groups:

Since all the family members now living in the other communities started from Tinawhich is predominantly SSEC, they all have the same social groupings such as:

(a) Women's Fellowship Groups
(b) Men's Fellowship Groups
(c) Youth Groups
(d) Sunday School Groups
(e) Soccer Teams
(f) Volleyball Teams
(g) Netball Teams

VIII. Livelihood:

(a) Women's activities involve gardening
(b) Marketing vegetables and other crops like potato, cassava, taro etc at the Honiara Market
(c) Sewing cloths for themselves and extras for sale
(d) Every Friday go to Honiara main Market
(e) Sell flowers
(f) Feed and sell pigs
(g) 12 workers employed at Gold Ridge
(h) 1 work for GPPOL
(i) 3 School Teachers
(j) 1 work in the THP Office
(k) 1 Public Servant
(l) 2 work as Police Officers at Tetere Police Post -(Chief Gabriel Gi's son and grandson)
(m) Milling timber for sale or personal use
(n) Dive for fish to sell or family consumption
(o) Hunt for pig for sale or to eat
(p) Logging in the area

IX. Women's Current Lifestyle in the Communities:

(a) Free to walk wherever they wish without fear
(b) Free to fee and raise their pigs and children
(c) Free to fee their dogs
(d) Free to breath fresh air
(e) Free to fish using fishhooks or their bare hands to catch the fish
(f) Free to walk along along the river banks
(g) Free to go to their gardens alone

X. Community Projects:

In Tina Community, the South Sea Evangelical Church had introduced in August 2012village projects that involved:

(a) Sanitation – which individual families are taught how to make proper sealed toilets
(b) Environment Cleaning – cutting down the grass, digging proper drainage systems, general village cleaning around residential dwellings and proper disposal of rubbish
(c) Piggery – the Church provided a boar and female pig
(d) Aims - to prevent unhealthy habits such as using the bushes and streams as toilets
(e) **-** toreproduce piglets for distributing to individual families to feed.
(f) Unfortunately, both pigs are so huge that they are unable to reproduce.
(g) Two persons from Tina community attended a training courseon how to properly manage pig farming at the Taiwan TechnicalFarm in Honiara

XI. Sacred/Tabu Sites:

(a) Vatulina is a sacrificial site from before
(b) Namuloha is a fish spurning big pool at Korobawhich is regarded as sacred
(c) The Pool is regarded sacred so that while the fish is spurning they are protected and preserved and later they can spread to other parts of the Tina River

XII. Health Issues:Main diseases/sicknesses

(a) Malaria (cases drastically reduced)
(b) Diarrhea (reduced)
(c) Hookworm (also reduced)
(d) Pneumonia (cases are increasing)
(e) Stress amongst women (slightly increasing)
(f) Still birth or other related difficulties in child delivery is not a problem

XIII. Main Health Concerns:

No health clinics close by so they have to travel to Honiara especially to

(a) Rove clinic
(b) Mataniko clinic
(c) Kukum clinic
(d) No. 9 Central Hospital
(e) Heavy alcohol consumption
(f) Youths involving in drug use
(g) Transportation is sometimes difficult in emergency cases

XIV. Problems with the construction of the dam for the Tina Hydro Project:

(a) Polluting the water
(b) No fishing
(c) No diving

(d) No clean drinking water
(e) No clean water for swimming
(f) No clean water for washing cloths and dishes
(g) Fear for the children
(h) Fear of the dam breaking during earthquakes and cyclones
(i) Fear of landslides causing the water to overflow from the dam
(j) Diseases like diarrhea might increase

XV. Men and Women's Concerns:

(a) Employment should involve locals who already have skills
(b) Nor respect for the custom/culture by those from outside
(c) Camp sites should have proper waste disposal in place
(d) Contracts should consider the locals first not like Gold Ridge Mining Company
(e) Dumping of raw sewerage straight into the water without treating like Gold Ridge Mining Company not acceptable
(f) Disrespect for young girls and even married women
(g) Security
(h) Women do not want the type of treatment Gold Ridge Mining Company has done to the local women in the Gold Ridge area
(i) Women want the Project to provide the opportunity for them to do catering, laundry and even driving some of the light vehicles
(j) They want the first chance for employment for unskilled work to be given to their men-folks

XVI. Long Term Concerns:

(a) Landslide into the lake/dam
(b) Trees for timber along the river bank in the dam area will not be possible to cut
(c) Will they continue to use the lake/dam for fishing
(d) Diving will no longer be possible
(e) Using the river as a means of transportation will be greatly affected

XVII. Benefits from the Hydro Project:

(a) Provide lighting for the communities
(b) People will be able to use refrigerators to store food/cold water
(c) Build mini hospital
(d) Improve the road and other infrastructures
(e) Provide good water supply system
(f) Use the Dam as part of tourism attraction
(g) Provide employment
(h) Building permanent houses
(i) Set up scholarships for local students
(j) Invest any money they earn from the project
(k) Involve in joint investment schemes
(l) Involve in eco-tourism development projects
(m) Operate canteens
(n) Set up furniture making workshops

XVIII. Some Mitigation Measures:

(a) Provision of water tanks
(b) Build water supply to provide water from other sources
(c) Possible use of lake/dam for transportation
(d) Sailing
(e) Fishing
(f) Other recreational activities

XIX. Final decision on the Benefits and Effects:

(a) 90% of those present supported the Project
(b) 10% undecided
(c) More information is still needed on the effects

XX. Concluding remarks:

When people do not benefit from any project on their land they cause social disturbance

XXI. Lunch was kindly provided:

Consisting of boiled bananas which was greatly appreciated

WEEK 1-DAY 4: Thursday 5th September 2013

SIA Team visit to-

I. Valesala: The main center for the Meeting

II. Targeted communities: Antioch, Valesala and Komeo

III. Total Attend Meeting: 41

IV. In attendance:

(a) Paramount Chief of Antioch Community, Eron Nose;
(b) Tribal Chief of Komeo Community, Mark Enoch;
(c) Tribal Chief of Valemaota, Enoch Maki who did not attend meeting at Tina;
(d) Ishmael Wesi, Elder of the Church and Village of Antioch;
(e) 38 Men and Women as well as children

V. Program:

(a) Opening pray by Elder Ishmael Wesi;
(b) Brief introduction of team members including local guides and field assistants by local Anthropologist;
(c) Chief remarked saying they did not receive any prior information about the SIA team's visit;
(d) SIA team leader, Gerard Fitzgerald expressed his regret about the information not reaching them in time before the team arrived even though it was sent earlier;
(e) Kellington Simeon explained the purpose of the visit by the SIA team; and
(f) Zimre Laoni further explained in language the purpose of the visit in response to a question from the former SSEC Pastor Osca Billy

VI. History of people migration from place to place:

(a) First wave of migration to these villages started around 1960s;
(b) First settlement at Kolohaji;
(c) From Kolohaji people move to Talamu and Torotolu;
(d) From Talamu to Vatunadi;
(e) From Vatunadi to Valelokea;
(f) From Valelokea to Valekocha;
(g) From Valekocha to Valelokea or Antioch and Valesala in the 1970s; and
(h) These movements also included members of the Moro or Gaena Alu Movement

VII. Reasons for moving from one place to another place:

(a) Easy access to Honiara town;
(b) Easy access to clinics;
(c) Easy access to schools;
(d) Easy access to other services like transportation, shops etc.;
(e) Also natural disaster like Cyclone Namu in 1986 caused people to move; and
(f) People move along their relationship ties, land boundaries and landownership

VIII. Livelihood:

(a) Full time employment
(b) 3 Teacher (Government)
(c) 2 GPPOL
(d) 4 Earth Movers Logging Company
(e) 1 Gold Ridge Mining Company
(f) 1 Pastor

IX. Other sources of income:

(a) Milling timber
(b) Fire wood
(c) Flowers
(d) Handicraft
(e) Garden products
(f) Fishing
(g) Hunting
(h) Gardening
(i) Marketing
(j) Day labor (earn between $50 and $100 or provide food)
(k) Contracted jobs
(l) Megapod or wild turkey eggs
(m) Chicken/Duck/Pigs
(n) Betel nut fruits
(o) Local building materials-sage palm leaves, vines, etc
(p) Local tobacco (lekona or savusavu)
(q) Nali Nut and Coconut (young and dry fruits)

X. Common Health Diseases/Sicknesses and Concerns:

(a) Malaria both adults and children
(b) Pneumonia
(c) Diarrhea both adults and children

(d) Measles mostly with children
(e) Influencer/common flu both adults and children
(f) Yellow fever rare
(g) Sugar or Diabetic common amongst adults
(h) High blood pressure adults only
(i) Main clinics far away at Rove, No. 9 for emergency cases only
(j) Namanu health aid center lacks fulltime medical staff and medicine
(k) Stress affects women because of drunken husbands and extra marital affairs
(l) Difficult child birth can cause death
(m) Accidents
(n) Children drowning in the river
(o) Body shaking, cold, fever-people associate this new kind of feeling in the body with the use of chemicals in the mining activities at Gold Ridge Mining sites

XI. Main Church and Groups:

(a) South Sea Evangelical Church
(b) Women's Fellowship Group
(c) Men's Fellowship Group
(d) Youth Group
(e) Music Group
(f) Sunday School Group

XII. Moro or Gaena Alu Movement:

(a) Preservation of Culture and Inheritance
(b) Moro's vision was to preserve the culture
(c) Preserve the Environment- **(Hairau)**
(d) Preserve the Land- **(Pari)**
(e) Preserve custom money, way of doing things and lifestyle of People- **(Tinoni)**
(f) Live simple life- **(Poua or Poor)**
(g) Look after the Ground/Land- **(Momoru)**
(h) Life of today (rich becomes richer and poor becomes poorer)- **(Vulua or Head)**

XIII. Current Situation:

(a) Use Kerosene for light
(b) Generator
(c) Solar Panels

XIV. Future Plans if Hydro Project is completed:

(a) Lighting
(b) Refrigerator
(c) Video
(d) Electric sewing machine
(e) Improve and upgrade Church Musical Instruments
(f) School computers

XV. Household:

If women have extra income they would

(a) Start income generating businesses
(b) Improve housing from thatched to iron

(c) Pay school fees

XVI. If men have extra income they would

(a) Purchase truck for marking timber
(b) Purchase truck and put on hire or rental
(c) Involve in Tourism/Home-stay
(d) Spend it on housing
(e) Purchase tools (chain saw)
(f) Build Community health
(g) Build Community hall

XVII. Final Remarks:

One of the women expressed her concerns regarding

(a) Road block to drinking water (Gold Ridge)
(b) Road block to gardening area (Gold Ridge)
(c) Continue the dialog after 1 year
(d) People in the affected areas to have maximize benefit and minimize the effects
(e) Communities should involve with the management of the project
(f) Any agreements should consider inclusion of any clause that will take into account reviewing the agreement**.**

WEEK 1-DAY 5: Friday 6th September 2013

SIA Team Program

I. Household Survey Review

II. Venue: Hyundai Office

III. Time: 8 am – 5 pm

IV. Attended by: All SIA Team members

V. Discussions led by Gerard Fitzgerald, SIA team leader, assisted by Kellington Simeon, Lawrence Foana'ota, Anthropologist and Sharon Para, Local Assistant Guide and Interpreter

VI. Went through the four days' field work results and fill in any gaps with the help of the other local guides such as Zimri Laoni and Rex Ata

VII. Planned the field work program for the rest of Week 2.

WEEK 2-DAY 6: Monday 9thSeptember 2013

SIA Team Visit to-

I. Senge – the main center where the meeting was held

II. Targeted Communities were: Senge, Koeroba and Choro

III. Present:

(a) Chief Joe Maneisu of Senge, & Son Clement Tovia
(b) Chief Hudson Micah of Koeroba, wife and Son-inlaw
(c) Chief of Choro did not attend
(d) Rest of those present were of those who went with the team
(e) SIA team-GF, KS, SP & LF

IV. Program:

(a) Brief welcome by Clement Tovia
(b) He also explained to those representatives from the other communities who attended the purpose of the meeting and told them to give the right information concerning the proposed Tina Hydro Project when they are asked questions.

VI. Introduction of each of the Team Members by Gerard Fitzgerald the SIA Team Leader.

VII. Presentations:

(a) Senge: was settled before World War 2.
(b) After the War some families decided tomove to communities like Marava, Vuramali, Managikiki and Koeroba
(c) Joe Maneisu and family remain until today.
(d) In 1986 Senge was destroyed by Cyclone Namu.
(e) People moved to Marava and after the cyclone return back to Senge again.

VIII. Reasons for moving:

(a) Natural disasters like cyclone Namu of 1986
(b) Easy access to job opportunities in Honiara
(c) Easy access to transportation
(d) Quicker to get to Health clinics

IX. First information about the Hydro Project:

(a) The people's first time to hear about the HP was in 2007;
(b) The person who first told them about the Project was Texas from Guadalcanal;
(c) He visited Koeroba and Senge;
(d) Life after the dam is built, is still unknown;
(e) Life now is all they know; and
(f) Little they know about the project at this time is that it will change their way of life and affect their use of the river

X. Main Livelihood Activities:

(a) Gardening;
(b) Hunting with dog & spear;
(c) Fishing;
(d) Diving;
(e) Marketing of ferns/tomatoes/egg plants;

(f) Milling timber for sale and own use (small scale);
(g) Development of Eco-Tourism (from 2009 till early 2013 already had 29 guests);
(h) Charging for accommodation (from beginning of 2013 already had 17 guests who paid a total of $17,000.00);
(i) Marketing of the Eco-tourism lodge at Senge overseas has already been made; and
(j) Foraging in the forest

XI. Other Village/Community Activities:

(a) Hunting and fishing may take villagers away from their homes for a week;
(b) Daily hunting and fishing take place between Senge and Terobisi;
(c) They may also hunt or fish along the Beahea or Bicho Rivers;
(d) Namutamadira Pool people believed in the past a family drowned inside after a landslide and still live in it. After Cyclone Namu people started fishing inside;
(e) Used fishing lines (in Senge they have about 6 fishing lines);
(f) Use goggles for diving (only 1 left):
(g) Hunt for pigs with dogs and spear;
(h) Opossums; and
(i) Large lizard known as Hunu

XII. Women's Roles:

(a) Weaving baskets;
(b) Planting vegetables like slippery cabbage, tomato, beans and egg plants;
(c) Cultivating root crops such as potato or kumara, cassava;
(d) Taking care of the household chores;
(e) Cooking for the family using fire;
(f) Fetching drinking and cooking water from the main Tina River;
(g) Collecting firewood for cooking;
(h) Feeding the pigs and other domestic animals;
(i) Washing the clothes & dishes; and
(j) Cleaning in and around the home

XIII. Varieties of Crops, Plants, Animals & Materials for family use and for Sale:

(a) Cassava, potato or kumara, yam, taro and banana;
(b) Betel nut;
(c) Ferns or Kasume planted;
(d) Slippery cabbage and beans;
(e) Wild yam is called Uvikambe;
(f) Wild taro is known as Kai Chui leaves;
(g) Swam taro or Kakake;
(h) Fish & Pigs;
(i) Loya cane; and
(j) Picho is a kind of local ice-cream.

XIV. How much they earn per month:

(a) In the past they used to earn between $250 to $500 per month;
(b) Now they may earn between $500 to $1,000 per month by selling betel nut; and
(c) Providing accommodation for tourists

XV. The main Church & Organization at Senge, Koerob & Choro:

(a) Roman Catholic;
(b) Moro or Gaena Alau Movement; and
(c) Seventh Day Adventist (1 person at Senge).

XVI. Main Diseases:

(a) Malaria (not a major problem);
(b) Pneumonia (caused by very bad cold);
(c) Influencer or common cold
(d) Hernia (caused by hard work); and
(e) Generally people in these communities are healthy

XVII. Health Concerns:

(a) Long distances to the Clinics like Rove, Mataniko and No. 9 Hospital;
(b) Namanu and Good Samaritan Clinic (near Nguvia) unable to deal with serious cases;
(c) Lack of transportation; and
(d) Being far away from any good roads and health facilities

XVIII. Communities' Needs:

(a) A health clinic;
(b) Good access roads;
(c) Need to setup an internet café; and
(d) Proper accommodation facilities for tourists

XIX. Education:

(a) The only Primary and Community High School in the area is at Rate;
(b) The children from Koeroba have to reside at Antioch to go to school and only return home during school holidays;
(c) Main worry is for food because they do have any land for gardening at Antioch; and
(d) So far only 1 person at Senge attended High School and is currently operating an Eco-Tourism lodge

XX. During Disasters or the Tina River floods:

(a) Seek government aid like in 1986 when Cyclone Namu struck;
(b) Seek help from Guadalcanal Disaster Management Committee in 2010's flooding;
(c) People eat swamp taro or kakake and banana during times of disasters; and
(d) People use Senge & Nembo streams to fetch water for drinking and cooking

XXI. Cultural Sites:

The following sites were used by the founding fathers who settled the land between Senge and Choro:

(a) Tulahi opposite Koeroba Settlement;
(b) Aho is a sacred Pool;
(c) Namoloha is a sacred Pool;
(d) Choga
(e) Vatukotiti is a sacred Stone;
(f) Bela located on Tulahi hill;

(g) Tovu;
(h) Babaru Luvia is a cave used in the past for sleeping; and
(i) Kabi

XXII. Their Sacred Totems:

(a) Helu (Big fish) represented by 2 stones;
(b) Eel – Mouvo;
(c) Prawn used for sacrifice;
(d) Hahate-poisonous snakes (2 types)
- One red in color is a totem;
- 2nd is called Hurusuli - dark-blue in color is poisonous but very rare and lives in the river; and

(e) Vatumosa is a Pig represented by a stone totem.

XXIII. Forest & Logging:

(a) Logging happened at the top of the mountains in 2011;
(b) Recent logging activities in the area was by Earth Movers;
(c) Problem of logging causing streams to get dirty and undrinkable;
(d) Arguments usually occur between family members regarding benefit sharing;
(e) Causes a bit of soil erosion;
(f) Tapu sites were marked with red paint;
(g) Koeroba main reasons for milling timber are for sale and house building;

XXIV. Benefit of Electricity if the Dam is built:

(a) Currently use solar (sun only heats up the panels from 11 am to 2 pm;
(b) Kerosene (now facing out);
(c) Sustainable lighting;
(d) Able to screen video/movies;
(e) Refrigerator for the Eco-Tourism Lodge;
(f) Set up internet café
(g) Relocation of the communities;
(h) Improvement of standard of living;
(i) Have proper water supply;
(j) Have protected area;
(k) Provide employment
(l) Contribute to the Development of Eco-Tourism Activities and Attractions;
(m) Provide Sports Facilities for communities;
(n) Provide scholarships and training;
(o) Provide close health facilities like clinics and even a mini-hospital;
(p) Improve the level of education in specialized skills;
(q) Tourists might be interested to come and see the lake; and
(r) It will make it easier for people to travel upstream by canoe or boat

XXV. Other Benefits if get extra Money:

(a) Buy an Out Board Motor & Canoe to use in the lake;
(b) Buy a truck;
(c) Establish a Fuel Station;
(d) Buy a laptop computer for entering data concerning tourists; and

(e) Set up a Tire Repair Workshop

XXVI. People's Concerns if the Dam is built:

(a) The use of plants for medicine will be affected;
(b) The use of plants for food may no longer available;
(c) Plants use to feed dogs in order to know where pigs live will be destroyed;
(d) Access to medicinal plants use for fishing, hunting and women will be limited;
(e) Leaves of plants use for separating married couples will be hard to find;
(f) Number of tourists visiting the place might be less;
(g) Some species of fish might migrate while those like living deep waters might stay;
(h) Calvelum trees and creepers need to be removed because they are poisonous and might kill the aquatic life in the dam;
(i) Logging trees must be compensated;
(j) If paid for the trees, the Project would have the right of ownership;
(k) Property lose;
(l) Lose of river access;
(m) Water contamination;
(n) Access for normal use will be affected;
(o) Pollution of the air, noise, and water;
(p) Tribal conflict over land and royalty sharing;
(q) Two graves at Koeroba will be under water;
(r) Gardening areas for potato, cassava, yam, taro, banana, betel nut, coconut and all kinds of fruit trees will be flooded;
(s) Aho stream on Tulahi land owned by Charana sub-tribe of Manukiki will be under water in the dam;
(t) Change of culture which might lead to women wearing shorts & driving trucks;
(u) Broken families;
(v) Ethnic differences and misunderstanding between locals and international employees might cause frictions; and
(w) Introduction of new diseases

XXX. Chief Hudson Micah of Koeroba's Movements:

(a) Chief Hudson Micah was born at Valehaitora within Manukiki land;
(b) From Valehaitora he moved to Muritovavi;
(c) From Muritovavi he moved to Hailake (on Garavu land);
(d) From Hailake he moved to Tavura (Manukiki land);
(e) From Tavura he moved to Vatumosa;
(f) From Vatumosa he moved to Turutolu;
(g) From Turutolu he moved to Valehaona;
(h) From Valehaona he moved to Valebokoboko;
(i) From Valebokoboko he moved to Malatoha;
(j) From Malatoha he moved to Tavura;
(k) From Tavura he moved to Hanilake;
(l) From Hanilake he moved to Marava (where he married in 1975);
(m) In that year he started Vuramali;

(n) From Vuramali he moved to Komeo (which was damaged by Cyclone Namu in 1986);
(o) From Komeo he moved back to Marava;
(p) From Marava he moved to Vuramali;
(q) From Vuramali he moved to Tina;
(r) From Tina he moved back to Vuramali;
(s) From Vuramali he moved to Valesala;
(t) In 1993 he moved from Valesala to Koeroba. and
(u) Established a hamlet on his land at Koeroba

XXXI. Main Reasons for Moving from Place to Place are:

(a) He was not accepted by Church leaders who disagree with the Moro Movement;
(b) He was not allowed to promote any activities associated with the Movement;
(c) Disrespecting the Movement's believes and teachings which he practices;
(d) Not allowing him to make money on land owned by other people;
(e) Disturbing his plans to build custom houses by taking him to court;
(f) His interaction with other community members was restricted; and
(g) His desire to return to his ancestral land where everything is free

XXXII. Some Information on the Moro or Gaena Alu Movement:

(a) Name Gaena Alu was given to the Moro Movement after it was registered under its Constitution.
(b) The Movement's main base is at Koeroba where Chief Hudson Micah is the main holder of everything related to the Movement.
(c) He has two boxes containing the things that he keeps in three compartments in each box.
(d) The purpose for keeping them in boxes is for security and safety reasons.
(e) Also when the dam is built and the place is flooded, they are easy to move to another safe location.
(f) By keeping them safe, he would use them to attract tourists.
(g) He is interested in developing eco-tourism facilities in his own place.
(h) He is not sure at this stage if the Hydro Project or Government would assist him finance his proposed plans.
(i) Items kept in the boxes are shell money rings use for life saving.

XXXIII. Some Issues Worth Noting:

1) Reiloto is the original place of settlement by the founding ancestors of the present families of Senge and Koeroba hamlets.
2) Descendants of the Charana sub-tribe continue to move around in the surrounding areas of land in search of good gardening, hunting and fishing spots along the Tina River.
3) Even though they move around, they still continue to think about their relationship and ownership of their land. Therefore, they continue to live until today in the hamlets at Senge and Koeroba.
4) The families in these hamlets continue to depend on what grows and lives in these areas of land along the river for their survival.

5) It was in 2007 that he first heard about the Hydro Project from one Government Officer who visited them.
6) From that time he started replanting his betel nut trees at Namopila away from the dam site.
7) He wants to relocate at Vukuraunaba further up in the hills from Koeroba.
8) To mitigate he needs to relocate his Custom House where he keeps the heirloom.
9) In each box he divided into three rooms.
10) Room 1: items relate to environment;
11) Room 2: items relate to good health; and
12) Room 3: items that make gardens produce high yields
13) These items represent similar ones held at the Movement's headquarters in Makaruka, on the Weather Coast of Guadalcanal Province

WEEK 2-DAY 7: TUESDAY 10TH SEPTEMBER 2013

SIA Team visit to-

I. **Pachuki –** main venue of the Meeting

II. **Targeted Communities:** Pachuki, Habusi and Veralokea

III. **Habusi Settlement:** A brief stopover was at Habusi where the power station will be located on the way to Pachuki. Only one person met the team at the settlement.

IV. **Program:**
(a) Introduction of the SIA Team members by Lawrence Foana'ota-National Anthropologist/Health and Cultural Heritage Expert
(b) Explaining the purpose of the visit by Gerard Fitzgerald-International Sociologist
(c) Questions and discussions about social aspects of the communities led by Kellington Simeon-National Assistant Sociologist assisted by Sharon Para, Zimri Laoni and Rex Ata, the local guides and interpreters

V. **Attendance:**
(a) Avai Gilbert, Chief of Pachuki Village
(b) Risiki Rongo, Chief of Habuchi Village
(c) Including men, women and youths from both communities
(d) SIA team- GF, KS, SR & LF

VI. **History of the two Settlements:**
1. **Pachuki**
- Started after Cyclone Namu in 1986
- Before that members were in Torotolu
- In 1966 they left Torotolu for Valekocha
- From Valekocha they moved to Valesala
- From Valesala they moved to Pachuki

2. Habuchi

- Also started after Cyclone Namu in 1986

VII. Livelihood:

(a) 1 person working at Gold Ridge
(b) 1 person worked with Earth Movers Logging Company
(c) Work on Contracts or Hiring bases
(d) Marketing flowers, cassava, kumara, fern (kasume), betel nut fruits
(e) Milling timber is rated number 1
(f) Gardening of cassava, kumara, taro and banana is rated number 2
(g) 1 chain saw owner from Habuchi is hired by others to cut timber
(h) Feed pigs and local chicken (sale in the village)
(i) Selling fruits like lemon, cut nut (*barringtonia*)

VIII. Concerns regarding the Construction of the Dam:

(a) Fear of losing their dependency on the river for transporting timber, swimming washing, diving and fishing etc
(b) Flow of the river between Senge, Habuchi and Pachuki will be low and so they cannot float their milled timber from Senge to Habuchi
(c) Habuchi and Pachuki will be badly affected so the only option is to be relocated.
(d) They are looking more towards relocating upstream rather than downstream because of their tribal connection to the land and resources upstream
(e) Right now they enjoy the free lifestyle, at the same time they are starting to worry about the future in relation to the dam and the power station

IX. Alternative River for Diving and Hunting area is

(a) Toni River

X. Cultural and Religious Sites:

(a) All their cultural and 1 grave sites are located at Koeroba
(b) While 1 grave is at Senge

XI. Health Issues:

(a) Main diseases are-

- Malaria
- Pneumonia
- Hernia
- Diarrhea
- Influencer or flu, etc

XII. Main Health Concerns:

(a) Namanu Health Aid Post-no permanent Medical staff based here
(b) Rove Clinic
(c) Mataniko Clinic
(d) Kukum Clinic
(e) No. 9 Central Hospital all located in Honiara

XIII. General Comments on the Current Situation:

(a) Like other communities, and hamlets already visited, everyone expressed the same concerns, fears and lack of knowing the future situation
(b) Despite of that they all wanted the Hydropower Project

WEEK 2-DAY 8: Wednesday 11th September 2013

SIA Team Program

VIII. Alteration to the planned field trip program to Namopila, Komureo, Valekocha and Vatunadi which was supposed to be made today

IX. This was because most of the people in these communities were away and so the only Chief who was around on Tuesday 10th was told about the change of date from Wednesday to Friday.

X. Therefore instead of going to the field today, the time was spent reviewing the Field Trip Programs based on the changes of dates and communities to be visited

XI. **Venue:** Hyundai Office

XII. **Time:** 8 am – 5 pm

XIII. **Discussion Session Attended by:** All SIA Team members
- Led by Gerard Fitzgerald (team leader);
- Kellington Simeon;
- Lawrence Foana'ota; and
- Sharon Para

XIV. Planned the field work program for the rest of Week 2.

WEEK 3-DAY 12: Tuesday 17th September 2013

SIA Team Visits to:

I. **Main Venue for the Meeting:** Mataruka 2
II. **Targeted Communities:** Malango, Mataruka 1, 2, 3, & 4
III. **In Attendance:**
(a) Allen Billy, Chief-Mataruka 1
(b) Malachi Rubu, Chief-Mataruka 2
(c) Timothy Palo, Chief-Mataruka 3
(d) Justice Deni, Chief-Mataruak 4
(e) SIA team-Gerard Fitzgerald, Kellington Simeon, Fred Patison, Lawrence Foana'ota & Sharon Para

IV. **Program:**
(a) Welcome & Opening Prayer by Daniel Una-Council Member from Rota Tribe
(b) Lawrence Foana'ota made the opening remarks in thanking those who have turned up for the Meeting on behalf of the team members
(c) Explaining the purpose of the visit –Gerard Fitzgerald, team leader

(d) Effects of the proposed Tina Hydropower Development Project-Discussions led by Kellington Simeon

(e) Fred S Patison was also present with the team and expressed the importance of taking note of the communities' concerns regarding land and its use. He gave examples of cases in Choiseul and Isabel Provinces regarding land issues.

V. Visitation by Staff from Project Office:

(a) It was confirmed that staff from the Project Office already visited the area and talked about Government's plan regarding the project

VI. Landownership & Rights to the Tina River:

(a) Those present explained that even though they are in Malango, their connection to the Bahomea tribe and landownership rights including rights to the Tina River are equally the same.

(b) Some of them expressed their disappointment regarding the fact that those who signed the documents allowing the government to develop the hydropower project on the river had not included them.

VII. Original Places of Settlements & Graves:

(a) Nala
(b) Turahi
(c) Makuricha
(d) Luga
(e) Tasi (4 graves, betel nut and cut nut trees)
(f) From Tasi to Chichinge (Garry is from Chichinge)
(g) From Chichinge to Namoraoni (Jeremiah Matebasia is from Namosa)
(h) From Namoraoni to Nala

The last place in the catchment area people left in 1950 to settle where they are today

VIII. Other Important Resources in the Catchment Areas:

(a) Minerals
(b) Logging
(c) Potential for Eco-tourism development
(d) Salt
(e) Hot spring (use for healing)
(f) Streams for growing water crease

IX. Their Relationship to the catchment's area:

(a) Hunting
(b) Fishing
(c) Diving

All these activities take place between Vatumosa to Choro and they continue until today. They always go to carry out these activities when they are holding Church fundraising programs, feast for the opening of a Church building or Christmas

X. Livelihood:

(a) Gardening-Kumara, cassava, taro, yam
(b) Marketing of yams, mushrooms and vegetables
(c) Cocoa (own small plots and sold dried beans)
(d) Coffee (" " " " " " ")

(e) Piggery- 10 to 20 (feed them with millrun)
(f) Milling timber (have about 30 chain saws)
(g) Hunting for pigs, opossum and lizards to sell
(h) Employment at Gold Ridge Mining Co. (50 employees)
(i) Earth Movers Logging Co.
(j) Guadalcanal Plains Palm Oil Ltd (GPPOL)- (5 employees)
(k) Teachers - (30 –Secondary and Primary)
(l) Central Government - 10
(m) Provincial Government - 2
(n) Medical - 1
(o) Ports Authority - 1
(p) Operating Canteens - many
(q) Bus - 6 Contracted out
(r) PhDs Qualification- 2

XI. Cultural Sites:

(a) Manukiki - owned by Wisely Sie of Havaina village who was born at Tanabou Village and belongs to a sub-tribe known as Uluna

XII. Health Issues/Main Diseases and Clinics:

(a) Malaria
(b) Pneumonia
(c) Diarrhea
(d) Still birth (big concern amongst women)
(e) Rove Clinic
(f) Mataniko clinic
(g) No.9 Hospital-(Emergency cases only)
(h) Transport hardship

XIII. Benefits if Hydro is Constructed:

(a) Improved standard of living
(b) Receive more cash
(c) Training and managing resources
(d) Government acting as guarantor for person loan
(e) Opportunity for improvement of businesses
(f) Pastors are paid
(g) Operate small businesses
(h) Light for Church groups to meeting at night & other community programs
(i) Refrigerator
(j) Electric Sewing Machines
(k) TV
(l) Video
(m) Charging Mobile Phones
(n) In Services

XIV. Youths:

(a) Access to proper and good education
(b) Everyone is provided technical and specialized training

(c) Establish workshops for furniture making
(d) Purchase equipments and tools
(e) Provide lighting for students to study at night

XV. Women:
(a) Sew calico for family & school uniforms
(b) Make ice blocks
(c) Have cold storage for keeping food
(d) Good housing

XVI. Main Church and Social Groups/Facilities:
(a) South Sea Evangelical Church
(b) Church Building
(c) Women's Fellowship
(d) Youth Groups
(e) Sports Groups- Soccer/Netball/Basketball
(f) Sports field

XVII. Land:
(a) Ownership is based on tribe
(b) Women has the right
(c) Important resource for sustaining community life

WEEK 3-DAY 13: Tuesday 17th September 2013

SIA Team Visits to:

I. Main Venue for the Meeting: Belaha
II. Targeted Communities: Belaha
III. In Attendance:
(a) Israel Trevor Sibia
(b) Members of the communities
(c) SIA team-GF, KS, FP, LF & SP

IV. Program:
(a) Began with Lawrence Foana'ota thanking the members of the communities who are able to attend the meeting on behalf of the SIA team
(b) A brief introduction of the team members and their responsibilities
(c) Followed by Kellington Simeon explaining the reason for the visit
(d) Gerard Fitzgerald explaining the meaning of social and livelihood
(e) Also explained steps to take in Hydro Project Development
(f) Followed with discussions and questions

V. Steps to take in Project Development:
(a) Planning includes lots of meetings, revisits to follow up
(b) Construction will disturb people, break custom, noise and river polluted
(c) Infrastructure good roads
(d) Completion will only employ a few
(e) Changes in the level of the water in the river
(f) Operating stage will cause long term changes

(g) Benefits should be positive for everyone

VI. Livelihood:

(a) Milling
(b) Cocoa
(c) Betel nut
(d) Marketing garden crops and vegetables
(e) Pig
(f) Shops for rice, taiyo, noodle
(g) Bottle Shop selling SP beer
(h) Poultry
(i) Coconut
(j) Fishing for eel, tilapia, river shells (leve) and shrimps
(k) Hunting for wild pigs, opossum, lizards (iguana)
(l) Formal employment c 20
(m) Earth Mover (Logging Co.) between 10-20 workers
(n) Small businesses-Canteens
(o) Teachers - 20 (Kiddy, Primary and Secondary)
(p) 50% make gardens for money
(q) Crops grown for consumption and sale-Cassava, kumara, cabbages

VII. Marriage:

(a) In order to maintain the proper cultural practice of marriage and to ensure landownership is sustained and kept within the tribe, a brother's son has to marry his sister's daughter.
(b) To keep the family relationship strong and intact, X's son must marry Y's daughter.
(c) If a woman marries outside of her tribe, the eldest daughter must marry someone within her tribe in order to maintain the right of use to the land

VIII. Where they get the fish and pigs:

(a) Belaha River
(b) Tina Catchment area
(c) Usually spend 1 to 2 days hunting for pigs
(d) If for special occasions they normally spend a week in the catchment area of the Tina River
(e) During this time they hunt for pigs, fish and dive for fish, eel and shrimps
(f) Where they normally come out after hunting or fishing is at Betiloga
(g) They also have time to re-visit old settlement sites to maintain the connection

IX. Land Ownership:

(a) In Guadalcanal landownership is handed down through women line
(b) Stretches from Senge to Koeropa
(c) Communities living in Belaha have the same right of landownership with those along the banks of the Tina River

X. Effects of the Hydro Project if Constructed:

(a) Change to lifestyle
(b) Increase in drunkenness by men and women

(c) Extra marital affairs will increase due to easy access to more money from the project
(d) Plants used for medicine in Choro will disappear
(e) Some of the livelihood activities connected to the Tina river will be affected
(f) Royalties if not fairly distributed like they have already experienced with Gold Ridge Mining Company will cause disunity among community members
(g) Timber will no longer be available for house building

XI. Benefits:

(a) Improve access roads
(b) Access to free power
(c) Provide good water supply
(d) Current source of water and quality not good
(e) Improve standard of living for more than 2,000 living in the community
(f) Provide employment
(g) Training
(h) Establish an institute and other schools improved
(i) Provide scholarships (currently GRMC provides scholarships but not enough)
(j) Light
(k) Refrigerator
(l) Operating small income generating businesses

XII. Health Issues:

(a) A Provincial clinic is near the Belaha School
(b) Improve sanitation
(c) 5 villages have pit toilets

XIII. Main Diseases:

(a) Malaria
(b) Pneumonia
(c) Diarrhea
(d) Dengue Fever

XIV. Suggested Alternatives Needed:

(a) Long term employment for members of the population
(b) Proper management of any royalties
(c) Change the leadership management
(d) Build institutions that will sustain the population
(e) Belaha school was built 30 years ago but not many go further so must be improved
(f) Improve the only Health Clinic at Belaha
(g) Most immediate need of the community is for water supply

XV. General Observations:

(a) Those who spoke generally supported the hydropower project
(b) Express the fact that since this is new in the country no one knows it's good and bad effects at this stage
(c) The discussions went well and it ended with a peaceful atmosphere

WEEK 3-DAY 14: Wednesday 18th September 2013

SIA Team Visits to:

I. Main Venue for the Meeting: Vera'ande (Roadside Communities)

II. Targeted Communities: Vera'ande, Verakweli, Niumahata

III. Attendance:

- **(a)** Ruth Kao- Chief Joshua Kao's wife (Vera'ande)
- **(b)** Johnson Tadokata - Originally from Choiseul (Verkweli)
- **(c)** Charity Tadokata - Johnson's wife
- **(d)** Grace Paul - (Niumahata)
- **(e)** Saleem Stephen- Muslim follower -(Pululaha-South Malaita)
- **(f)** Women, youths and children

IV. Program:

- **(a)** Introduction by Lawrence Foana'ota
- **(b)** Explanation by Kellington Simeon of the reasons for the visit and how people live
- **(c)** 3 parts (i) story, (ii) household survey & (iii) interview with women
- **(d)** Sharon Para translated the information in the local language

V. History of the Villages:

- **(a)** Families moved from Tina to Vera'ane on April 3rd 2000 because they took up one of the cocoa blocks nearby left by Levers on land they owned
- **(b)** Niumahata community was established by families from the Weather Coast who moved in 1968 because of a major landslide and earthquake in that part of Guadalcanal Province
- **(c)** Verakweli was established by families who used to live at Veravolia. They moved because of easy access to the road

VI. Livelihood:

- **(a)** Market-pick coconut, kasume
- **(b)** Gardening-families main source for food
- **(c)** Cocoa-only during pick season from June to August
- **(d)** Sewing sago palm leaves and sell the panels at the market
- **(e)** Casual work around the villages
- **(f)** Milling timber
- **(g)** 6 employed by Lee Kwok Kuen- from Vera'ande
- **(h)** 8 employed by Lee Kwok Kuen- from Vermahata
- **(i)** 3 employed by Lee Kwok Kuen- from Verakwele
- **(j)** 1 employed by Gold Ridge Mining from Vera'ande
- **(k)** 1 employed by Guadalcanal Plains Palm Oil Ltd from Niumahata
- **(l)** Diving along the Tina River by young people for fish/no hunting

VII. Women's Roles:

- **(a)** Operate small income generating businesses like selling ring cakes, young coconuts, bans and other small items
- **(b)** Washing clothes and dishes
- **(c)** Fetching water from drinking and cooking, collecting food from the gardens

(d) Women, men and youths harvest cocoa and young coconuts together

VIII. Church Groups in the 3 Communities:

(a) Seventh Day Adventist (SDA)- Place of Prayer- Namanu
(b) Church Of Melanesia (COM)- Place of Prayer- Ngalimera/Good Shepard
(c) South Sea Evangelical Church (SSEC)- Place of Prayer- Veravinua
(d) United Church (UC)- Place of Prayer-GPPOL/Town
(e) Assembly Of God (AOG)- Place of Prayer- Verakabikabi

IX. Health Issues-Main Diseases/Clinics:

(a) Malaria
(b) Pneumonia
(c) Diarrhea
(d) Influencer
(e) Namanu Health Clinic
(f) Good Samaritan Mini Hospital/ Clinic near Ngovia School
(g) Central Hospital at No.9

X. Main Source of Water for Drinking and Washing:

(a) 3 wells (1 for drinking 2 for washing) at Vera'ande

XI. Main Concerns, Needs and Worries when the TH Project Actually started:

(a) Not enough cash to pay for family needs
(b) Generator to pump water
(c) If road is constructed, it will be dusty
(d) Children's safety will be at risk
(e) Random visits by drunkard
(f) Put up fence to protect children from running onto the road
(g) Road should be tar seal to avoid dust
(h) Have check points
(i) Put in place speed humps
(j) Security will be threatened and probably increase if development takes place
(k) Main road use by children going to Rate and Namanu schools
(l) Changes may be for good or bad
(m) Heard houses might be moved if they are 1 meter within the perimeters of the road
(n) Fear of losing their current way of life if they are to be relocated
(o) Peace at night will be disturbed due to vehicles going up and down the road
(p) Need Police Post
(q) Emergency Post
(r) School and Clinic at Namanu need to be moved because they are situated on someone else's registered land and relocate them on secure land elsewhere

XII. Benefits as Perceived by People from these Communities:

(a) Easy access to transport
(b) Set up side road markets
(c) Light
(d) Water supply from own source will be improved
(e) Good road

(f) Easy to get quickly to hospital in emergency cases
(g) Fulltime and Part time employment
(h) Good housing
(i) Improve and upgrade the existing schools

XIII. Some General Observations and Comments:

(a) People were basically satisfied with their present way of life
(b) They are healthy and are generally easy going with not too much to worry about except when drunkards from other neighboring communities sometimes disturb them because their houses are located near the main road
(c) Their feelings about the Tina Hydro Project and plans to expand and use the road as the main access to the location of the site were of a welcoming nature but at the same time of concern and fear for their communities' safety and security.

WEEK 3-DAY 14: Wednesday 18th September 2013

SIA Team Visits to:

I. Main Venue for the Meeting: Horohotu 1
II. Targeted Communities: Horohotu 1, 2, & 3

III. Attendance:

(a) Village Chief- Seth Givu
(b) Other Community members
(c) SIA Team

IV. Program:

(a) Brief welcome on behalf of the SIA team members and introduction
(b) Chief's brief on the history of the communities
(c) Discussions and questions regarding topics like livelihoods, health etc
(d) The communities' thoughts about the benefits and effects of the Tina Hydro Project

V. History:

(a) Originally came from the Weather Coast of Guadalcanal
(b) First settled at Konga in 1974 while working for Foxwood Timber Milling Co based near Red Beach
(c) From Konga they moved and started the settlement at Horohotu 1. They were already in Horohotu 1 before Cyclone Namu struck in 1986
(d) Horohotu 2 was the second community to be established after Horohotu 1 followed by Horohotu 3

VI. Livelihood:

(a) Marketing - 2 days a week - Mondays and Thursdays
(b) Gardening-potato or kumara, cassava, tomatoes, beans, pawpaw, banana
(c) Project involved in farming tomatoes, pawpaw and bananas for sale
(d) Youths employed by others to cut timber and paid
(e) 1 employed by World Vision
(f) 1 employed by Police as a Prison Warder

(g) 1 employed by Gold Ridge Mining Co.
(h) 6 employed by Guadalcanal Plains
(i) 1 gone to work in Makira/Makira-Ulawa Province
(j) Dig side of Tina River for drinking water
(k) 1 rain water tank near the Church

VII. Heath Issues: Diseases:

(a) Malaria
(b) Pneumonia
(c) Diarrhea
(d) Influencer or flu

VIII. Facilities:

(a) Namanu Clinic
(b) Clinics in Honiara
(c) Project should make allowances for two more main markets

On the East and West sides of the Project

IX. Effects from Hydro Project as Communities Foresee:

(a) Water from the river will be polluted
(b) Clean drinking water will be scarce
(c) Not be able to wash calico or dishes

X. Benefits from the Hydro Project:

(a) Provide water tanks
(b) Young people will work for the project
(c) Easy access to transportation
(d) Build clinic
(e) Improve schools including Rate Primary and Secondary School
(f) Borehole for water for the communities
(g) Improve transportation
(h) Improve road

XI. Church Organization:

(a) Seventh Day Adventist or SDA

XII. General Comments:

(a) Members did not come to SIA Meeting held at Vuramali
(b) Some of the community members were away for a Church Meeting
(c) The Pastor of the SDA Church is from Marovo area/Western Province
(d) The Village Chief did not look healthy due to old age

Week 3-Day 15: Thursday 19th September 2013

SIA Field Visit to:

I. Main Venue for the Meeting: Ravu, Westside of Ngalibiu Bridge

II. Targeted Communities: Downstream- *(East of Ngalibiu Bridge):* GPPOL 1,

Baravale – c7 houses 1 Church, Kadavu, Pokaso- c7 houses, Selaghoghoro- 3 houses, Omba- c2 houses, Papaghu- c 10 houses (indigenous people from the Plains)
(West of the Bridge): Ravu, Ngalimera (Yellow nut), Siroigha, Old Selwyn, Kolina-Popoloi 1 (Settlers from the Weather Coast), Pololoi 2- Lee Kwok Kuen Farm and gravel extraction site

III. Attendance:

(a) Moses Karuku- Assistant Pastor, Church of the Living Word
(b) Geoff Alexander- Originally from South Malaita but married to a Guadalcanal lady and is now living near GPPOL (His wife is Agnes Putu's sister)
(c) Cathy Kakamo
(d) Agnes Putu
(e) James Laisa - Assistant Administration Officer – Guadalcanal Province
(f) SIA Members
(g) Community Leaders
(h) Men, women & youths

IV Program:

(a) Brief Introduction of SIA team members
(b) Inform those present of the reason for the visit
(c) Clarify the status of the SIA team that members are not from the Government or Project Office but are independent with sponsorship by the World Bank.
(d) Explain nature of the SIA team's work
(e) Asking questions and having general discussions

IV. General Discussions:

(a) Most of the time was spent by those who spoke which seem to be dominated by three men complaining about their past experiences with Government and NGOs that did not keep their promises or assist them with programs like improvement of their school or building a nearby clinic
(b) Examples they gave- Ngalibiu Primary School has 417 students, Grades 1-6 with two streams for each class a day which means that they have 12 class sessions per day in order to cater for the learning needs of the 417 kids
(c) Government has already assisted Rate School but not their school at Ngalibiu
(d) Ravu Community consists of about 16 villages
(e) They use the water from the river for- drinking, swimming, washing and cooking
(f) They raised the issue about not being included in the group that signed the agreement for the project to go ahead

V. Impacts:

(a) If the dam is built it will have some social effects on the life of those who use the water from river.
(b) They feel the water might dry up during the dry season
(c) They dig the side of the river to get water for drinking and watering their gardens
(d) They are concerned about river pollution during the construction of the dam

(e) Replacement of gravel which they depend on for cash will be affected
(f) During the dry weather the level of the river will be low
(g) Any plans to develop this hydro project must take into account the welfare of those using the river for the livelihood
(h) Already they have been unfairly treated because of their exclusion from the initial discussions with the government and those who use the river for their livelihood
(i) No water supply in the communities
(j) Use old World War 2 drums for their water wells
(k) If the dam will be safe because of fear that it might break if there is a storm or earthquake.
(l) Fear is based on their experience during Cyclone Namu in 1986 when the river flooded and swept many of their homes which caused a huge disaster for the families
(m) A woman expressed her concern that "culture" was not observed during this particular meeting because they always have refreshments when such gathering is held.
(n) They will lose the income they generate from sale of gravel from the river
(o) Use of the river for rubbish disposal from the upstream communities
(p) Oil spill from Lee Kwok Kuen farm upstream as well
(q) They are not happy with the way information is passed to the communities. For example, government initiates a project the information about it is then passed onto the Member of Parliament who in turn channels it to the Provincial Member who finally informs the communities. So far this system has not worked well in the country
(r) Flooding of houses if dam breaks or during heavy rain
(s) Arguments over unfair sharing of royalty payments
(t) Government funding always given to Member of Parliament but never get to people in the communities in the rural areas
(u) Employment by GPPOL mostly from other Provinces, very low from the village. 95% of the workforce from other Provinces only 5% local
(v) Lack of money is a major issue of concern

VI. Possible Options or Solutions:

(a) Need to form 3 representative groups- Upstream, Midstream and Downstream to sign agreements to ensure proper and fair sharing of benefits
(b) Help to build raised houses on stilts
(c) Provide water tanks, boreholes, water pumps, wells improved & water supply
(d) Government need to contact Solomon Island Water Authority
(e) Connect to main water supply from Honiara which is only 21.1 km away
(f) Set up alarm system to warn people of danger when the water level rises
(g) Improve already existing wells and provide water pumps
(h) Involve more men, women and youths in the workforce
(i) Relocate or identify place for communities to escape to during disasters on higher grounds

(j) Wanted members of their communities to visit the proposed dam site since Tina communities already visited and seen it or in other countries with dams already exist. So government should include them in delegation in the future.

(k) Women only heard about the dam but do not know how it works. So they need more information

(l) Weather Division in Government should visit the lower parts of Ngalibiu River because when it rains the gardens and villages are always flooded

(m) Should have good drainage system in place and proper designs for the settlements

(n) All communities should have free electricity

VII. Livelihood:

(a) Sale of gravel (Lee Kwok Kuen-Charge $100 per load/use 15 ton truck) while Dalgro is charged $390 per cubic

(b) Gardening

(c) Piggery

(d) Poultry

(e) Cocoa

(f) Tourism-guided tours to tapu sites

(g) Fishing for eel (paleo), kola, mamata, ghatubi, Kukuli (fish with poisonous fins), bagovu, lae, shrimps (ura), mathi, tilapia

(h) Kasume, Water Lillie, kamau, pumpkin, pawpaw, banana, taro-swamp taro, tagolo-swamp taro or kakake

(i) Aligeto

VIII. Health Issues:

(a) Malaria (low)

(b) Dengue Fever – (about 100 cases)

(c) Bakua – skin disease **(Havole** vernacular name) (social effect people not married)

(d) Pneumonia

(e) Diarrhea

(f) Diabetes – poor diet, sugar or fast food

IX. Clinics:

(a) Goro Mini Hospital

(b) Ngalibiu Clinic

(c) No. 9 Central Hospital-Honiara

X. Benefits:

(a) Have free electricity

(b) Employment

(c) Improved standard of living

(d) Improved roads

XI. General Observations:

(a) People were frustrated

(b) Young people not interested in working for GPPOL

(c) At the end they wanted more information about the project and also others dams in other countries
(d) Discussion took too long because those who spoke continue to repeat their frustrations and anger
(e) The meeting ended with a prayer by the Assistant Pastor- Moses Karuku

Week 3-Day 16: Friday 20th September 2013

SIA Team Visit to:

I. Main Venue of the Meeting: Verakabikabi (Settlers from the Weather Coast)

II. Targeted Communities: Verakabikabi Community

III. Attendance:
(a) Dominic Kusoli – Paramount Chief
(b) Evens Seleso – Village Chief
(c) SIA team –GF, KS, SP & LF
(d) Ray Roberts – Engineer-Guadalcanal Province
(e) Cathy Kakamo
(f) Agnes Puti

IV. Program:
(a) Opening Prayer and Introduction of SIA team by Ray Robert
(b) Spoke's person on behalf of community was Stanley Veke

V. History concerning the Settlement:
(a) 1965 big cyclone caused big flood forced the first families to move
(b) Later other families came to join them from the Weather Coast in 1970 after a big flood and landslide.
(c) They bought the land at Verakabikabi from the landowners in the custom way
(d) The total number of households in the community is 43

VI. Livelihood:
(a) Most of the family members away in Gold Ridge to dig for gold
(b) Marketing- Cabbage, banana, beans cassava, kumara, coconut
(c) Panning for gold and selling any finds
(d) Hunting for pigs
(e) Using eel trap to catch the eel at Betisasanga
(f) Hunting for opossum
(g) Gardening
(h) Diving
(i) Farming cocoa
(j) Grow swamp taro
(k) Fishing
(l) Collecting fern-kasume
(m) Collecting amau - a kind of leave of a shrub like sand-paper which they eat the young leaves and use the mature ones for washing pots and other cooking utensils

VII. Concerns:

(a) Lack of own transport
(b) When the road is constructed, it might cause dust
(c) Children use the road to walk to school
(d) Hydro dam might break causing huge damages
(e) Need more information about the Project
(f) Always arrange with landowners if want to make gardens
(g) Main stream they draw their drinking water from at Ngongoti might be affected when the access road to the dam site is constructed
(h) Gardening areas and 1 cemetery near the road might be destroyed
(i) Split after family argument resulted in joining two separate churches (Roman Catholic & Assembly of God)
(j) During construction of the road, families walking to Church in Marava might be affected
(k) Main worries-Money and Food
(l) Good clinics are in Honiara
(m) School fees
(n) Good houses
(o) Land

VIII. Health Issues - Main Diseases:

(a) Malaria
(b) Pneumonia
(c) Diarrhea
(d) Worry/anxiety

IX. Clinics & Schools:

(a) Namanu Clinic
(b) Marava Kindergarten
(c) Rate School

X. Churches:

(a) Roman Catholic (Only one Church before 1990)
(b) Assembly of God (Establish in 1990)

XI. Cultural &Historical Sites:

(a) No cultural tapu sites
(b) 3 Burial grounds

WEEK 3-DAY 16: Friday 20th September 2013

SIA Team Visit to:

I. Main Venue for the Meeting: Old Selywn
II. Targeted Community: Old Selwyn
III. Attendance:

(a) Alifox Ulu- Chief
(b) Agnes Putu - Landowner & Her Home
(c) Cathy Kakamo

(d) Ray Roberts-Engineer-Guadalcanal Province
(e) SIA Team-GF, KS, SP & LF
(f) Ronald Vosiu-Bougainville Christian Mission Fellowship
(g) Community members

IV. Program:

(a) Brief remarks and introduction of SIA team members by Ray Roberts (GP Rep)
(b) Explanation concerning the Project visit of this independent team was by Kellington Simeon

V. History of the Community:

(a) This place used to be called Nasilagu when the Anglican Church started a Primary School here
(b) When the Church decided to upgrade it to a high school they changed the name to Selwyn College
(c) In 1986 when the Cyclone Namu struck, the school was destroyed by flood from the Tina River and was abandoned and the School was relocated near Marovovo on the West side of the island
(d) After the school moved out the members of the families that own the land moved in after 1986 and settled in the houses that were not destroyed by the floods and they use the name Old Selwyn and Popoloi to refer to their community
(e) Before Cyclone Namu they used to live at Siroigha

VI. Livelihood:

(a) Gardening
(b) Plan cocoa, banana, etc
(c) Coconut
(d) Lease land for oil palm
(e) 2 members work at Gold Ridge Mining
(f) Sale of river gravel @$500.00 (SBD) per cubic
(g) Royalty payment from Guadalcanal Plains Palm Oil Ltd
(h) Use Ngalibiu river side for gardening, drawing drinking water, washing when generator is not working
(i) Use a well to draw water and only one tank at the Church Building
(j) Use two boreholes and two wells

VII. Their Needs:

(a) Solar power pump immediately needed
(b) Old pipes needed replacing
(c) Power needed to be re-connected

VIII. Concerns:

(a) Their community is located on flat plains and so they fear if a big flood they will be badly affected
(b) During dry season the wells become dry
(c) Oil and fuel spill
(d) To build their houses they have to buy building materials
(e) Support for the Government = 0%
(f) Promises never been fulfilled

(g) Only trustees benefit from any help
(h) To have a plan in place in case of any disaster happening like the dam breaking
(i) Interim Committee already in place but not legal
(j) Access road still under negotiation
(k) Upstream already well established with their organization
(l) Lower stream/downstream still unorganized
(m) Water boundary need chiefs to discuss and decide
(n) Parts of the Tina and Ngalibiu are registered and customary owned
(o) They need to be listened too and recognized also in any benefit sharing
(p) Damming the water will affect the flow of gravel

IX. Benefits:

(a) Still needed to be seen
(b) Improve the road
(c) Opportunity for employment
(d) Connected to the main power grid

X. Health Issues:

(a) Diarrhea
(b) Malaria
(c) Pneumonia
(d) Dengue Fever -2-3 cases

XI. Schools & Clinics:

(a) Ngalibiu Primary School-Guadalcanal Provincial School
(b) Good Samaritan Mini-Hospital administered by the Roman Catholic Church
(c) No. 9 at the Central Hospital

XII. Church:

(a) Christian Mission Fellowship
(b) Two Missionaries from Bougainville looking after the work of the Church

XIII. Alternatives:

(a) Plan for any areas for safety during disasters
(b) MOU with Project Office
(c) During the period the work of the Project goes on they need power restored and pump repaired or provided with a new one
(d) $3 million a year should be shared equally amongst family members may be affected
(e) Government to put in place clear guidelines on how trustees should distribute any benefits
(f) Tribes should choose who should be a trustee

WEEK 4-DAY 17: Monday 23rd September 2013

SIA Team Visit to:

I. Main Venues for the Meetings: Ministry of Environment & Conservation & Guadalcanal Provincial Headquarter

II. **Targeted Officials:** Permanent Secretary/ME&Con & Provincial Secretary/GP

III. **Present:**

(a) Permanent Secretary
(b) GF & KS

IV. **Program:**

(a) Main purpose of the visit was to update the Permanent Secretary of the work that have been done so far among those communities the SIA team members visited
(b) This was actually a courteous call
(c) Meeting with Guadalcanal Provincial Officials never materialized because the Provincial Government was having problems with its members
(d) Instead the SIA team decided to work on the plans for the writing up of their reports.

WEEK 4-DAY 18: Tuesday 24th September 2013

SIA Team Visit to:

I. **Main Venue of the Meeting:** Solomon Islands Development Trust or SIDT Office

II. **Targeted Organization:** SIDT

III. **Present:**

(a) Longden Mankdika- Director
(b) SIA team - Gerard Fitzgerald
(c) Kellington Simeon
(d) Lawrence Foana'ota

IV. **Program:**

(a) Brief on the work of the SIA team
(b) Brief on the work of SIDT

V. **Main purpose of SIA team visit:**

To hear if SIDT has any

(a) Current projects in the Tina Hydro Project area
(b) Plans for future projects

VI. **SIDT's Involvement:**

(a) Has a project in Chichinge Community
(b) Aim at developing rural people
(c) Encourage more development at village level
(d) Introduction of malaria model to get rid of the disease
(e) Malaria projects already in place at Tinahulu, Chichinge and Ngalimera
(f) Facilitators of projects that help villages to be self reliance

(g) Provision of drawn maps to locate village sites
(h) Value their sites
(i) Provide advice to communities on how to improve themselves

VII. Other SIDT's Activities:

(a) Carry out work on Mining and Gender funded by World Bank
(b) Involved with the rehabilitation of families from the Gold Ridge Mining area
(c) Data collecting excise is all they do
(d) Find out how involved are women in any development projects
(e) Conducted research 3 years ago with Out-growers at GPPOL but initiative not working
(f) Build capacity for a period of 9 months and then they should sustain themselves
(g) Encourage all social groups or organizations to work together
(h) Promote and encourage villages to involve in small solar and water projects

VIII. Projects that are still going:

(a) Chichinge the project belongs to the people so it is still going
(b) Roroni Kindergarten has become self reliance after SIDT assisted in establishing it in the community
(c) Tina and Marava eco-tourism project, women's center and sanitation projects are going well especially Tina community's sanitation project

IX. Main Theme of their Approach to village improvement and sustainability is

"VILLAGE STAND UP SELEVA"

This was the last field visitation and consultation that the SIA team members carried out and on Wednesday 25th the SIA team spent in the office discussing their writing up plans and on Thursday 26th the International Expert, Gerard Fitzgerald left the country.

Morning meal	% of hhd	Midday meal	% of hhd
rice	43%	rice	41%
kasava	25%	cabbage (no detail)	34%
cabbage (no detail)	20%	kasava	25%
tea	20%	banana	14%
kumara	11%	kumara	14%
silver fern/fern/kasume	16%	water	11%
banana	9%	silver fern/fern/kasume	11%
bread	7%	taiyo (canned tuna)	14%
tea-coffee mix	7%	beans	5%
taiyo (canned tuna)	7%	noodles (instant)	5%
beans	5%	pig meat	5%
biscuits	5%	potato	5%
noodles (instant)	5%	tomato	5%
pig meat	5%	cabbage (wild taro leaf)	2%
potato	5%	cake	2%
tomato	5%	coconut	2%
water	5%	coconut milk	2%
slippery cabbage	5%	eggplant	2%
chinese cabbage	5%	fish (savutu)	2%
cabbage (wild taro leaf)	2%	chinese cabbage	2%
cake	2%	pawpaw	2%
coconut	2%	pumpkin	2%
garlic	2%	pumpkin soup	2%
milo	2%	pumpkin tops	2%
pumpkin	2%	slippery cabbage	2%
shallot	2%	taro	2%
		tea	2%

Evening meal	% of hhd	Snacks	% of hhds
rice	77%	none	43%
cabbage (no detail)	36%	banana	32%
kasava	23%	coconut	16%
kumara	22%	pawpaw	14%
silver fern/fern/kasume	16%	betelnut	7%
tomato	11%	cucumber	5%
water	11%	cutnut	5%
beans	9%	apple	2%
noodles (instant)	9%	biscuit	2%
taiyo (canned tuna)	9%	breadfruit (May)	2%
banana	7%	silver fern/fern/kasume	2%
pig meat	7%	cakes	2%
potato	7%	cassava	2%
tea	7%	guava	2%

Evening meal	% of hhd	**Snacks**	% of hhds
eel fish	5%	Malay apple	2%
chicken	2%	noodles (instant)	2%
coconut milk	2%	orange	2%
corned beef	2%	pig meat	2%
fish	2%	rice	2%
kaimosamosa (sand paper)	2%	ringcake (doughnuts)	2%
onions	2%	sugarcane	2%
pawpaw	2%	soft drink-soda	2%
prawns (ura)	2%	tea	2%
pumpkin	2%		
pumpkin top	2%		
sanage	2%		
savutu	2%		

The following table lists aquatic insects (water dependant) insects that thrive in Guadalcanal.

Table 1 List of aquatic insects in Guadalcanal

Name	Species particularity	Stations
Heteroptera		
Notonectidae		
Anisops browni	Endemic to the Solomon Islands	Data from previous surveys (mentioned in Polhemus et al., 2008)
Anisops capitata	Endemic to the Solomon Islands	
Anisops cheesmanae	Endemic to the Solomon Islands	
Anisops leucothea		
Anisops nasuta		
Anisops philippiensis		
Anisops sp.		Charebuma River (stations 64a & 64b)
Anisops tahitiensis		Downtown Honiara
Enithares gibbera	Endemic to Guadalcanal	Charebuma River (stations 64a & 64b)
Enithares loria		Data from previous surveys (mentioned in Polhemus et al., 2008)
Enithares sp.		Tenaru River at Tenaru Falls (station 14)
Gerridae		
Halobates micans		Data from previous surveys (mentioned in Polhemus et al., 2008)
Halobates princeps		
Halobates proavus		
Limnogonus fossarum skusei		
Limnogonus luctuosus		Lungga River at mouth of gorge, Sasaa River at road bridge, Ndoma River at road bridge
Limnogonus sp.		Tenaru River at Tenaru Falls (station 14), Charebuma River (stations 64a & 64b)
Limnometra hysterema	Endemic to Guadalcanal	Tenaru River at Tenaru Falls (station 14)
Limnometra lipovskii		Lungga River at mouth of gorge, Ndoma River at road bridge, roadside pond in forest
Limnometra sp.		Charebuma River (stations 64a & 64b)

Name	Species particularity	Stations
Metrobatopsis browni	Endemic to the Solomon Islands	Tenaru River at Tenaru Falls (station 14), Tinahulu River (station 15), Lungga River at mouth of gorge, Ndoma River at road bridge, Charebuma River (stations 64a & 64b)
Neogerris parvula		Data from previous surveys (mentioned in Polhemus et al., 2008)
Mesoveliidae		
Mesovelia sp.		Sasaa River at road bridge, Ndoma River at road bridge, Charebuma River (stations 64a & 64b)
Mesovelia subvittata		Tenaru River at Tenaru Falls (station 14)
Mesovelia vittigera		Data from previous surveys (mentioned in Polhemus et al., 2008)
Ochteridae		
Ochterus nigrinus	Endemic to Guadalcanal	Data from previous surveys (mentioned in Polhemus et al., 2008)
Ochterus sp.		Tenaru River at Tenaru Falls (station 14)
Saldidae		
Saldula parens	Endemic to Solomon Islands	Data from previous surveys (mentioned in Polhemus et al., 2008)
Saldula solomonensis	Endemic to Guadalcanal	Data from previous surveys (mentioned in Polhemus et al., 2008)
Saldula sp.		Tenaru River at Tenaru Falls (station 14), Lungga River at mouth of gorge, Sasaa River at road bridge
Veliidae		
Microvelia sp.		Tenaru River at Tenaru Falls (station 14), Tinahulu River (station 15), Lungga River at mouth of gorge, Sasaa River at road bridge, Ndoma River at road bridge, Charebuma River (stations 64a & 64b)
Rhagovelia browni	Endemic to Guadalcanal	Tenaru River at Tenaru Falls (station 14), Tinahulu River (station 15), Lungga River at mouth of gorge, Sasaa River at road bridge, Ndoma River at road bridge, Charebuma River (stations 64a & 64b)
Rhagovelia n. sp.	Endemic to Guadalcanal	Charebuma River (stations 64a & 64b)
Corixidae		
Micronecta ludibunda ludibunda		Lungga River at mouth of gorge, Charebuma River (stations 64a & 64b)
Micronecta virgata		Data from previous surveys (mentioned in Polhemus et al., 2008)
Gelastocoridae		

Name	Species particularity	Stations
Nerthra gurneyi	Endemic to Guadalcanal	Data from previous surveys (mentioned in Polhemus et al., 2008)
Nerthra macrothorax		
Nerthra omani	Endemic to Guadalcanal	
Leptopodidae		
Valleriola n. sp.		Lungga River at mouth of gorge
Valleriola "solomonensis"	Endemic to Solomon Islands	Data from previous surveys (mentioned in Polhemus et al., 2008)
Ochteridae		
Ochterus sp.		Lungga River at mouth of gorge
Hydrometridae		
Hydrometra horvathi		Data from previous surveys (mentioned in Polhemus et al., 2008)
Odonata		
Chlorocyphidae		
Rhinocypha liberata	Endemic to Solomon Islands	Tenaru River at Tenaru Falls (station 14), Charebuma River (stations 64a & 64b)
Coenagrionidae		
Agriocnemis pygmaea		Data from previous surveys (mentioned in Polhemus et al., 2008)
Agriocnemis salomonis	Endemic to Solomon Islands	Sasaa River at road bridge, Ndoma River at road bridge, roadside pond in forest
Agriocnemis sp.		Tinahulu River (station 15), Lungga River at mouth of gorge
Ceriagrion erubescens		Data from previous surveys (mentioned in Polhemus et al., 2008)
Ischnura aurora aurora		
Pseudagrion incisurum	Endemic to Guadalcanal	Tenaru River at Tenaru Falls (station 14), Charebuma River (stations 64a & 64b)
Pseudagrion microcephalum		Tinahulu River (station 15), Sasaa River at road bridge, Ndoma River at road bridge
Pseudagrion sp.		Lungga River at mouth of gorge
Teinobasis bradleyi	Endemic to Solomon Islands	Charebuma River (stations 64a & 64b)
Teinobasis imitans	Endemic to Guadalcanal	Data from previous surveys (mentioned in Polhemus et al., 2008)
Xiphiagrion cyanomelas		Sasaa River at road bridge, Tina river
Protoneuridae		
Nososticta salomonis		Tenaru River at Tenaru Falls (station 14), Lungga River at mouth of gorge, Charebuma River (stations 64a & 64b)
Libellulidae		

Name	Species particularity	Stations
Aethriamanta subsignata		Data from previous surveys (mentioned in Polhemus et al., 2008)
Agrionoptera insignis similis		
Agrionoptera papuensis allogenes		
Brachydiplax denticauda		
Brachydiplax duivenbodei		
Crocothemis nigrifrons		
Diplacodes trivialis		
Hydrobasileus brevistylus		
Orthetrum sabina sabina		
Orthetrum villosovittatum bismarckianum		
Pantala flavescens		
Protorthemis woodfordi	Endemic to Solomon Islands	
Rhodothemis rufa		
Rhyothemis phyllis chloe		
Rhyothemis phyllis marginata		
Rhyothemis regia juliana		
Tapeinothemis boharti	Endemic to Solomon Islands	
Tramea liberata	Endemic to Solomon Islands	
Neurothemis terminata		Tina river
Neurothemys stigmatizans bramina		Lungga River at mouth of gorge, Tina river
Platycnemididae		
Lieftinckia lairdi	Endemic to Guadalcanal	Charebuma River (stations 64a & 64b)
Lieftinckia salomonis	Endemic to Solomon Islands	Data from previous surveys (mentioned in Polhemus et al., 2008)
Salomonocnemis gerdae	Endemic to Guadalcanal	Charebuma River (stations 64a & 64b)
Isostictidae		
Cnemisticta latilobata		Data from previous surveys (mentioned in Polhemus et al., 2008)
Gomphidae		
Ictinogomphus australis lieftincki	Endemic to Solomon Islands	Data from previous surveys (mentioned in Polhemus et al., 2008)
Aeschnidae		

Name	Species particularity	Stations
Anasciaeschna melanostoma	Endemic to Guadalcanal	Data from previous surveys (mentioned in Polhemus et al., 2008)
Gynacantha rosenbergi		
Corduliidae		
Eusynthemis frontalis	Endemic to Guadalcanal	Data from previous surveys (mentioned in Polhemus et al., 2008)
Guadalca insularis	Endemic to Guadalcanal	
Coleoptera		
Dytiscidae		
Genus and species unknown		Tinahulu River (station 15), Sasaa River at road bridge, Ndoma River at road bridge, Charebuma River (stations 64a & 64b)
Gyrinidae		
Dineutes (Callistodineutus) pagdeni	Endemic to Guadalcanal	Charebuma River (stations 64a & 64b)
Gyrinus sericeolimbatus		Data from previous surveys (mentioned in Polhemus et al., 2008)
Diptera		
Dolichopodidae		
Genus and species unknown		Lungga River at mouth of gorge
Simuliidae		
Morops kawagishii	Endemic to Guadalcanal	Data from previous surveys (mentioned in Polhemus et al., 2008)
Morops papuense		
Morops pohaense	Endemic to Guadalcanal	
Morops selwynense	Endemic to Guadalcanal	
Simulium (Gomphostilbia) hiroshii	Endemic to Solomon Islands	
Simulium (Gomphostilbia) rhopaloides	Endemic to Guadalcanal	Charebuma River (stations 64a & 64b)
Simulium (Gomphostilbia) sherwoodi	Endemic to Guadalcanal	Charebuma River (stations 64a & 64b)

Source : Adapted from Polhemus et al., 2008, BRLi, 2013

The following list of tables present plants that were identified during on-field baseline.

Flora Transmission Line 1: Secondary vegetation on grassland next to Oil Palm plantation			
Scientific Names	Common/Vernacular Names	Distribution Status	Protection Status
1 Broussonetia papyrifera	Paper mulberry	Common, Widespread	Least concern
2 Elaeis guineensis	Oil palm	Common, Plantation	Least concern
3 Mikania micrantha	Mile-a-minute	Common	Least concern
4 Euphorbia hirta	Milky weed	Common	Least concern
5 Mimosa invisa	Sensitive grass	Common	Least concern
6 Mimosa pudica	Sensitive grass	Common	Least concern
7 Hemigraphis reptans	Hemigraphis	Few, Uncommon	Least concern
8 Pueraria lobata	Legume Cover crop	Common	Least concern
9 Sida rhombifolia	Sida	Few, Uncommon	Least concern
10 Ipomoea illustris	Ipomoea	Few, uncommon	Least concern
11 Pennisetum polystachyon	Mission grass	Common	Least concern
12 Pennisetum purpureum		Common	Least concern
13 Brachiaria mutica	Para grass	Common	Least concern
14 Paspalum conjugatum	T - grass	Common	Least concern

Flora Transmission Line 2: Secondary vegetation on grassland next to Oil Palm plantation			
Scientific Names	Common/Vernacular Names	Distribution Status	Protection Status
1 Broussonetia papyrifera	Paper mulberry	Common, widespred	Least concern
2 Pennisetum polystachyon	Mission grass	Common	Least concern
3 Mimosa invisa	Sensitive grass	Common	Least concern
4 Mimosa pudica	Sensitive grass	Common	Least concern
5 Euphorbia hirta	Milky weed	Common	Least concern
6 Hemigraphis reptans	Hemigraphis	Few, uncommon	Least concern
7 Pueraria lobata	Legume cover crop	Common, widespred	Least concern
8 Phragmites karka	Fi'l Rade	Common, widespred	Least concern
9 Cucurbita sp?	Cucurbita	Common, widespred	Least concern

Flora Transmission Line 3: Open grassland - Secondary vegetation on roadside			
Scientific Names	Common/Vernacular Names	Distribution Status	Protection Status
1 Mimosa pudica	Sensitive grass	Common	Least concern
2 Pennisetum polystachyon	Mission grass	Common	Least concern
3 Sida rhombifolia	Sida	Common	Least concern
4 Broussonetia papyrifera	Paper mulberry	Common, widespread	Least concern
5 Starchytapheta jamaicensis	Blue Rat's tail	Rare, Uncommon	Least concern
6 Brachiaria mutica	Para grass	Common	Least concern
7 Acacia auricauliformis	Acacia	Planted near a house	Least concern, Exotic ornamental

Flora Transmission Line 4: Lowland forest - open vegetation - secondary regrowths			
Scientific Names	Common/Vernacular Names	Distribution Status	Protection Status
1 Canarium indicum	Ngali nut	Planted, Few trees	Threatened
2 Intsia bijuga	Kwila, Iron wood	Few trees	Threatened
3 Pometia pinnata	Pometia, Taun	Few trees	Threatened
4 Vitex cofassus	Vitex, Vasa	Few trees	Threatened
5 Macaranga dioica	Macaranga	Common	Least Concern
6 Broussonetia papyrifera	Paper mulberry	Common	Least Concern
7 Premna corymbosa	Premna	Few trees	Least Concern
8 Solanum torvum	Egg Plant	Planted, Garden crop	Least Concern
9 Mikania micrantha	Mile-a-minute	Common	Least Concern
10 Starchytapheta jamaicensis	Blue rat's tail	Common	Least Concern
11 Acalypha grandis	Acalypha	Few trees	Least Concern
12 Calophyllum peekelli	Calophyllum	Few trees	Least Concern
13 Ficus septica	Ficus	Common	Least Concern
14 Alstonia scholaris	Alstonia, Milky Pine	Few trees	Threatened
15 Sida rhombifolia	Sida	Common	Least Concern
16 Alstonia spectabilis	Alstonia	Few trees	Least Concern
17 Merremia peltata	Merremia	Common	Least Concern
18 Trichospermum psilocladum	Trichospermum	Few trees	Least Concern
19 Cananga odorata	Ylang ylang, Cananga	Few trees, Rare	Least Concern
20 Macaranga similis	Macaranga	Common	Least Concern
21 Rhus taitensis	Rhus	Few trees	Least Concern
22 Ficus variegata	Ficus	Few trees	Least Concern
23 Carica papaya	Pawpaw, Papaya	Garden crop	Least Concern
24 Musa sapientum	Banana	Garden crop	Least Concern
25 Manihot esculenta	Cassava, Tapioka	Garden crop	Least Concern
26 Ipomoea batatas	Potato	Garden crop	Least Concern

Flora Transmission Line 5: Secondary vegetation on open ridgetop overlapping grasslands			
Scientific Names	Common/Vernacular Names	Distribution Status	Protection Status
1 Broussonetia papyrifera	Paper mulberry	Common, widespread	Least concern
2 Nephrolepis hirsutula	Fish tail Fern	Common, widespread	Least concern
3 Cananga odorata	Ylang ylang, Cananga	Few trees	Least concern
4 Ficus longifolia	Ficus	Few trees	Least concern
5 Ficus septica	Ficus	Few trees	Least concern
6 Alpnia purpurata	Red Ginger	Common	Least concern
7 Cyathea Vittata	Tree Fern	Few Plants	Least concern
8 Nephrolepis biserrata	Fish tail Fern	Common	Least concern
9 Merremia peltata	Merremia	Common, widespread	Least concern
10 Costus speciosus	Costus	Few Plants	Least concern
11 Pipturus argenteus	Pipturus	Few trees	Least concern
12 Mikania micrantha	Mile-a-minute	Common, widespread	Least concern
13 Pueraria lobata	Legume cover crop	Common	Least concern
14 Manihot esculenta	Cassava, Tapioka	Garden crop	Least concern
15 Pennisetum polystachyon	Mission grass	Common, widespread	Least concern
16 Solanum torvum	Egg Plant	Common, Garden crop	Least concern
17 Colocasia esculenta	Taro	Common, Garden crop	Least concern
18 Viola odorata	Violet	Rare, Only a couple of plants	Least concern
19 Ludwigia octovalvis	primrose willow	Common	Least concern

Flora Access Roads 1: Lowland rainforest on ridgetop			
Scientific Names	Common/Vernacular Names	Distribution Status	Protection Status
1 Pometia pinnata	Pometia, Taun	Few trees	Threatened
2 Canarium indicum	Ngali, Canarium nut	Few trees, Planted	Threatened
3 Uncaria appendiculata	Water rope	Few plants	Least concern
4 Pleomele angustifolia	Pleomele	Few plants	Least concern
5 Ptychosperma salomonense	Ptychosperma palm	Few plants	Least concern
6 Licuala lauterbachii	Licuala palm	Few plants	Least concern
7 Celtis philippinensis	Celtis	Few trees	Least concern
8 Alpinia oceanica	Alpinia	Common	Least concern
9 Heterospathe minor	Heterospthe palm	Few plants	Least concern
10 Heterospathe salomonensis	Heterospathe palm	Few plants	Least concern
11 Selaginella rechingeri	Selaginella	Common, widespread	Least concern
12 Calamus hollrungii	Lawyer cane, Rattan	Few plants	Least concern
13 Brownlowia argentata	Brownlowia	Few trees	Least concern
14 Schizostachyum tessellatum	Bamboo	Few plants	Least concern
15 Calamus vestitus	Lawyer cane, Rattan	Few plants	Least concern
16 Planchonella firma	Planchonella	Few trees	Least concern
17 Mangifera indica	Native mango	Uncommon	Least concern
18 Myristica fatua	Myristica	Uncommon	Least concern
19 Semecarpus forstenii	Semecarpus	Common	Least concern
20 Syzygium onesima	Syzygium, wild local apple	Uncommon	Least concern
21 Rhopaloblaste elegans	Rhopaloblaste palm	Uncommon	Least concern

Flora Access Roads 2: Lowland forest on ridgetop			
Scientific Names	Common/Vernacular Names	Distribution Status	Protection Status
1 Calophyllum peekelli	Calophyllum	Uncommon	Threatened
2 Syzygium onesima	Syzygium	Uncommon	Threatened
3 Syzygium tierneyana	Syzygium	Uncommon	Threatened
4 Syzygium myriadena	Syzygium	Uncommon	Threatened
5 Canarium salomonense	Small Ngali nut, Canarium	Uncommon	Threatened
6 Semecarpus forstenii	Semecarpus	Common	Least concern
7 Vitex cofassus	Vitex, Vasa	Uncommon	Threatened
8 Pometia pinnata	Pometia, Taun	Uncommon	Threatened
9 Mangifera indica	Native mango	Uncommon	Least concern
10 Intsia bijuga	Kwila, Iron wood	Uncommon	Threatened
11 Schizomeria serrata	Schizomeria	Uncommon	Least concern
12 Parinari glaberrima	Tita tree	Uncommon	Least concern
13 Heterospathe minor	Heterospathe palm	Uncommon	Least concern
14 Calamus hollrungii	Lawyer cane, Rattan	Common	Least concern
15 Calamus vestitus	Lawyer cane, Rattan	Common	Least concern
16 Calanthe longifolia	Terrestrial Orchid	Rare, Uncommon	Vulnerable
17 Celtis philippinensis	Celtis	Uncommon	Least concern
18 Sterculia conwentzii	Sterculia	Uncommon	Least concern
19 Calophyllum paludosum	Calophyllum	Uncommon	Threatened
20 Areca macrocalyx	Wild Betel Nut	Common	Least concern
21 Alpinia oceanica	Alpinia	Common	Least concern
22 Pterocarpus indicus	Rose wood	Uncommon	Threatened
23 Polyscias guilfoylei	Polyscias	Common	Least concern

Flora Access Roads 3: Lowland forest on ridgetop			
Scientific Names	Common/Vernacular Names	Distribution Status	Protection Status
1Boerlagiodendron novo-guineensis		Common	Least concern
2 Plerandra solomonensis	Plerandra	Common	Least concern
3 Hydriastele macrospadix	Tall Palm	Uncommon	Least concern
4 Cycas seemanii	Cycad	Rare, Uncommon	Vulnerable
5 Heterospathe minor	Palm	Common	Least concern
6 Heterospathe solomonensis	Palm	Uncommon	Least concern
7 Rhopaloblaste elegans	Palm	Uncommon	Least concern
8 Pterocarpus indicus	Rose wood	Uncommon	Threatened
9 Calophyllum peekelli	Calophyllum	Common	Threatened
10 Pometia pinnata	Pometia, Taun	Uncommon	Threatened
11 Kleinhovia hospita	Kleinhovia	Common	Least concern
12 Ficus wassa	Ficus	Common	Least concern
13 Ficus longifolia	Ficus	Common	Least concern
14 Cominsia gigantea	Cominsia	Common	Least concern

Flora Power Plant 1: Lowland forest - secondary and riparian vegetation			
Scientific Names	Common/Vernacular Names	Distribution Status	Protection Status
1 Cananga odorata	Ylang ylang, Cananga	Uncommon	Least concern
2 Broussonetia papyrifera	Paper mulberry	Common, Widespread	Least concern
3 Samanea saman	Rain tree	Common, Widespread	Least concern
4 Merremia peltata	Merremia	Common, Widespread	Least concern
5 Mikania micrantha	Mile-a-minute	Common, Widespread	Least concern
6 Pueraria lobata	Legume cover crop	Common, Widespread	Least concern
7 Solanum torvum	Egg plant	Uncommon	Least concern
8 Alpinia purpurata	Alpinia, Ginger	Common, Widespread	Least concern
9 Nephrolepis hirsutula	Fish tail fern	Common	Least concern
10 Macaranga tanarius	Macaranga	Common	Least concern
11 Metroxylon salomonense	Sago palm, Sagu	Uncommon	Least concern
12 Areca catechu	Betle nut	Common	Least concern
13 Cocos nucifera	Coconut	Common	Least concern
14 Diplazium esculentum	Edible fern	Uncommon	Least concern
15 Musa sapientum	Banana	Common	Least concern
16 Commelina diffusa	Herb	Uncommon	Least concern
17 Dendrocnide inerme	Poison or Stinging tree	Uncommon	Least concern
18 Cyrtosperma johnstonii	Wlid taro	Uncommon	Least concern
19 Barringtonia procera	Cut nut	Uncommon	Least concern
20 Theobroma cacao	Cocoa	Uncommon	Least concern

Flora Power Plant 2: Lowland forest			
Scientific Names	Common/Vernacular Names	Distribution Status	Protection Status
1 Calophyllum peekelli	Calophyllum	Common	Threatened
2 Pometia pinnata	Pometia, Taun	Common	Threatened
3 Syzygium onesima	Syzygium	Common	Threatened
4 Canarium salomonense	Small Ngali nut, Canarium	Uncommon	Threatened
5 Barringtonia procera	Cut nut	Common	Least concern
6 Licuala lauterbachii	Licuala palm	Common	Least concern
7 Heterospathe minor	Heterospathe palm	Common	Least concern
8 Planchonella firma	Planchonella	Uncommon	Least concern
9 Celtis philippinensis	Celtis	Uncommon	Least concern
10 Elaeocarpus sphaericus	Elaeocarpus	Common	Least concern
11 Macaranga dioica	Macaranga	Common	Least concern
12 Alpinia oceanica	Alpinia, Ginger	Common	Least concern
13 Calamus hollrungii	Lawyer cane, Rattan	Uncommon	Least concern
14 Dysoxylum excelsum	Dysox	Uncommon	Least concern
15 Ficus benjamina	Ficus	Common	Least concern
16 Heterospathe solomonensis	Palm	Common	Least concern
17 Vitex cofassus	Vitex, Vasa	Uncommon	Threatened
18 Cryptocarya medicinalis	Cryptocarya	Uncommon	Least concern
19 Ptychosperma salomonense	Ptychosperma palm	Common	Least concern
20 Macaranga dioica	Macaranga	Common	Least concern

Flora Power Plant 2: Lowland forest			
Scientific Names	Common/Vernacular Names	Distribution Status	Protection Status
21 Pandanus compressus	Pandanus	Uncommon	Least concern
22 Actinodaphne solomonensis	Actinodaphne	Common	Least concern

Flora Reservoir 1: Lowland forest - Secondary regrowths and riparian vegetation			
Scientific Names	Common/Vernacular Names	Distribution Status	Protection Status
1 Vitex cofassus	Vitex, Vasa	Uncommon	Threatened
2 Semecarpus forstenii	Semecarpus	Common	Least concern
3 Dysoxylum excelsum	Dysox	Common	Least concern
4 Pometia pinnata	Pometia, Taun	Uncommon	Threatened
5 Drymophloeus salomonense	Drymophloeus	Uncommon	Threatened
6 Areca macrocalyx	Wild betle nut	Common	Least concern
7 Alpinia purpurata	Ginger, Alpinia	Common	Least concern
8 Donax canniformis	Donax	Common	Least concern
9 Cyathocalyx petiolaris	Cyathocalyx	Common	Least concern
10 Cyathea brackenridgei	Cyathea, Tree Fern	Common	Least concern
11 Artocarpus altilis	Bread fruit	Uncommon	Least concern
12 Calophyllum peekelli	Calophyllum	Common	Threatened
13 Schizostachyum tessellatum	Small Bamboo	Common	Least concern
14 Brownlowia argentata	Brownlowia	Common	Least concern
15 Stenochlaena palustris	Climbing Fern	Common	Least concern
16 Planchonella thyrsoidea	Planchonella	Uncommon	Least concern
17 Selaginella rechingeri	Selaginella, Fern Ally	Common	Least concern
18 Macaranga dioica	Macaranga	Common	Least concern
19 Macaranga tanarius	Macaranga	Common	Least concern
20 Calophyllum paludosum	Calophyllum	Uncommon	Least concern
21 Leea indica	Leea	Common	Least concern
22 Euodia elleryana	Euodia	Common	Least concern
23 Elaeocarpus sphaericus	Elaeocarpus	Uncommon	Threatened
24 Syzygium tierneyana	Syzygium	Common	Least concern
25 Heterospathe minor	Heterospathe palm	Common	Least concern
26 Calamus hollrungii	Lawyer cane, Rattan	Uncommon	Least concern
27 Elatostema salomonense	Elatostemon	Common	Least concern
28 Hernandia peltata	Hernandia	Common	Least concern
29 Mucuna elegans	Mucuna	Common	Least concern
30 Flagellaria gigantea	Flagellaria	Common	Least concern
31 Polyscias sp?	Polyscias	Uncommon	Least concern
32 Macaranga similis	Macaranga	Common	Least concern
33 Tapeinochilus solomonense Tapeinochilus	Ginger	Uncommon	Least concern

Flora Reservoir 2: Lowland forest overlapping secondary vegetation (old garden and village site)			
Scientific Names	Common/Vernacular Names	Distribution Status	Protection Status
1 Spathodea companulata	African Tulip	Uncommon, Introduced	Least concern
2 Ficus longifolia	Ficus	Common	Least concern
3 Semecarpus forstenii	Semecarpus	Common	Least concern
4 Merremia peltata	Merremia	Common	Least concern
5 Artocarpus altilis	Bread fruit	Uncommon	Least concern
6 Ficus chrysochaete	Ficus	Common	Least concern

Flora Reservoir 2: Lowland forest overlapping secondary vegetation (old garden and village site)			
Scientific Names	Common/Vernacular Names	Distribution Status	Protection Status
7 Saurauia purgans	Saurauia	Common	Least concern
8 Areca macrocalyx	Wild betel nut	Common	Least concern
9 Areca catechu	Betel nut	Uncommon	Least concern
10 Ficus copiosa	Ficus	Common	Least concern
11 Alpinia purpurata	Alpinia, Ginger	Common	Least concern
12 Citrus limon	Bush lime	Uncommon, Introduced	Least concern
13 Costus speciosus	Costus, Ginger	Common	Least concern
14 Ficus septica	Ficus	Common	Least concern
15 Broussonetia papyrifera	Paper mulberry	Common, widespread	Least concern
16 Dendrocnide inerme	Poison or Stinging tree	Common	Least concern
17 Pometia pinnata	Pometia, Taun	Common	Threatened
18 Canarium indicum	Ngali nut, Canarium	Uncommon	Threatened
19 Mikania micrantha	Mile-a-minute	Common	Least concern

Flora Reservoir 3: Lowland forest - Secondary regrowths on a very steep slope			
Scientific Names	Common/Vernacular Names	Distribution Status	Protection Status
1 Pometia pinnata	Pometia, Tauna	Common	Threatened
2 Astronidium salomonensis	Astronidium	Uncommon	Least concern
3 Astronidium novae-georgiae	Astronidium	Uncommon	Least concern
4 Cyathea vittata	Tree Fern	Common	Least concern
5 Cyathea brackenridgei	Tree Fern	Common	Least concern
6 Alpinia purpurata	Ginger, Alpinia	Common	Least concern
7 Alpinia oceanica	Ginger, Alpinia	Common	Least concern
8 Rubus moluccanus	Wild Raspberry	Uncommon	Least concern
9 Paraserianthis falcata	Albizia	Uncommon	Threatened
10 Ficus septica	Ficus	Common	Least concern
11 Ficus copiosa	Ficus	Common	Least concern
12 Ficus wassa	Ficus	Common	Least concern
13 Ficus longifolia	Ficus	Common	Least concern
14 Ficus variegata	Ficus	Uncommon	Least concern
15 Macaranga dioica	Macaranga	Common	Least concern
16 Macaranga similis	Macaranga	Common	Least concern
17 Macaranga tanarius	Macaranga	Common	Least concern
18 Macaranga fimbriata	Macaranga	Common	Least concern
19 Terminalia brassii	Brown Terminalia, Swamp Oak	Uncommon	Threatened
20 Alstonia scholaris	Milky Pine	Common	Threatened
21 Calamus hollrungii	Lawyer Cane, Rattan	Common	Least concern
22 Ptychosperma salomonense	Native Palm	Uncommon	Least concern

Flora Reservoir 4: Lowland forest - Riparian vegetation			
Scientific Names	Common/Vernacular Names	Distribution Status	Protection Status
1 Paraserianthis falcata	Albizia	Uncommon	Threatened
2 Terminalia brassii	Brown Terminalia, Swamp Oak	Uncommon	Threatened
3 Macaranga dioica	Macaranga	Common	Least concern
4 Macaranga tanarius	Macaranga	Common	Least concern
5 Ficus wassa	Ficus	Common	Least concern
6 Merremia peltata	Merremia	Common	Least concern
7 Alpinia purpurata	Ginger, Alpinia	Common	Least concern
8 Cyathea vittata	Tree Fern	Common	Least concern
9 Vitex cofassus	Vitex, Vasa	Uncommon	Least concern
10 Hornstedtia lycostoma	Hornstedtia, Sweet Ginger	Uncommon	Least concern
11 Acalypha grandis	Acalypha	Common	Least concern
12 Piper betle	Piper	Common	Least concern
13 Calamus hollrungii	Lawyer Cane, Rattan	Common	Least concern
14 Calamus stipitatus	Lawyer Cane, Rattan	Common	Least concern
15 Saurauia purgans	Saurauia	Common	Least concern
16 Euodia solomonensis	Euodia	Common	Least concern
17 Pometia pinnata	Pometia, Taun	Common	Threatened
18 Trema orientalis	Trema	Common	Least concern
19 Dysoxylum excelsum	Dysox	Common	Least concern
20 Colocasia esculenta	Wild Taro	Uncommon	Least concern
21 Mikania micrantha	Mile-a-minute	Common	Least concern
22 Nephrolepis biserrata	Fish tail fern	Common	Least concern
23 Nephrolepis hirsutula	Fish tail fern	Common	Least concern

Flora Dam 1: Riparian Vegetation			
Scientific Names	Common/Vernacular Names	Distribution Status	Protection Status
1 Tapeinochilus solomonense	Taipeinochilus, Ginger	Uncommon	Least concern
2 Alpinia purpurata	Ginger, Alpinia	Common	Least concern
3 Broussonetia papyrifera	Paper mulberry	Common, widespread	Least concern
4 Ficus longifolia	Ficus, Fig	Common	Least concern
5 Macaranga tanarius	Macaranga	Common	Least concern
6 Artocarpus altilis	Bread fruit	Uncommon	Least concern
7 Pometia pinnata	Pometia, Taun	Common	Threatened
8 Schizostachyum tessellatum	Bamboo	Uncommon	Least concern
9 Heterospathe minor	Palm	Common	Least concern
10 Calamus vestitus	Lawyer cane, Rattan	Uncommon	Least concern
11 Selaginella rechingeri	Selaginella	Common	Least concern
12 Areca macrocalyx	Wild betel nut	Common	Least concern
13 Ficus variegata	Ficus, Fig	Common	Least concern
14 Ficus septica	Ficus, Fig	Common	Least concern
15 Ficus copiosa	Ficus, Fig	Common	Least concern
16 Flagellaria gigantea	Flagellaria	Common	Least concern
17 Elatostema salomonense	Elatostema	Common	Least concern
18 Cyathea vittata	Tree Fern	Common	Least concern
19 Cominsia gigantea	Cominsia	Uncommon	Least concern
20 Ficus chrysochaete	Ficus, Fig	Common	Least concern
21 Paraserianthis falcata	Albizia	Uncommon	Threatened
22 Barringtonia sp?	Wild Cut nut	Uncommon	Least concern
23 Leea indica	Leea	Uncommon	Least concern

Flora Dam 1: Riparian Vegetation			
Scientific Names	Common/Vernacular Names	Distribution Status	Protection Status
24 Nastus obtusus	Bamboo	Uncommon	Vulnerable
25 Hornstedtia lycostoma	Sweet Ginger	Uncommon	Least concern
26 Saurauia purgans	Saurauia	Common	Least concern

Flora Dam 2: Secondary lowland forest			
Scientific Names	Common/Vernacular Names	Distribution Status	Protection Status
1 Pometia pinnata	Pometia, Taun	Common	Threatened
2 Palaquium firmum	Pencil Cedar	Uncommon	Threatened
3 Calophyllum peekelli	Calophyllum	Uncommon	Threatened
4 Piper wichmanii	Piper	Uncommon	Least concern
5 Cominsia gigantea	Cominsia	Common	Least concern
6 Ficus wassa	Ficus, Fig	Common	Least concern
7 Ficus copiosa	Ficus, Fig	Common	Least concern
8 Ficus longifolia	Ficus, Fig	Common	Least concern
9 Ficus chrysochaete	Ficus, Fig	Common	Least concern
10 Cyathea brackenridgei	Tree Fern	Common	Least concern
11 Alpinia purpurata	Alpinia, Ginger	Common	Least concern
12 Heliconia salomonensis	Heliconia	Uncommon	Least concern
13 Macaranga tanarius	Macaranga	Common	Least concern
14 Dysoxylum excelsum	Dysox	Common	Least concern
15 Dendrocnide inerme	Poison or Stinging	Common	Least concern
16 Elatostema salomonense	Elatostema	Common	Least concern
17 Merremia peltata	Merremia	Common	Least concern
18 Flueggia flexuosa	Flueggia	Uncommon	Least concern
19 Areca macrocalyx	Wild betel nut	Common	Least concern
20 Leea indica	Leea	Uncommon	Least concern
21 Artocarpus altilis	Bread fruit	Common	Least concern
22 Semecarpus forstenii	Semecarpus	Common	Least concern
23 Ficus variegata	Ficus, Fig	Common	Least concern
24 Homalomena alba	Homalomena	Common	Least concern

Flora Dam 3: Old Garden Area - Secondary forest			
Scientific Names	Common/Vernacular Names	Distribution Status	Protection Status
1 Broussonetia papyrifera	Paper mulberry	Common,widespread	Least concern
2 Alstonia spectabilis	Alstonia	Common	Least concern
3 Pometia pinnata	Pometia, Taun	Common	Threatened
4 Macaranga dioica	Macaranga	Common	Least concern
5 Musa sapientum	Banana	Common	Least concern
6 Ficus septica	Ficus, Fig	Common	Least concern
7 Ficus wassa	Ficus, Fig	Common	Least concern
8 Ficus copiosa	Ficus, Fig	Common	Least concern
9 Ficus longifolia	Ficus, Fig	Common	Least concern
10 Dioscorea alata		Uncommon	Least concern

Flora Dam 4: Lowland forest and Riparian Vegetation on very steep cliff substrat			
Scientific Names	Common/Vernacular Names	Distribution Status	Protection Status
1 Pometia pinnata	Pometia, Taun	Common	Threatened
2 Artocarpus altilis	Bread Fruit	Common	Least concern
3 Ficus virgata	Ficus, Fig	Common	Least concern
4 Ficus wassa	Ficus, Fig	Common	Least concern
5 Rhus taitensis	Rhus	Uncommon	Least concern
6 Trichospermum psilocladum	Trichospermum	Uncommon	Least concern
7 Neonauclea orientalis	Nauclea	Uncommon	Least concern
8 Ficus variegata	Ficus, Fig	Common	Least concern
9 Terminalia brassii	Brown Terminalia, Swamp Oak	Common	Threatened
10 Calamus hollrungii	Lawyer cane, Rattan	Common	Least concern
11 Flagellaria gigantea	Flagellaria	Common	Least concern
12 Hornstedtia lycostoma	Sweet Ginger	Common	Least concern
13 Areca macrocalyx	Wild betel nut	Common	Least concern
14 Mussaenda cylindrocarpa	Mussaenda	Common	Least concern
15 Heterospathe minor	Palm	Common	Least concern
16 Paraserianthis falcata	Albizia	Common	Least concern
17 Elatostema salomonense	Elatostema	Common	Least concern
18 Selaginella rechingeri	Selaginella	Common	Least concern

Flora Tunnel: Lowland forest - Secondary Vegetation			
Scientific Names	Common/Vernacular Names	Distribution Status	Protection Status
1 Pometia pinnata	Taun, Pometia	Common	Threatened
2 Cananga odorata	Ylang ylang, Cananga	Uncommon	Least concern
3 Artocarpus altilis	Bread fruit	Common	Least concern
4 Premna corymbosa	Premna	Uncommon	Least concern
5 Ficus longifolia	Ficus	Common	Least concern
6 Dysoxylum excelsum	Dysox	Common	Least concern
7 Terminalia sp?	Terminalia	Uncommon	Least concern
8 Calamus stipitatus	Lawyer cane, Rattan	Uncommon	Least concern
9 Cyathea vittata	Tree fern	Common	Least concern
10 Areca macrocalyx	Wild betel nut	Common	Least concern
11 Drymophloeus salomonensis	Drymo Palm	Uncommon	Least concern
12 Schizostachyum tessellatum	Bamboo	Common	Least concern
13 Ficus Chrysochaete	Ficus	Common	Least concern
14 Macaranga tanarius	Macaranga	Common	Least concern

Flora Cliff 1: Uphill forest - Riparian vegetation on Very Steep Cliff Substrate			
Scientific Names	Common/Vernacular Names	Distribution Status	Protection Status
1 Pometia pinnata	Taun, Pometia	Common	Threatened
2 Rhus taitensis	Rhus	Common	Least concern
3 Macaranga dioica	Macaranga	Common	Least concern
4 Cyathea vittata	Tree Fern	Common	Least concern
5 Cycas seemanii	Cycad	Uncommon	Vulnerable
6 Timonius timon	Timonius	Common	Least concern
7 Alpinia purpurata	Ginger, Alpinia	Common	Least concern
8 Phragmites karka	Phragmites	Common	Least concern
9 Ptychosperma salomonense	Palm	Common	Least concern

Flora Cliff 1: Uphill forest - Riparian vegetation on Very Steep Cliff Substrate			
Scientific Names	Common/Vernacular Names	Distribution Status	Protection Status
10 Rubus moluccanus	Wild raspberry	Uncommon	Least concern
11 Uncaria appendiculata	Sweet Rope	Common	Least concern
12 Pandanus sp?	Pandanus	Uncommon	Threatened
13 Pholidota sp?	Orchid	Uncommon	Vulnerable
14 Spathoglottis plicata	Groung Orchid	Common	Vulnerable
15 Hoya guppyi	Hoya	Common	Least concern

Flora Cliff 2: Uphill forest - Riparian vegetation on very steep cliff substrate			
Scientific Names	Common/Vernacular Names	Distribution Status	Protection Status
1 Terminalia brassii	Brown Terminalia, Swamp Oak	Common	Threatened
2 Terminalia calamansanai	Yellow Terminalia	Uncommon	Least concern
3 Pometia pinnata	Taun, Pometia	Common	Threatened
4 Ficus variegata	Ficus	Common	Least concern
5 Broussonetia papyrifera	Paper mulberry	Common, widespread	Least concern
6 Khleinhovia hospita	Khleinhovia	Uncommon	Least concern
7 Ficus copiosa	Ficus	Common	Least concern
8 Ficus septica	Ficus	Common	Least concern
9 Ficus wassa	Ficus	Common	Least concern
10 Cyathea brackenridgei	Tree Fern	Common	Least concern
11 Paraserianthis falcata	Albizia	Uncommon	Least concern
12 Calamus hollrungii	Lawyer cane, Rattan	Common	Least concern
13 Calamus stipitatus	Lawyer cane, Rattan	Common	Least concern
14 Merremia peltata	Merremia	Common	Least concern
15 Uncaria appendiculata	Sweet rope	Common	Least concern
16 Pterocarpus indicus	Rosewood	Common	Threatened
17 Hornstedtia lycostoma	Sweet Ginger	Common	Least concern
18 Elaeocarpus sphaericus	Elaeocarpus	Uncommon	Threatened
19 Rhopaloblaste elegans	Palm	Common	Least concern
20 Heterospathe salomonensis	Palm	Common	Least concern
21 Dysoxylum excelsum	Dysox	Common	Least concern
22 Macaranga dioica	Macaranga	Common	Least concern
23 Macaranga similis	Macaranga	Common	Least concern
24 Macaranga tanarius	Macaranga	Common	Least concern

Flora Upper Stream 1: Lowland - Riparian vegetation			
Scientific Names	Common/Vernacular Names	Distribution Status	Protection Status
1 Pometia pinnata	Taun, Pometia	Common	Threatened
2 Terminalia brassii	Brown Terminalia, Swamp Oak	Common	Threatened
3 Paraserianthis falcata	Albizia	Common	Least concern
4 Macaranga tanarius	Macaranga	Common	Least concern
5 Cassia alata	Cassia	Uncommon	Least concern
6 Diplazium esculenta	Fern	Common	Least concern
7 Alpinia purpurata	Ginger, Alpinia	Common	Least concern
8 Mussaenda cylindrocarpa	Mussaenda	Common	Least concern
9 Ficus copiosa	Ficus	Common	Least concern
10 Ficus longifolia	Ficus	Common	Least concern
11 Ficus wassa	Ficus	Common	Least concern

Flora Upper Stream 1: Lowland - Riparian vegetation			
Scientific Names	Common/Vernacular Names	Distribution Status	Protection Status
12 Crinum asiaticum	Crinum, Lilly	Uncommon	Threatened
13 Pterocarpus indicus	Rosewood	Common	Threatened
14 Calophyllum peekelli	Calophyllum	Common	Threatened

Flora Upper Stream 2: Lowland forest - Riparian vegetation			
Scientific Names	Common/Vernacular Names	Distribution Status	Protection Status
1 Alpinia purpurata	Alpinia, Ginger	Common	Least concern
2 Gymnostoma papuana	Casuarina	Rare, Uncommon	Least concern
3 Paraserianthis falcata	Albizia	Common	Threatened
4 Pometia pinnata	Taun, Pometia	Common	Threatened
5 Vitex cofassus	Vitex, Vasa	Common	Threatened
6 Cyathea brackenridgei	Tree Fern	Common	Least concern
7 Pandanus sp?	Pandanus	Uncommon	Least concern
8 Heliconia solomonensis	Heliconia	Uncommon	Least concern
9 Calophyllum paludosum	Calophyllum	Uncommon	Least concern
10 Calophyllum peekelli	Calophyllum	Common	Threatened
11 Cominsia gigantea	Cominsia	Common	Least concern
12 Alstonia scholaris	Alstonia, Milky Pine	Uncommon	Threatened
13 Flueggia flexuosa	Flueggia	Common	Least concern
14 Costus speciosus	Costus	Common	Least concern
15 Trichospermum psilocladum	Trichospermum	Common	Least concern
16 Neonauclea orientalis	Nauclea	Uncommon	Least concern
17 Melastoma affine	Melastoma	Uncommon	Least concern
18 Syzygium onesima	Syzygium	Common	Least concern
19 Areca macrocalyx	Wild Betel nut	Common	Least concern
20 Saurauia purgans	Saurauia	Common	Least concern
21 Medinilla cauliflora	Medinilla	Common	Least concern
22 Selaginella rechingeri	Selaginella	Common	Least concern
23 Schizostachyum tessellatum	Bamboo	Common	Least concern
24 Rhus taitensis	Rhus	Common	Least concern
25 Ficus variegata	Ficus	Common	Least concern
26 Ficus chrysochaete	Ficus	Common	Least concern
27 Dendrocnide inerme	Poison or Stinging tree	Common	Least concern
28 Piper wichmanii	Piper	Uncommon	Least concern
29 Euodia elleryana	Euodia	Common	Least concern

Flora Upper Stream 3: Lowland forest - Riparian vegetation			
Scientific Names	Common/Vernacular Names	Distribution Status	Protection Status
1 Terminalia brassii	Brown Terminalia, Swamp Oak	Common	Threatened
2 Calophyllum peekelli	Calophyllum	Common	Threatened
3 Pterocarpus indicus	Rosewood	Common	Threatened
4 Pometia pinnata	Taun, Pometia	Common	Threatened
5 Cyathea brackenridgei	Tree Fern	Common	Least concerned
6 Cyathea vittata	Tree Fern	Common	Least concerned
7 Ficus longifolia	Ficus	Common	Least concerned

Flora Upper Stream 3: Lowland forest - Riparian vegetation			
Scientific Names	Common/Vernacular Names	Distribution Status	Protection Status
8 Ficus wassa	Ficus	Common	Least concerned
9 Paraserianthis falcata	Albizia	Uncommon	Threatened
10 Boerlagiodendron novo-guineensis		Common	Least concern
11 Uncaria appendiculata	Uncaria	Common	Least concern
12 Alpinia purpurata	Ginger, Alpinia	Common	Least concern
13 Areca macrocalyx	Wild Betel nut	Common	Least concern
14 Hydriastele macrospadix	Gulubia palm	Uncommon	Least concern
15 Heterospathe minor	Heterospathe	Common	Least concern
16 Rhopaloblaste elegans	Rhopaloblaste	Uncommon	Least concern
17 Homalomena alba	Homalomena	Common	Least concern
18 Dendrocnide inerme	Poison tree	Common	Least concern

Annex 9: Example of field maps

Here insert an example of field map

Annex 10: Regulatory analysis

CONSTITUTION OF SOLOMON ISLANDS

The preamble of the Constitution declares that the natural resources of Solomon Islands are vested in the people and government of the Solomon Islands.[8] This declaration is significant in that it adopts the common law concept where the State owns the natural resources, in particular for example mineral resources, and the perception that natural resources, including water resources are owned by the people. The basic idea is that the natural resources of Solomon Islands (water included) are owned by customary landowners and the Government. Therefore, the customary landowners possess the property rights over their natural resources and accessing that will require their consent.

The right of customary landowners' over their land is recognized in the Constitution of Solomon Islands.[9] The extent of this recognition and protection is argued to be comparable only to that formally given to private property under any Common Law system of land ownership.[10] The concession to the special status of customary tenure is that the alienation or acquisition should be for as short a time as possible to achieve the public purpose being sought.[11] The access to resources also means access to land in which the resources is being sought, in the case of the TRHDP accessing the water resources also means accessing the land in which it is located. This means that the TRHDP requires registering the land under the Land and Titles Act. This will require two possibilities of processes to acquire the land. First compulsory land acquisition, which is often used for purposes of national interest, and land acquisition through a land acquisition officer. The option that the TRHDP will take require vigorous consultations which resources customary land resources owners and respecting the rights given to those customary owners under the Solomon Islands Constitution.

AGRICULTURE QUARANTINE ACT 1982

The Agriculture and Quarantine Act 1982 provide for preventing the introduction of disease into Solomon Islands through the importation or landing of animals, plants and other things and preventing the introduction of pests and undesirable plants; for requiring vessels and aircrafts to give notice of their arrival in Solomon Islands; and for connected purposes.[12] This Act grants regulation-making powers to the Minister in respect of the introduction or importation of plants and animals and substances or other material that may be the carrier of plant or animal pests and diseases.[13] The Act further provides for the appointment of inspectors and defines their powers and prescribed list offences.[14] An Order of the Minister may prohibit or regulate the importation or landing of: (a) animals and animal products; (b) plants; (c) earth; and (d) other things by, or by means of, which it appears to the Minister that any disease or pest might be introduced.[15] The First Schedule sets out the matters which may be dealt with by Order made under this Act.[16]

ENVIRONMENT ACT 1998 AND ENVIRONMENT REGULATION 2008

The *Environment Act 1998* was passed by parliament in October 1998 and came into force (gazetted) on the 1st of September 2003.[17] Its introduction is to provide a regulatory mechanism to address adverse environment impacts of major economic development projects in the country.

[8] *Constituion of Solomon Islands*
[9] Ibid s112.
[10] ibid.
[11] ibid.
[12] *Agriculture Quarantien Act 1982*
[13] ibid.
[14] ibid
[15] ibid
[16] ibid
[17] *The Environment Act 1998* (Solomon Islands)

The Act emphasizes upon environmental management and protection, even at the expense of the development project.[18] The Act tries to address this through the application of environmental impact statement (EIS) in order to include environmental considerations as a component of the project.[19] The Act requires that an EIA should be carried out in the project planning stage prior to implementation.[20] As a planning and management tool, EIS is very important for decision making processes.[21]

Any large scale development pursuant to the Environment Act is a 'prescribed development'.[22] 'Development consent' is required by the developer from the Environment and Conservation Division in order for operations to begin. The development consent is the permit given by the Director of the Environment and Conservation Division after a developer submits an ESIA report and is approved. In the context of the TRHDP, once the ESIA is submitted and approved by the Director a development consent will then be issued for the development to occur. In 2008, the Environment and Conservation Division then developed the Environment regulations 2008 which outlines a set of criteria and specific guideline for the development of an EIS and a Public Environment Report (PER).

The Tina Hydropower Development Project is a prescribed development under schedule 2 (section 16) of the *Environment Act 1998* and therefore required the formulation of an Environment Impact Statement through the Environment and Social Impact Assessment Process.[23] The EIS is required where a very large-scale development will be undertaken such as TRHDP and a PER for small-scale development such as logging or urban developments.

The scope of the Environment Act and Environment Regulations encompasses a number of processes, procedures and the establishment of an institution to regulate them. The following are the key components of the legislation:

It provides the guiding principles and definition for environment management.[24]

Establish the Environment and Conservation as a key institution responsible for managing environmental issues in the country.[25]

Sets out the procedures for undertaking and approval of Environment and Social Impact Assessments.[26]

Develop requirements for robust stakeholder engagement process through public consultation as part of assessment and in the decision making process.[27]

Requires the formulation of appropriate environment and social safeguards as part of the environment and social impact assessment process (section 31)

Environment monitoring of the development (section 31)

Establish the Environment Advisory Committee as the appeal body where the developer or any person may within 30 days of the publication of the Director's decision, appeal against the Director's decision concerning the issuing of development consent.[28]

FISHERIES ACT 1998

The Fisheries Act 1998 provides the legal basis for a comprehensive and responsive national fisheries management regime.[29] It promotes a precautionary approach to fisheries management and encourages the long-term sustainable management of fish stocks.[30] It provides that the Minister may make regulations for "carrying into effect the provisions of this Act in particular it focuses on :

[18] Ibid
[19] ibid
[20] ibid
[21] ibid
[22] Ibid annex 1
[23] ibid sec 16
[24] ibid sec 3
[25] Ibid sec 5-7
[26] Ibid 15-23
[27] Ibid sec24
[28] Ibid sec 13
[29] *Fisheries Act 1998* (Solomon Islands).
[30] Ibid s3-4.

the licensing, regulation and management of any fishery and the conservation of particular species of fish or other aquatic organisms.[31] (s59(1)(ii));

prescribing fisheries management conservation measures, including prescribed mesh size, gear standards, minimum and maximum species sizes, limitation on the amount of fish authorized to be caught by any vessel or person or from any fishery, closed season, closed areas, prohibited methods of fishing or fishing gear and schemes for limiting effort in all or any specified fisheries[32] (s59(1)(iv)).

The powers vested to the provincial government under the Act could have implications for the Project. In particular, the provisions where each provincial government "is responsible for" the proper management and development of the reef, inshore, and freshwater fisheries within its provincial waters.[33] (FA s9). It empowers the province to take the lead on management of resources within reef and inshore waters and in freshwaters.[34]

The Fisheries Act has no direct specific implications on the Project except with the provincial legislative provision earlier stated. There is a possibility that the fisheries sector could also be involved if compensation measures for the Project, such as development of aquaculture in the reservoir, arises.

FOREST RESOURCES AND TIMBER UTILIZATION ACT 1979

The Forest Resource and Timber Utilization Act 1979 (Cap 40) regulates the timber industry in the country through a license system issued by the Commissioner of Forest.[35] There are two types of timbers licenses that can be issued, one is for a milling license and the second one widely used for logging operations is a felling license. The Act made provision for logging operations to occur in customary land through the timber rights hearing process. It commences with an application to the Commissioner of Forest to grant consent to negotiate with the relevant Provincial Government Executive, and the owners of the customary land. If the Commissioner of Forest grants his consent then the Provincial government will organize a timber rights hearing meeting for the purposes of identifying the persons who have rights under customary land and are willing to dispose of their timber rights. A Timber Rights Agreement will then be entered into between the applicant and the persons having rights over the area. The Commissioner of Forest will be advised of the outcome and where a Timber Rights Agreement has been signed, he will issue a felling timber license.

The felling of trees under the act is for the purposes of commercial activity relating to the sale of logs or timber. Whilst the intention of law is not for vegetation removal for construction or other purposes, there is a possibility that a felling license could be required for a large amount of vegetation to be removed. Further consultation will be undertaken with the Ministry of forests if a reasonable amount of vegetation is to be removed during the construction phase of the Project.

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31 **Ibid.s59(1)**

32 **Ibid s59(1)(iv)**

33 **Ibdi s9**

34 Provinces may prepare ordinances regarding a wide range of issues, including:
(b) registration or recording of customary fishing rights, their boundaries and the persons or groups of persons entitled under those rights;
(c) open or closed seasons for fishing for all or any species of fish or other aquatic organisms in all or any areas of provincial waters based on scientific advice;
(d) the closure of areas in which fishing for all or any species of fish or other aquatic organisms may be prohibited;
(e) prescribing the minimum mesh sizes for nets employed, and minimum species sizes for all or any species of fish or other aquatic organisms caught and retained or collected in all or any fisheries management areas in provincial waters;
(f) prescribing the number of fishing vessels, the types of fishing gear employed in any fishery or fishery management area in provincial waters;
(g) prohibiting specified methods of fishing that are harmful to fisheries and the environment, or the use of specified types of fishing gear in provincial waters;
(h) the establishment and protection of marine reserves;
(i) regulating and prohibiting the destruction of mangroves;
(j) authorising the use of specified natural poisons indigenous to Solomon Islands for fishing in, any specified area or areas of provincial waters (provided the provincial assembly has determined that the use of the natural poison is a customary practice in the area and that the continued use of such poison will not significantly impair the ecology of such area)(FA s10(3));
and regulating the local use of explosives, poisons or other noxious substances in **fishing s10,s30(1)**

35 ***Forest Resources and Timber Utilization Act 1979 (Cap 40) (Solomon Islands).***

LABOR ACT 1996

The Labor Act 1996 makes provisions for the protection of the workers and their rights during employment. It establishes the office of the commissioner of labor to address all labor related issues. The legislation broadly covers the roles and powers of the office, identifies the commissioner as the administrative body, outline specific guidance on wages and hours of work and minimum wages for all workers in the country.[36] The minimum is set by the Minister of commerce from time to time, however minimum amount of time for work and overtime is clearly stated in the law as follows :

(a) the normal weekly hours of any worker shall not exceed forty-five hours;

(b) the normal daily hours of work of any worker in an industrial or agricultural undertaking shall not exceed nine hours;

(c) a worker whose hours of work exceed six hours daily shall be given a break of at least thirty minutes arranged so that the worker does not work continuously for more than five hours;

(d) hours of work and breaks from work shall be so arranged as not to require the worker's presence at the place of work for more than twelve hours daily;

(e) a worker shall be given a weekly rest of at least twenty-four continuous hours, which shall, where practicable, include Sundays or other customary rest days; and

(f) no worker shall be required to work on a gazetted public holiday or on more than six days in one week, unless such worker is employed in a service to which the Essential Services Act applies or in an occupation in which work on public holidays or customary rest days is expressly provided for in his contract of service.

It also made provision in the manner in which contracts for employment are made for both nationals and foreign workers. Part VI of the Act provide guidance on the treatment of women and their rights on conditions of employment, maternity leave and their protection from working during unusual hours.[37] Section 39 prohibits women from working at night, with night being defined as the period between 7 o'clock in the evening and 6 o'clock the next morning.[38]

Part VII focus on the employment of child and young person to ensure that child labor is restricted. Section 46 states that "No child under the age of twelve years shall be employed in any capacity whatsoever"; Section 47 further state that "A person under the age of fifteen shall not be employed or work" - (a) in any industrial undertaking, or in any branch thereof, except in employment approved by the Minister; or (b) on any ship:

Part IX outlines the basic conditions for the general care of workers by any employer.[39] The Minister under the Act can make special exceptions on the provision of the act on the condition that it does not contravene the purpose and objective of the Act and does not result in abuse or the infringement of the individual workers rights.[40]

[36] *Labor Act 1996*
[37] Ibid s 40
[38] Ibid.
[39] ibd
[40] ibid

The employment of foreign (to Solomon Islands) employees on the Project will be subjected to the requirements of the Immigration Act 1987.[41] All entrants who wish to reside and work in the Solomon Islands must have two distinct authorizations; a valid permit that allows them to enter and reside in the Solomon Islands and a work permit that authorizes the holder to undertake employment or business in the Solomon Islands.[42] The permit to enter and reside in the Solomon Islands is issued by the Ministry of Immigration and is valid for two years.[43] At the end of the two year period it can be renewed or extended by applying to the Director of Immigration two months prior to the expiry of the existing permits.[44]The work permit is issued by the Commissioner of Labour as set out in the Labour Act Part V Section 37.[45] Anyone wishing to work or operate a business while residing in the in the Solomon Islands must submit an application to the Commissioner of Labour.[46] Foreign nationals currently working in the Solomon Islands often enter the country on a visitor's permit or a 92B (business) permit and apply for a work permit after they have commenced work.[47] The practice is to avoid long delays in the process of getting work permits.

The provisions of both the labor act and the immigration act will be important during the construction phase if foreign workers are to be engaged.

LAND AND TITLES ACT

The issue of land is the most challenging in the modern development of Solomon Islands. This is due to the fact that landownership is related to customary practices and communal ownership of land and resources. Land ownership is attributed to tribes, clans and families rather than an individual. Land include vast majority of land, including forests, lagoons and reefs and that the clan or tribe, the chiefs or family heads decide over the deployment and use of the land for the benefit of the clan or community at large. This definition applies to everything on land and for the TRHDP includes the river itself, reservoir and the catchment areas. No person other than a Solomon Islander may hold or enjoy any interest of whatever nature over, or affecting, customary land. A Solomon Islander is defined under the Land and Titles Act as a person born in the Solomon Islands who has two grand-parents who were members of a group, tribe or line indigenous to the Solomon Islands. An exception is made to this rule - s.241 (2), for a person, not being a Solomon Islander, who:

is or has been married, whether according to current customary usage or otherwise, to a Solomon Islander and who according to current customary usage becomes entitled to acquire or enjoy the interest in question in right of his being or having been so married; or

acquires or becomes entitled to enjoy such interest by inheritance according to current customary usage.

The Lands and Titles Act provided two alternative mechanisms by which land can be acquired. Under Part V of the Lands and Titles Act, voluntary acquisition under Division 1 or compulsory acquisition under Division 2.

Under Division 1, when a customary owner wishes to transfer or lease his land, this must be done by a transfer or lease it to the national Government (through the Commissioner) or a Provincial Assembly (traditionally in the name of the Premier) and any customary usage prohibiting or restricting such transactions will be disregarded.

[41] *Immmigration Act 1987*
[42] Ibid.
[43] Ibid.
[44] Ibid.
[45] above n 25
[46] Ibid.
[47] Ibid.

Part V Division 2 provides for a compulsory acquisition and compensation process is available in the case of both registered and unregistered land (including customary land). These provisions are subject to section 8 of the Constitution, which permits compulsory acquisition of property for specified public purposes, in particular where (i) the acquisition is necessary or expedient in the interests of town or country planning or for developing or utilizing the property to promote the public benefit, (ii) there is reasonable justification for any hardship caused and (iii) the acquisition is permitted by statute which provides for reasonable compensation and a right of access (direct or on appeal).

The Lands and Titles Act also made provision for preservation orders to be applied to land of "historic, architectural, traditional, artistic, archaeological, botanical or religious interest", and permits the establishment of nature reserves.

The Tina Hydropower Development Project is located on customary land and therefore is required to adhere to processes under the Lands and Title Act through land acquisition. The most obvious process would be the voluntary land acquisition process. This will be done by undertaking a land identification process as a prelude to the acquisition process.

The current process undertaken by the TRHDP Project office is an internal process developed in consultation with customary landowners of the TRHDP. This process is called Land Identification (Land ID) process. Customary landowners organize themselves through the House Chiefs with respective tribes, clans and families in shorting out ownership and boundaries of the respective lands. The information is compiled by customary landowners after full agreement by all parties and provided to the project office. The TRHDP project office will then use the information to register the land either through land acquisition or compulsory acquisition as described above. The Land ID process is currently in progress and is expected to finish soon.

CUSTOMARY LAND RECORDING ACT

The Customary Land Record Act provides that the decision to apply for registration belongs to customary land holding group. Boundary disputes are to be settled by negotiation and in case no agreement or settlement is reached, the final and conclusive decision belongs to the traditional chiefs and no longer to the members of the Government. However, the determination of the chiefs is still subject to judicial review by the High Court and, on appeal, by the Court of Appeal. This Act is much more based on negotiation with customary land holding groups.

One of the strengths of the Act is that it differentiates between primary and secondary rights. By contrast, a weakness is that it does explain how a commercial investor can deal with landowning groups once they are recorded under the Act. In practice, the Customary Land Record Act has been applied only very rarely since 1994, and the provisions of the Land and Titles Act regarding the registration process remains in effect. Therefore the Project as discussed will require the land registration process under the lands and titles act rather than this particular law. As earlier stated, the house of chiefs are yet to be formally recognised and therefore whilst informal process of recording can occur formal recording will be done under the lands and titles act.

MINES AND MINERALS (AMENDMENT) ACT 2008

The Mines and Minerals (Amendment) Act 2008 provides the statutory framework for the mining sector. Section 2 states that no mining operations shall take place except in accordance with its provisions. Mining is defined as intentionally extracting any mineral which is itself defined as any substance found naturally in the earth except petroleum.[48] Several types of permits may be granted by the Minister responsible for mines and minerals: reconnaissance permits, prospecting licences, mining leases, alluvial mining, gold dealing and building materials permits.[49]

[48] Mines and Minerals Act 1996
[49] Ibid.

The section of the Act most relevant to the Project is for material extraction from the site to be used as building material for the Project construction. Part VIII of the Act states that a permit is required for extraction of building materials.[50] Only the holder of such a permit may undertake mining or quarrying to obtain building materials. The Mines and Minerals (Amendment) Act 2008 defines building materials as "clay, gravel, sand and stone used for buildings, roads or other construction purposes"[51]. The building materials permit is not transferable and royalties must be paid at the prescribed rate per cubic meter for all building materials extracted. However, similar to many of the laws in the Solomon Islands the Minister under Section 69 of the Act can make an exemption to the building materials permit: "building materials for building or road construction for the personal use of the landowner or occupier, or for sale not exceeding a prescribed amount, may be mined without a building materials permit".[52] The extraction of materials for the TRHDP will require seeking an appropriate permit from the Ministry of mines for quarry development to occur. However, the Minister of mines has powers to make exemption where a national project such as the TRHDP is involved.

NATIONAL PARKS 1954

The Act provides for the creation of national parks in Solomon Islands. The minister responsible at that time was the minister for cultural affairs and parks. The Minister can make a proclamation declaring certain area to be a national Park and purchase or acquire any land for such purpose. The rights of residence in Parks are restricted and there is a ban on hunting (other than fishing), carrying arms and making fires. The Queen Elizabeth II Park near Honiara was declared a National Park in 1965, today it exists in name only as it is highly degraded and squatters have long settled in the Park. The administration of the Act vests with the Minister and Park Rangers. These Park Rangers are appointed by the Minister. Park Rangers are empowered to ensure that national parks are well kept.

This Act would be important is the upper Tina catchment is to be declared a National Park, however it is outdated and lacks provisions to empower customary landowners to make decisions about their resources.

PROTECTED AREAS ACT 2010

The Protected Area Act 2010 is developed with the objective of establishing protected areas to conserve biological diversity.[53] To achieve these, the Act provided for the establishment of a Protected Areas Advisory Committee (PAAC) and made provisions for declaration of protected areas by the Minister of Environment from the advice of the Director of environment.[54] As a means to finance biodiversity protection, the Act established a protected area trust fund to be also managed by the PAAC.[55]

In order for an area to become a protected area (PA), a community or organization will prepare an application to the Director of Environment for their site to be declared as a protected area. The application will need to include a PA management plan and scientific studies to show that the areas is of significance to biological diversity and to the community in terms of natural resources. The application will also include estimated budget for the PA and evidence of agreement by all customary landowners, map showing the boundary and size of the site. The director upon receiving the application will review the application and make recommendation to the Minister if the application have merits and should declared a PA. The basic requirements for considerations by the minister include:

(a) the conservation objectives of the protected area are identified and are in accordance with sound conservation practices;

(b) the boundaries of the area are accurately identified, or otherwise demarcated and surveyed;

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50 **Ibid.**

51 **Ibid.s 3.**

52 **Ibid s 69.**

53 *The Protected Are Act 2010* (Solomon Islands) s 3 objectives are;
establish a system of protected areas where special measures need to be taken to conserve biological diversity , develop guidelines for selection, establishment and management of protected areas , regulate and management biological resources important for the conservation of biological diversity within or outside protected areas , promote the protection of ecosystems, natural habitats and maintenance of viable population for species in natural surroundings. promote environmentally sound and sustainable development in areas adjacent to protected areas and rehabilitate and restore degraded ecosystems and promote the recovery of threatened species through development for management plans and strategies.

54 **Ibid s 4-9 s 10-12.**

55 **ibid s 13-15.**

(c) the consent and approval are obtained from persons having rights or interests in the area;

(d) an appropriate conservation, protection or management plan is developed for the area to ensure that the conservation objectives of theprotected area will be achieved.

The Act then focused on the regulating research of biological diversity and bio-prospecting prohibiting biodiversity research unless a permit is issued by PAAC.[56]

The PAAC assumes many powers under this Act. It consists of the chair, a deputy chair, four NGOs representative, four others appointed by Minister of Environment and a secretary.[57] The Act explicitly states their functions and their powers.[58] These include appointing management committee for protected areas, overseer the use of the protected area fund, provide technical support for protected areas management and approval of biodiversity research permits.[59] Although there is a provision for public officers or any person appointed by Minister of Environment to enforce the act as inspectors, the powers of the inspectors are also subject to directions issued by the PAAC.[60] Since its inception, no site has been declared as a formal protected area. The PAAC which has the responsibility of overseeing its implementation have not been formally appointed.

The legislation provides the opportunity for the Tina upper catchment area to be under formal protection. This is a process that has to start sooner rather than later as the issues relating to landownership over the catchment may take sometimes to resolve.

PROVINCIAL GOVERNMENT ACT 1997

The Provincial legislative authority derives from a combination of this Act and the accompanying Devolution Orders. The Devolution Orders enable each province to make legislative power over a range of matters of direct relevance to natural resource management and environment.

Power for making ordinances over wildlife and marine resources is also devolved under the Provincial Government Act 1997. "Provincial legislative authority derives from a combination of the Provincial Government Act 1997 (PGA) and the accompanying devolution orders (PGAs33). Regulatory or executive powers derive from valid provincial ordinances or may be delegated to the province under national statutes, devolution orders, or by negotiation between the province and responsible national authority (s31(1)).

The Devolution Orders made in respect of each province give them legislative competence over a range of matters of direct relevance to natural resource management."

The Provincial Government Act 1997 Schedule 3 provides a list of activities for which the provinces have responsibility and have the power to pass ordinances;

Trade and Industry - Local licensing of professions, trades and businesses, local marketing.

Cultural and Environment Matters - Protection of wild creatures, coastal and lagoon shipping,

Agriculture and Fishing - Protection, improvement and maintenance of fresh-water and reef fisheries.

Land and Land Use - Codification and amendment of existing customary law about land. Registration of customary rights in respect of land including customary fishing rights. Physical planning except within a local planning area

Local Matters - Waste disposal

Rivers and Water - Control and use of river waters, pollution of water,

[56] ibid s16-18.
[57] ibid s 4.
[58] ibid s 5 6.
[59] ibid .
[60] Ibid s 20.

Corporate or Statutory Bodies - Establishment of corporate or statutory bodies for provincial services including economic activity. (Provincial services include "Conservation of the Environment" and "Fishing").

The Guadalcanal Province Wildlife Management Area Ordinance 1990 (GPWMAO) applies for the protection of wildlife. This ordinance applies to TRHDP to ensure that wildlife impacts are understood. The ESIA will study freshwater wildlife and biodiversity mitigation measures will sufficiently address the requirements of this ordinance. It also states that Management area may be established where the Guadalcanal Provincial Executive decides that an area requires management to protect, maintain, improve, or propagate any species that the area uses as habitat.

Other requirements also include business license during construction and approval for construction permit of buildings under the provincial planning board.

RIVER WATERS ACT 1964

The objectives of the Act are to provide for the control of river waters and for the equitable and beneficial use thereof. The Act however, only applies to rivers that are specifically designated. The Act devolves all ministerial functions to be exercised by the relevant provincial ministers.[61] The inspector's power however remains with the national (central) Government inspectors. The River Waters Act 1964 clearly stated that it is an offence to interfere with a river except in accordance with the terms and conditions of a permit.[62]

A permit may be granted for the following operations on a river :

"by means of a ditch, drain, channel, pipe or any other means whatsoever, diverts any water from a river;

fells any tree so that it falls into a river or river bed;

in any manner obstructs or interferes with a river or river bed;

builds any bridge, jetty or landing stage over or beside any river;

damages or interferes with the banks of any river; or

contravenes any order made under section 4 of this Act".63 This means that a permit cannot be issued where a river is declared by order as being protected by the minister.

The legislation is applicable to the following rivers Mataniko River, White River, Mbalisuna River, Ngalibiu River, Lungga River and Mamara River. All these rivers are on Guadalcanal and Ngalibiu is downstream of the Tina river.

The law specifically applies to the section of the river called Ngalibiu referred to as the part of the Ngalimbiu River and the land adjoining within the area edged red on Plan number 2034 held in the office of the Commissioner of Lands, Honiara. The maps currently does not exist in the Commissioner of lands office and thus the requirement for a permit will be sought from the Minister for MMERE before constructions works occur.

The process for applying for a permit is by submitting details of the proposed construction and diversion that will occur including maps of the location in which construction will occur. The conditions for issuing of permit include the studies of the current use of the rivers and the potential impact of the river. Section 7 (2) states that "In granting any permit under this section the Minister shall have regard to the existing use of water and shall safeguard such existing use of water as far as appears to him to be practicable and consistent with the provisions and purposes of this Act". A practical application would be to submit the EIS and proposed development plan for a permit to be issued. The law does not provide for timeframe for the permit to be issued.

[61] *Rivers and Water Act*
[62] Ibid. s 5
[63] Ibid.

SAFETY AT WORK ACT 1982

The legislation codifies the duties of employers to their employees and others responsible in ensuring the safety of workers in various work environments. In particular safety of workers in dangerous and risky conditions. It provides for the civil and criminal liability of employers who are negligent to the safety of their workers. Part III of the legislation stipulates very specific duties relating to work environment that is dusty, have fumes, pressures and vacuum systems, machinery, electrical installations, fires and explosions, and other hazardous work environment. Part IV provides for the regulation of these conditions and powers given to the commissioner of labor to regulate working conditions, investigate offences and prosecution where there is breach.

Schedule I, II III and IV of the legislation provide for the duties of employers in terms of safety and outlines the expected standards that should be adhered to.

The legislation has a number of subsidiary legislation focusing on very specific areas as follows:

Code of practice for timber scaffolding – this section is for timber process and does not apply to the TRHDP.

Code of practice for flammable and combustible liquids

Safety at work first aid provision regulations – provides basically states that first aid kit should always be provided for labours on site.

Safety at work pesticide regulations.

TOWN AND COUNTRY PLANNING ACT 1980

The *Town and Country Planning Act 1980* provides for the regulation of planning at national and provincial level.[64] Although it has a national scope, the legislation can only be applied to urban areas. The Act empowered each province to have a town and country planning board.[65] Their responsibility is to prepare local planning schemes and control development of land within urban areas.[66] However, the definition of “development” under the legislation excludes agricultural activities, fisheries and forestry.[67] The Board members are appointed by the Minister[68] in accordance with the advice of the Provincial Executive. The board is responsible for making decision on certain developments according to local planning schemes for each provincial urban development. The board has no jurisdiction over customary land which is a significant limitation.[69]

In the case of TRHDP, which is located on a customary land, this particular legislation does not apply. Although this could change if the site is to be declared as part of a local planning scheme for urban development.

WILD BIRDS PROTECTION 1914

This Act is repealed by the WildLife Protection and Management Act (Cap 10 of 1998).

WILDLIFE PROTECTION AND MANAGEMENT ACT 1998

The preamble to The Wildlife Protection and Management Act 1998 states that it is "An act to provide for the protection, conservation and management of wildlife in Solomon Islands by regulating the export and import of certain animals and plants; to comply with the obligations imposed upon Solomon Islands under the Convention on International Trade in Endangered Species of Wild Fauna and Flora and for other matters connected therewith or incidental thereto".[70]

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[64] *The Town and Country Planning Act 1979* (Solomon Islands).
[65] Ibid.
[66] ibid.
[67] Ibid.
[68] The Act refers to the Minister charged with the responsibility for town and country planning. The relevant minister is the Minister of Finance, National Reform and Planning.
[69] ibid s 13.
[70] *The Wildlife Protection and Management Act 1998* (Solomon Islands)

The object of the Act is to regulate the international trade in the country's wildlife resources including birds, reptiles, amphibians, mammals, insects, plants and marine organisms. In order for anyone to be involved in the wildlife trade that individual or organization needs to have an "approved management programme" and have its name entered into a specific "register".[71] In regulating the export or import of plant or animal specimen, the Act prohibits any export or import of plant or animal specimen without the relevant permit. The procedure for application for a permit is set out in the Act. The export of live animals from Solomon Islands is also dealt with in the Act and a separate permit is required. The Director has the discretion to permit the export or import of specimen that is prohibited under the Act in exceptional circumstances. Schedule I lists the species that are prohibited to exports, Schedule II lists the regulated and controlled species for which a valid permit to export such specimen is required.

The legislation also has a list of protected species that will require attention if they or their habitat are at risk. These species are identified by the flora and fauna baseline sections.

ENVIRONMENTAL HEALTH ACT 1980

The Minister of Health is responsible for the administration of the environmental health services. The Minister may delegate this administration to the Provincial Government and the Honiara City Council that are designated as Enforcement Authority. There is provision in the Act that if the Enforcement Authorities do not perform their duties under the Act, then the Minister can arrange to have their functions carried out by others, and require the Enforcement Authority to reimburse the Ministry for the cost of doing so. The Enforcement Authority is given power to make its own by-laws under the Act to facilitate the efficient operation of environmental health services. The Enforcement Authority is required by the Act to carry out a program of health education and publicity in accordance with directions given by the Minister.

Environmental Health (Public Health Act 1970) Regulations

The Public Health Act, (No 2 of 1970) was repealed under this regulation. It was contemplated that a new Public Health would be enacted, however this did not happened, resulting in saving some parts of the Act. These regulations consist of Parts III to XII and section 2 of the repealed Act.[72] These regulations deal with public health issues and how to deal with them when they occur. The regulations empowers the Minister and the Under Secretary of the Ministry of Health and Medical Services to take specific measures to prevent the occurrence of a public health disease or where such decease had already occurred, to take measures to contain and prevent the spread of the disease. The Minister establishes "local authorities" which are the Executive of the Honiara City Council and the Executive of the Provincial Assemblies, plus any others, which can include Area Councils.

The Minister also establishes public health areas. Any such areas can be exempted from some or all of the provisions of the regulations. The duty of every local authority is:

" *to take all lawful, necessary, and, under its special circumstances, reasonably practicable measures for preventing the occurrence or dealing with any outbreak or prevalence of any infectious, communicable or preventable disease, to safeguard and promote the public health and to exercise the powers and perform the duties in respect of the regulations…"*[73]

[71] Ibid
[72] *Environment Health Regulations*
[73] Ibid.

In the case of the TRHDP, the Guadalcanal provincial health authorities has a duty to take necessary and reasonably practicable measures to enforce the law and request that at all time the Project site be in a clean and sanitary condition. When a local authority or health inspector becomes aware of a nuisance (pollution into environment from business activity or development), a notice to remove the nuisance must be served. There is a set procedure where the owner or person causing the nuisance fails to comply with the notice, the local authority or the health inspector shall cause a complaint relating to such nuisance to be made before a court. The court may by summons require that person to appear before it. The regulations spells out the actions that the court may take including the imposing of penalties and fines on the person that fails to comply with any order of the court. The regulations also deal with offensive trades (offensive trades are defined in the Second schedule of the regulations). It is an offence for any person to carry on any offensive trade (business activity that results in pollution into the environment) on any premises without the written consent of the local authority and the Health Director.

SOLOMON ELECTRICITY ACT

The Electricity Act was initially established 1969, and amended several times up to 1988. It establishes the Solomon Islands Electricity Authority ("SIEA") and sets out the overall rules regarding power production and supply. The Electricity Act is a very basic piece of legislation, which does not address issues relating to the power sector in any detail. The main subsidiary legislation on the matter has been drawn up by the Ministry in charge of the sector (currently the MMERE) and is as follows (in descending order of relevance for the Project):

Electricity (Tariff) Regulations;

Electricity (Tariff) (Amendment) Regulation 1999;

Electricity (Tariff) (Automatic Fuel Price Adjustment) Regulations ;

Electricity Regulations (Amendment) Regulation 1997;

Electricity (Exemptions) Order.

The SIEA is generally in charge of all matters related to electricity production and transmission/distribution in the Solomon Islands, including ensuring standards of safety, efficiency and economy. It also advises the Government on matters related to electricity and can make recommendations as to regulatory instruments.

The SIEA is set up as a "body corporate", with independent liability and the capacity to independently enter into contracts.The SIEA consists of a Chairman and four members (which together form its Board), as well as a general manager (acting ex officio). The general manager is appointed by the Authority, while the five members of the Board are all appointed by the Minister in charge of the electricity sector in the Government (the "Minister").

The definitions section of the Electricity Act distinguishes between "private" and "public" electrical installations, as follows:

"private installation" means an installation operated by a licencee or owner solely for the supply of electricity to and use thereof on the licencee's or owner's own property or premises; or, in the case of a consumer taking electricity from a public installation for use only on the property or premises of the licencee or owner;

"public installation" means an installation operated by a licencee for the supply of electricity to any person other than the licencee: provided that the licencee may use electricity for his own purposes where such use is consistent with the terms of the licence.

The Electricity Act sets out in very wide terms the functions and duties of the SIEA in this domain, as follows:

(a) to manage and work any electrical installations transferred to the SIEA by the Government and other installations and apparatus acquired by the SIEA (this mainly relates to the transfer to the SIEA of installations existing at the time the SIEA was established);

(b) to establish, manage and work such electrical installations as the Minister may from time to time require or as the SIEA may from time to time deem it expedient to establish;

(c) to secure the supply of electricity at reasonable prices;

(d) to promote and encourage the generation of electricity with a view to the economic development of Solomon Islands;

(e) to advise the Minister on all matters relating to the generation, transmission, distribution and use of electricity; and

(f) to ensure standards of safety, efficiency and economy in respect of the production, transmission, distribution and use of electricity.

In particular, the Act empowers the SIEA to:

(g) generate, transmit, transform, distribute and sell electricity either in bulk or to individual consumers;

(h) purchase, construct, reconstruct, maintain and operate supply lines, generating stations, transformer stations and all other appropriate stations, buildings and works;

(i) sell, hire or otherwise supply electrical plant and electrical fittings and apparatus, and install, repair, maintain or remove any electrical plant, fittings and apparatus;

(j) acquire any property, real or personal, which the Authority deems necessary or expedient for the purposes of constructing or extending or maintaining any installation or otherwise for carrying out its duties and functions under the provisions of this Act.

GUADALCANAL HISTORIC PLACES ORDINANCE 1985

This Ordinance allows for protection of heritage sites. A heritage place can be declared protected by resolution by the Provincial Assembly. Consent of the representative of landowners is necessary. Prior to an activity, any developer has to undertake a site survey to identify and locate sites of historical, cultural and archeological significance.

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Annex 12: Minutes of Mitigation Workshops

Mitigation Workshop Team

BRLi Team; Eric Deneut, Gerard Fitzgerald, Lawrence Fonoata and Fred Patison
TRHDP Team; Fred Conning and Brally Jim Tavalia

Meeting and Workshops	Comments, issues , concerns and recommendations
03/02/2014	**Preparatory Meeting – TRHDP Project Office**
▶ A general discussion with the project office of option 7c for the scheme. There is a number of discussion on technical issues related core land and its acquisition. ▶ Discussion was also held on the environmental flow for the section between the Dam and the power station. ▶ There is also a micro-scheme that will be set up for the environmental flow release. ▶ The meeting proper proceeded with Eric going through the power point presentations he prepared. The presentation covered a number of major themes as summary to the mitigation matrix. The focus of the discussion is the improve the presentation and its outline.	▶ Cultural heritage confidentiality ▶ Emphasis on community service and development ▶ Benefit sharing mechanism is currently being developed ▶ Avoid use of the word royalty ▶ Important that people understand the project, the impact and the measures being proposed.
4/02/2014, 9AM-12PM	**Meeting with Tina Hydro Taskforce and PS's**
▶ Welcome and introduction by TRHDP Project Manager. ▶ Eric Deneut started presentations on the impacts and mitigation	▶ Discussions on the environmental flow and further explanation by the project office on the Dam design. ▶ Initial discussion on the fisheries above the dam as result of its development and the need for a fish pass. ▶ Questions were raised on how Fiji addresses the environmental flow and the fish pass. It is clarified that no such environmental consideration for fish pass has been reflected in the Fiji project ESIA ▶ A question was raised on the broader lesson learned from international experience and Asia-pacific region on fish passes. It's being clarified that further studies will be done and reflected in the ESIA report. ▶ It is being raised that specific species should be targeted to ensure that there is clear information on the species affected by the development. ▶ Clarification was being sought if non-native species of fish will be introduced and if so what kind of species. It is being clarified that this will not occur.

Meeting and Workshops	Comments, issues , concerns and recommendations
	▶ A question was raised if the fishery on the river is of economic scale. It is clarified that this not economical and also not significant for domestic use either. ▶ A question was raised on the impacts of gravel extraction downstream. It is clarified that no clear information exists on the status of gravel but there won't be any significant impact at least for another 50 years (short term). There is a need for more information on the deposition rate of the gravel for the whole river system. ▶ A concern was raised on the impact of population increase due to the development. This is in relation to the squatters and settlements. This will be further discussed. ▶ A concern was raised on the potential impact on floods during heavy rain falls. This was clarified by the BRL team. ▶ A concern was raised on the potential for labor camps being created. It is clarified that all external labors will be housed in Honiara and that on site accommodation not an option at this stage. ▶ A question was raised on the waste management issues for the project and a landfill site. This will be further explored by BRL. ▶ Another concern was raised on the health risks from water borne diseases considering the fact that the site is a hot spot for Malaria. This needs to be reflected in the ESIA. It is further stated that the whole of Guadalcanal plains will be affected by the risk of water diseases due to a large body of stagnant water inland. ▶ A concern was raised on the measures that are put in place as mitigation actions. The mitigation actions recommended needs to get the consent of local communities. The communities also need to be comfortable with the any proposed mitigation actions. ▶ The issues of security for the communities from intruders will need to be fully considered in the ESIA. ▶ A question was raised if the definition of impacts also includes those of the transmission lines. ▶ A question was raised on who will be responsible financially for the proposed mitigation actions. The important question is whether it is the SIG or the project investor. This was clarified by the Tina hydro project manager. ▶ A further clarification was sought if the assessments also include impacts of transmission line development. It's being clarified that the lines are included. ▶ A question was asked on the nature of the road access to the project site and current plans are for its development. Clarification was made that discussion are underway on the development of the road access. Further discussions were made on who owns the road, who will meet the cost of its development and also the expected nature of the development.

Meeting and Workshops	Comments, issues , concerns and recommendations
	▶ A concern was raised on how the ESIA process is informed by the Land Identification process, the benefit sharing mechanisms and the grievance mechanism. ▶ A final comment was made on the need for the work currently being done by the project office to be reflected in the ESIA process.
4/02/2014, 2PM-4PM	**Government officials, NGOs and private sector**
▶ Welcome and Introduction of the project by the TRHDP Project Manager. ▶ The presentation of impacts and mitigation matrix by Eric Deneut.	▶ A question was raised on the impact of the dam on sediment deposit for downstream agricultural activities. ▶ The issue of water temperature is also being raised in relation to impacts on the biota within the river system ▶ A question was also raised on dissolved oxygen change due to the Dam. ▶ The impacts of vegetation on the reservoir will need to be investigated especially for biomass decomposition in the reservoir. ▶ The need to have in place the institutional arrangements for the river monitoring regime. ▶ A concern was made on the giant African snail and other invasive species. The BRL team stated that this will be dealt with in the report. ▶ The issue of giant African snail management after construction is being raised. A question if there is a map of the distribution of the snail. ▶ A question was raised on the rubber plant as an invasive and how the dam construction can exacerbate invasive species. ▶ It is stated that the Giant African snail is a French delicacy and should be considered as a management option. ▶ The risk of social upheaval in context of a post-conflict situation specific to the site is raised as a concern. ▶ A question was raised in relation to issues related to education and its importance. This was being clarified by the TRHDP project manager. A comment was raised on the need for education schemes to be done after a proper assessment is being done. ▶ A comment was made on the need for a comprehensive process of empowerment for leadership and also mechanism that facilitate community development activities. In particular the issue of trusteeship needs to be carefully navigated with agreements that will be negotiated and formulated. The cash hand out is an example of a very poor means of benefit. ▶ Project office made a clarification that mechanism currently being developed for education as a package of the benefit distribution system. ▶ It is further stated that the lessons from the global experience is that, cash hand out do not work and involvement of women in the consultation and engagement processes is critical.

Meeting and Workshops	Comments, issues , concerns and recommendations
	▶ A question was raised on seismic consideration in the feasibility studies. It is clarified that it is part of the geological studies. ▶ A comment was made on the need to ensure that grievance mechanism includes local communities in the implementation framework. ▶ A question was raised If there will be an emergency plan in the case of dam failure. It is clarified this is a standard operation procedure for Dams. ▶ A question was raised on the issue of social inconvenience usually raised by the project affected communities. This needs to be captured in the ESIA as it will certainly become part of future demands. Further concern was raised on the needs for caution on the kind language being used as well. ▶ A question was raised on the mechanism for cultural heritage and tabu site recording for the ESIA. ▶ Comments that for Gold Ridge, all taboo sites are being recorded and mapped by the national museum. This is something that can be replicated by the TRHDP. ▶ A question on the percentage of women being consulted out of the 500 people being met. There is a need to rethink of having women as focus group and thus there is a need for change on what issues are being discussed within the context of women's group. It is important that they are being consulted on major key issues as well. ▶ Gender is an important issue for the WB and therefore it is important that how they are being consulted is being documented. ▶ A comment was made on the fact that the project should not be a proxy government – it has to make the government see the need for things to happen.
05/02/2014, 3-6PM	**Tina Village – Bahomea**
▶ Opening statement and Welcome by Brally from the project office ▶ Eric Deneut introduced the BRL team and started with presentation. Mr. Lawrence F. provided interpretation in pidjin with Mr. Fred P taking the minutes. ▶ At the end of the meeting a representative of the Tina and nearby communities presented 10 benefits that should part of any agreement negotiated with landowners and communities in the project affected area. The request are as follows;	▶ On the issues of alternative water supply there is a need for a committee to be established by the communities and the TRHDP to focus on water related issues. ▶ The water will be subject to construction and therefore there is potential for spillage from the heavy machines being used. Thus it is recommended that all villages downstream close to river including Tina village to be relocated to a new site. This new site should have access to clean water supply. ▶ A comment was made on the fact that women are dependent on river for daily subsistence activities. Therefore before any construction start the supply of alternative water sources is a pre-requisite. ▶ A question was raised on the actual timeframe on what exactly will happen for the project and the ESIA studies. ▶ A suggestion was made for the Solomon Island Government to establish a police post within the project area to help provide security.

Meeting and Workshops	Comments, issues , concerns and recommendations
• All affected communities to have access to free electricity • Water supply and alternative water sources to be installed before any construction start. • All access roads including those going to communities to be sealed. • A mini-hospital to bebuild within the project affected area (not clinic). • Communities near the river including Tina village to be relocated to a new site. • Scholarship scheme for all Bahomea communities • A representative body established to include current settlers • Rate School to upgraded to Form 1-7 levels • A transport scheme to be established for land owners and project affected communities.	▶ A recommendation was made for the road that will be constructed to be sealed and four layered. This to ensure that it is not the like the roads in Honiara which are easily damaged after heavy rain. ▶ On the issues recruitment of local workers, the suggested mitigation to have all recruitment in Honiara is not helpful to local workers. Therefore a recruitment office for all local workers must be established on site. ▶ A concern was raised on the risk of dam failure and therefore to avoid the risk relocation is best option that should be considered for the community of Tina village. ▶ A concern by women is that during the consultations, relocation is an issue that they have raised (option they would support) but was not reflected in the mitigation measure being proposed. ▶ A comment was made requesting that examples of dams that have failed to be presented to the community. This is because they are not convinced the dam will not fail as this cannot be fully guaranteed. ▶ A recommendation was therefore made that the Dam and Safety Panel visit the communities to further explain safety related issues. ▶ A recommendation was made that despite of the dam being safe they would like to be relocated to a new site to avoid any form of fear and risk. ▶ A request was made for copies of presentation by BRL to be provided. ▶ A request was made for a timetable of when agreements will be signed. ▶ A question was raised concerning why the landowner's council established is not functioning and not supported by the project office. Further clarification was sought as whether the landowner council will be re-established. ▶ A concern was made on the removal of taboo sites as it is culturally insensitive. ▶ The impact on current social structure of communities such as the church, women, youths and children needs to be reflected in the report. ▶ A concern was raised on the need to do awareness on the impacts of the project on their culture. In particular, it should focus on all the aspects of modernity and foreign cultures. ▶ A concern was raised on the need to rehabilitate youths who are affected by the recent civil unrest and also those involved in other anti-social behaviors'.
06/02/2014, 9-12 PM	**Belaha Relocation School**
▶ Welcome and Introduction by Brallyfrom the TRHDP office.	▶ A question was raised on the environmental flow and how it will be managed. The concern is related to fish and the ecology between the dam and the power station.

Meeting and Workshops	Comments, issues , concerns and recommendations
▶ The presentation was made by Eric Deneut of BRL with interpretation by Lawrence and minutes taken by Fred Patison. ▶ Final Remarks at end of presentation; ▶ A general comment was made concerning the process in which the ESIA is being conducted. In particular where experts who understand the expected impacts and also solutions are continuously asking the community for solutions. The view shared was that the Solomon Islands Government and those participating in the ESIA process provide the environment and social solutions as experts. It is further stated that consideration to communities should focus on economic benefits and livelihood alternatives and for the people of Bahomea it is Cocoa farming. The Government should think seriously about enhancing Cocoa farmers' livelihood in the area. It is stressed that education is the key issues for many people on Guadalcanal and that investment and support should focus on community empowerment.	▶ A comment was made that fish will not actually be depleted but rather adapt and increase in numbers. This will need to be further studied. ▶ A comment was made of the need for a full comprehensive study of the cultural heritage sites. This will include their location, description and if they are going to be threatened as result of the development. ▶ A recommendation for alternative protein sources needs to be provided as an option for the communities. ▶ A concern was raise from the previous experience that explosions from dynamite may result in the death of fish in the river. This is in reference to the construction of the Dam and the tunnel. ▶ A question was raised whether consideration will also be given to the Belaha communities in terms of employment at the project site. ▶ A recommendation was made for consideration to fish farms as an alternative. ▶ A question was raised whether the people of Bahomea will have access to free power.
06/02/2014, 1-5PM	**Malango – Mataruka, Job Varie's Residence**
▶ Welcome and Introduction by Brally from the TRHDP office. ▶ The presentation was made by Eric Deneut of BRL with interpretation by Lawrence and minutes taken by Fred Patison. ▶ Final Remarks at end of presentation were made purposely for the project office World Bank Representatives.	▶ A comment was made that there will be fish in the upstream of the Dam which will survive through adaptations and therefore the fish issues is not necessarily a serious issue. Further explanation was made by the BRL team on the migratory nature of the fish species studied at the river. ▶ A comment was made of the need for clear and precise example of the kind of fish pass that will be proposed for the Dam. ▶ A concern was raised on the oxygen level in the dam which will affect the biodiversity of the river in the Dam. This will need further clarification as to how this will be mitigated.

Meeting and Workshops	Comments, issues , concerns and recommendations
▶ There is considerable concern on the manner in which the project is currently being implemented. The communities of both Bahomea and Malango have established the landowner's council as a representative body for all the tribes within the project affected area. This body although still exist is no longer recognized by the Government and the project office. Instead certain individuals were courted by the project office and excluded the representative of Malango. Whilst it is a fact we will not be directly affected by the project as communities we will be affected as primary landowners as we are members of tribes that are within Bahomea and the project affected area. Our recommendation is that the land owners' council be re-established as the representative body of landowning groups. We are aware of the fact that other groups such as women, youths and settler's needs representation and that will have to be facilitated as well. This should be reflected in the review of the TOR for the LOC before its re-establishment.	▶ A concern was raised on the removal of vegetation on the fringes of the lake and those that will be covered by the Dam. How will the mitigation measures address biomass decomposing in the lake which may affect the river systems for the first period of operation? ▶ The use of traditional knowledge and practice for the project site including the river needs to be documented and be reflected in the ESIA report. ▶ A question was raised in relation to the Monasavu Dam in Fiji. It has been observed that water quality remains very poor despite being operational for more than 20 years. The hydro dam was built in 1982 and the water quality remains very poor. The question is whether this dam will be the same? ▶ A question was raised with the people of Choro, Korepa and Senge will be relocated. ▶ A comment was made outlining the fact that the people of Bahomea and Malango actually came from same tribes that own land at the project site. Therefore equal involvement must be fully realized in order for the project to proceed successfully. ▶ A question was raised whether land acquisition will be made before the development. It is clarified that indeed that will have to occur. ▶ There are concerns that road access development also affected and therefore studies must be done to verify this. ▶ A concern was raised on ground water contamination from surface development activities. Also of concern is the surface run- off, the impacts on water bodies and other water tributaries. ▶ A major issue of concern is the Dam safety and associated risks. ▶ The guarantee of communities and landowners being given priority to work during the hydro development is a major concern. The experiences in the past have shown that this has not happen effectively. ▶ A woman expressed gratefulness that BRL presented the environment and social impacts of the project. The only concern is the need for alternative water supply to be provided for the communities in the project affected area. ▶ A recommendation was made that the Solomon Islands government seriously consider enacting an act of parliament to protect the interest of both the landowners and the project operator. This is in particular reference to the agreements made between landowners of the gold ridge mining area in which all agreements signed are not upheld by successive companies and the Government. The concern is that an Act of parliament will ensure that all parties are protected legally but also obligated legally. ▶ A question and concern was raised on how taboo sites in the middle of the river are going to be preserved.

Meeting and Workshops	Comments, issues , concerns and recommendations
	▶ A recommendation was made for a SWAT analysis to be done for all proposed impacts and mitigation measures. ▶ A recommendation was made that all taboo site destroyed be compensated by the developer or the Solomon Islands Government.
08/02/2014, 9-12PM	**GPPOL 1 HALL – Downstream Ngalibiu communities**
▶ Welcome and Introduction by Brally and Fred Conning from the TRHDP office. ▶ The presentation was made by Eric Deneut of BRL with interpretation by Lawrence and minutes taken by Fred Patison.	▶ On the discussion on water quality monitoring and freshwater species studies. The downstream communities are concerned that the data collected is not independent and therefore it would be good if independent consultants representing downstream communities can be engaged. ▶ There is a need for the Ghaobata house of chief to be consulted in order for them to make their recommendations. In the regard it would be appropriate if a traditional ceremony (Chubu) be organized. ▶ There is concern that the project office have not been able to facilitate some of the request made by the Ghaobata house of Chiefs. ▶ A concern was raised on the safety of Dam and if it will stand cyclones and other severe weather conditions. This was clarified by the BRL team and also the project office. ▶ The downstream communities would like assistance to organize and undertake comprehensive awareness activities on the proposed project. ▶ A question was raised as whether the alternative water sources recommended would also include downstream communities. It is clarified that this will be part of the benefit sharing mechanism. ▶ A question was raised on the different fish species that are being studied. ▶ A concern was raised if chemicals such as lubricants will be used during operation for the generators. ▶ There is concern that gravel supply will be affected due to the Dam and also that the quality of gravel will be affected by siltation during construction. This will need further investigations. ▶ A concern was raised that fisheries will be affected due to the change in environment as result of the development. It is clarified that this has been considered and the option of a fish pass is being explored. ▶ A comment was made that the concerns of PE holders along the Ngalibiu river needs to be taken independently ▶ A question was raised on how long it will take for the Dam to be filled after construction. ▶ A request was made for representatives of landowners to attend a study tour of the similar projects. ▶ One of the concerns raised was the frequent change of PS and Minister within the Government which huge impediment to continuity in addressing outstanding issues.

Meeting and Workshops	Comments, issues , concerns and recommendations
	▶ A recommendation for was made for an "environment bond" to made in advance to a neutral account. This will only be accessed if there is an environment disaster. ▶ A question was raised if climate change factors are being considered in the studies of the ESIA. ▶ A concern was raised by a women representative on the need for alternative water sources to be provided. ▶ There are concerns that similar experience with Gold Ridge will occur especially with the SIG not fulfilling their commitments. ▶ A recommendation was made for a representative body other than the Ghaobata house of Chiefs that represent the interest of women groups, youth and children.
08/02/2014, 1:30pm – 5pm	**Rate School – Bahomea**
▶ Welcome and Introduction by Brally and Fred Conning from the TRHDP office. ▶ A formal welcome and remarks was made by the Paramount Chief of Bahomea. ▶ The presentation was made by Eric Deneut of BRL with interpretation by Lawrence and minutes taken by Fred Patison.	▶ A recommendation was made on the need for an eco-tourism initiative to be part of the benefit package. ▶ A recommendation was made for the road access not to be acquired by the government or declared as a public road for access. This is to ensure that control of the road is managed by community to reduce any influx of settlers. Instead of declaring the road a public access road, the Bahomea house chief or a governing body should be establish to manage the access road. ▶ A recommendation was made for a gate to be established at the entrance of the project area and managed by both the company and landowners. ▶ A comment was made that the biggest threat to the project is the people and communities within the project area. They are the ones that invite settlers and intruders into the community and also are involved in illegal sale of land to those outside of the project area. ▶ A recommendation was made of the need to involve communities in landuse planning meetings and workshop in anticipation of the hydropower development. This should also involve the house of chiefs. ▶ The Bohomea house of chief capacity should be enhanced and supported so that they can support the project in planning and development phase. ▶ A recommendation was made that all access roads should sealed. ▶ A question was raised on the how many species of fish will be affected. A discussion was then made with photo of fish species observed being shown and local names were given to each of the species. Local communities have presented to the ESIA team the species that they would like to continue fishing upstream from the dam, as many villagers go to the upper catchment to fish for traditional events (the "upper catchment sampling area" as presented in the baseline is a fishing spots). Here are the results of communities opinion:

Meeting and Workshops	Comments, issues , concerns and recommendations
	• Gobiidae / Sicydiinae = Savutu et Vosu (in local language) • Eels = Mauvo (in local language) • Silver fish = Lae or Helu (in local language) ▶ A concern was raised on the voltage that the transmission line from the power house will carry towards Honiara. Further comments was made on the risk from vehicles accidently hitting the grid post as they are located along the access road. The suggestion was for alternative routes for the transmission lines to reduce the risk of being hit by vehicles and vandalism. ▶ A question was raised on how wide the road will be and the potential impact on vegetation. The concern is the impact on medicinal plants and other use plant species. ▶ It was recommended that the value of any medicinal plant and animal species within the road access area should be valued on monetary terms by local experts from the community. ▶ A request was made of a clear timeframe be in place for activities that will be undertaken from now until the completion of the Dam. This is to ensure that the communities are prepared and that implementation of the mitigation measures is being monitored. ▶ A comment was made regarding the need to address the economic issues related to the project. It was clarified that the benefit sharing workshops will also be part of the process. ▶ A concern was again raised concerning the safety of dam and potential risk it poses. ▶ A concern was raised on the fact that current laws and regulations for the environment and management of the project are very weak and not being effectively enforced. Therefore there is a need for the enactment of a law that specifically focuses on the Tina Hydro Project. The enactment of the Act would also mean that the hydropower company or government can be held accountable for environment damages. This also means that all negotiations on benefits will be made under the framework of the proposed Act. ▶ A recommendation was made that all cultural heritage sites be compensated by monetary means if they are being disturbed or removed.

Annex 13 : List of participants to the Mitigation Workshops

Feb 4th2014, Heritage park, Ministries and Task force

Name	Organisation	Title	Email contact
Fred Conning	TRHDP	Deputy Project Manager	fred.conning@tina-hydro.com
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Eric Deneaut	BRLi	Consultant/Team Leader	
Hon Stephen Panga	Premier	Guadalcanal Province	
Noelyne Biliki	MEHRD	Director Planning	pcm@mehrd.gov.sb
John Muria Jr	Attorney General's Chamber		jmuria@attorneygeneral.gov.sb
Richard Austin	Solomon Water	CEO	richard.austin@solomonwater.com.sb
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Feb 4th 2014, Heritage park, NGOs

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Debra Potakana	ECD/MECDM	Senior Environment Officer	
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Ruth Liloqula	Gold Ridge Mining		
Deneut Eric	BRLi	Envir. Spec	eric.deneut@brl.fr
Julian Maka'a	TRHDP	Comms Officer	julian.maka@tina-hydro.com

Feb 6th 2014, Ado

List of female participants		List of male participants	
1.	Lucia Jorrick	1.	John Batisi
2.	Anna Cheka	2.	Francis Maesi
3.	Pile	3.	Thomas Tona
4.	Anna Javen	4.	Fred Lani
5.	Vecho	5.	Kuki
6.	Bere	6.	Simon R
7.	Ellen	7.	Romando
8.	Uliana	8.	Kasiano
9.	Rita	9.	Peter Togovi
10.	Patricia E	10.	Samuel Sapu
11.	Salome Otary	11.	Jimmy P
12.	Jonita	12.	Morris Susa
13.	Hilda	13.	Devis D
14.	Odilia	14.	Leonsio
15.	Monica	15.	Philip Veke
16.	Sharon	16.	Peter Tanda
17.	Teresa	17.	Christopher L
18.	Esther	18.	Paul Bale
19.	Lydia	19.	George Dick
20.	Sololia	20.	Cypriano Vola
21.	Malina	21.	Peter Lale
22.	Francina	22.	Manuel
23.	Placinda	23.	Jovino
		24.	Jeffery
		25.	Kerry
		26.	Eddie
		27.	Robert Totolo
		28.	Mark Chuba
		29.	Grey
		30.	James
		31.	Makario Kulo
		32.	Anorld
		33.	Grey Bobo
		34.	Chris Sio
		35.	Peter Siosi
		36.	Bartholomew
		37.	Mevin

Feb 6th 2014, Mataruka

List of female participants	List of male participants
1. Vuvusi Patson	1. Mislam Soma
2. Mede Nesa	2. Justus Deni
3. Emu Amos	3. Thomas McKenzie
4. Abigail Job	4. Herman Pilo
5. Helen Clyde	5. Gerry Masedi
6. Eta	6. Erastus Kokoi
7. Enini Oko	7. Jethro Omi
8. Victoria Vare	8. Clodius rima
9. Cavu Pilosi	9. Lauvisu
10. Anita Riu	10. Urias Senge
11. Sepa Toni	11. Zibu Regeni
12. Vaelyn Timo	12. Job Vari
13. Sovea Toni	13. Jesmel Kesi
14. Selele Urias	14. Nelson Kepulu
15. Laga	15. Ashley Pengua
16. Jand O'so	16. Stephen Chiria
17. Rita Sae	17. Gigiano Lou
18. Ren Jeremiah	18. Michael Igi
19. Noela Gigiano	19. Jotham Kati
20. Bethy Jack	20. Genesis Oota
21. Joy Kiseni	21. Timothy Launi
22. Genda Riu	22. Nathaniel Obe
23. Sandra Obe	23. Malachi Rubo
24. Petrina Pilosi	24. Michael West
25. Beresia Jame	25. James Peku
26. Jocabeth Sammy	26. Clyde Maeni
27. Melda Steve	27. Aaron Hotai
28. Julan	28. Brian Lugu
29. Eileen Andrew	29. Japhet Racha
30. Pretty Lovo	30. John Adam
31. Mena Palo	31. Geoffrey Mak
32. Leanne Toki	32. Ziarah Geoffrey
33. Sopia Job	33. Peter Mover
34. Irene Hendry	34. Isaac Suhara
35. Elsie Wovick	35. Isaac Launigo
36. Elisah Lau	36. James Taniha
37. Fancy Liong	37. Josiah Frank
38. Aroma Clyde	38. Paul Branco
39. Mechol Warick	39. Kalona
40. Delilah Oko	40. William Manila
41. Ridah	41. Willy Taluga
42. Doris Asen	42. Amos Palo
43. Agaphe Amusiah	43. Jeremiah Matebasia
44. Teslin Julas	44. Juras Lobi
45. Joan Michael	45. Patson Kekegolo
46. Mercy Kila	46. Mangi Oro
47. Judith Raes	47. Philemon Mostyn
48. Gillian Obe	48. Dudley Pilo
49. Grace Teke	49. Bonny Saini
50. Janet Oota	50. Hagah Pilo
51. Charity Adam	51. Norman Amos
52. Lila Jeri	52. Asen Loni
53. Prudence Likona	53. Bredly Sade
	54. Elitoh Sae
	55. Lloyd Clyde
	56. Howard
	57. Wheatley Maeni
	58. Wigan Palo

List of female participants	List of male participants
	59. Zachariah Mete 60. Vicky Toni 61. Nicky Moni 62. Billy Maesedi 63. Gabriel 64. Ben Ege 65. Obed Ochele 66. Steve Gauna 67. Jordan Para

Feb 8th 2014, GPPOL community building

List of female and male participants	
1. Margaret Rava	38. Mose Karuku
2. Frances Bosauni	39. Isaac Gagau
3. Edlyn Lipa	40. John Nawei
4. Alifox Ulu	41. Allen Kigota
5. Baddley Lagatia	42. Leon Thugea
6. Coelins Sau	43. Samuel Bosawai
7. Henry Hinui	44. William Utuzia
8. Alfred Tora	45. Benedict Garimane
9. Floyed Talu	46. Stephen Oma
10. Andrew	47. Danny Nunuvia
11. Fredrick Manengelea	48. Frances Thugea
12. Miriam Vokia	49. Jacob Vuza
13. Brandie Tavake	50. Seai Keta
14. Pete Steve	51. Paul Vogithie
15. Philip Garimane	52. Dudley Gani
16. Charles Bunia	53. Philip Gusto
17. John Salo	54. Timothy Urobo
18. Patterson Ngelea	55. Stephen Luke
19. Michael kori	56. Jimmy Nollas
20. Pete	57. John Nunuvia
21. Simon Lumasa	58. John Kulu
22. Mattew Mole	59. Jude Kekea
23. Edmondson Tavea	60. Allen Tanasia
24. Peter Kakava	61. Ben Pilopuso
25. Daniel Poru	62. Steven Komopper
26. James Tiva	63. Joshua Halu
27. John Seketala	64. Silas Pirona
28. Nelson Matai	65. Nicholas Mekai
29. John Billy	66. Hoe Nanata
30. James Pogula	67. Martha Bako
31. Frames Garimane	68. Halida Tabala
32. Alfred Lova	69. Annie Leana
33. Selwyn Kulzar	70. Gwyneth Sekani
34. Joseph Kukale	71. Michael Su8klu
35. Miriam Kukale	72. Tome Koetevo
36. John Nemei	73. Charles Kakamo
37. Erick Ata	74. Nelson Ratu

Feb 8th 2014, Rate school

List of female and male participants	
1. Denson Dii	16. Alen kula
2. David Tabea	17. Michael Laosa
3. Peter Rocky	18. Enoch Mark

List of female and male participants	
4. Michael Litani	19. Asaraiah Sakeni
5. Robert Para	20. Rickson (Principal)
6. Ovea Piuna	21. Kathy Rickson
7. Gravis Gesi	22. Para Byce
8. Chuba Garusi	23. Luisa Mada
9. Josiah Gesi	24. Alick Lua
10. Qurusu	25. Selly Meki
11. Gilbert Avoli	26. FRed Tani
12. Alfred Bua	27. Sam Gasmate
13. Muni Kau	28. Yanny
14. Sosimo Kapini	29. Kevin
15. Dipson Meki	30. Paul Heti

Annex 14: Summary of community and landowner engagement and communication activities undertaken by the Project Office

REPORT FOR ALL COMMUNITY AND LANDOWNER CONSULTATIONS WITHIN BAHOMEA, MALANGO AND GHAOBATA CARRIED OUT BY THE TINA RIVER HYDRO DEVELOPMENT PROJECT FROM 2011 – 2016

No.	Year	Month	Activity	Venue	No of Participants	Output	Issue discussed
1	2011: Overall Picture of Tina River Hydro	April	13th - Women's 1-day workshop	Guadalcanal Women's Resource Centre	34	Benefits from the Hydro must be different from Gold Ridge	Women views on benefits
2		August :	18th - CLA induction workshop	PO conference room	10	Introduced to the project and what it is	Introduction to work in the communities
3-14		Sept	14th: 1st awareness about the project in Bahomea and Malango	19th: Namopila, 20th: Verakuji 14th :Marava 15th: Tina 15th: Vuramali Pamphylia Namoraoni 26th: Mataruka 27th: Belaha 26th: Chichinge	35 73 20 33 53 34 50 64 75 55	Informed, updated, educated	Overall picture of the Project – history, rationale, ESIA, Benefits, timeline, Processes. Distributed copies of Tina Hydro booklet

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15		October	4th – quick meeting at Marava re drilling at Senge with Charana tribe members	Senge, Koropa, Choro	7	Voiced their views	Community views on the hydro being in their area
16			5th – a follow up on the previous updates - Charana	Marava Hall	7	Informed/updated	Sort out details of drilling
17			6/7th – Debriefing on major awareness - Charana	Marava Hall	5	Informed/updated	Evaluate the major awareness in Sept for Lessons Learnt
18			10th – presented report of awareness to members of the LOC	Flamingo, Honiara Hotel	27	Update LOC members	Give a general idea about the first awareness To see how they feel Option 6e
19			10th – Interviews with Senge Community leaders 12th – Helicopter flies drilling gear into Senge	Various Homes	7	Get their views on record Start of drilling works	Asked about their views, where to move to if project was to be established

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20			21st: Drunken Roha men disturbed the drilling works	Riverbed drilling	Less than 10	Drilling stopped 2 days	Disagreed about the drilling, claiming they were the owners of the area
21			24th – Reconciliation meeting, Roha and Charana	PO	11	Sorted out differences in peace	Drilling concerns between tribes reconciled
22		November	21st: Briefing for G Province Executive	Burns Creek Hall	20+	Informed/updated	1st briefing for G Province Exec
23			26th 27th :2nd Benefits Workshop 1st group	Rate Primary/High School	132	Communities updated/informed	Get views of all communities on whether or not the project should continue/benefits/carbon credits/benefits from conservation. All members signed to say the project should go ahead.
24			28th 29thL :2md Benefits Workshop 2nd group on same presentation	Rate Primary/High School	100+	Communities updated/informed	
25		December	4th: Taskforce meeting	Kitano/Mendana	10+	Informed/updated	Briefed them about drilling

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26			5 -8th: 2nd Phase Workshop	Kitano/Mendana	100+	Updated/informed	Inform landowners/stakeholders about the feasibility studies carried out in Oct/Nov
27	2012: .Extend to Downstream communities Geotech Studies Safeguards Team Visit Feasibility Studies	January:	25th: Meeting with Downstream reps	COM church leaf hut, Ngalimbiu	20+	Updated/educated	First contact with downstream communities
28			31st :1st awareness for Ghaobata communities	Guadalcanal Plains Plantations Ltd, GPPOL 1 Hall	100+	Communities updated/educated/aware	General picture of the Hydro Project , History, Location, Pre=feasibility studies, ESIA

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29	SEP/Updates of progress	February:	1st: SEP Consultations	Ado village	25	Discussed/agreed	Updates
30			2nd: Collected and drew up a list of all tribes in the community	PO	10	Helpful for references	
31			3rd : conducted awareness at Chichinge about an SEP for the Project	Chichinge	36	Most wanted more regular updates	Allow community put in ideas, if any
32			5th: Drove Jean Williams into communities for assessment for her report	Bahomea Road	3	Seen/collected info	Consultant on Social and Resettlement Framework Plan
33			7th: Developed list of downstream communities	PO	10	For records/information	

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34			12th : Joint meeting between Ghaobata Hoc and downstream CLAs	Kairos Conference Centre, Hyundai Mall	13	Informed, updated, educated	Sort out misconception that project should also be launched downstream
35			16th: Induction	Kairos Conf Centre	9	Updated/educated	Briefing for CLAs on how they would work in their communities
36			19th:	Valesala	13	Updated, informed	Feasibility2 results; permission for 6e; support for SEP
37	Feasibility study results/ option 6e		20th: Updates	Namopila community	40	Updated, informed	Feasibility 2 results; permission for 6e and support for SEP
38			21st: Updates	Antioch	74	Informed/updated	Update was about the results 2nd Feasibility Studies; get support for option 6e and views about the Stakeholder Engagement Plan
39			22nd: Updates	Vuramali	80	Informed/updated	Same as above

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40			23rd: Updates	Tina	72	Informed/updated	Same as above
41			24th: Updates	Kairos Conf Centre	13	Discussed/updated	Clarified misunderstanding about launching the project downstream
42			27th: Updates	Mataruka meeting hut	70+	" "	" "
43			28th: Updates	Chichinge	45	" "	" "
44			29th: Updates	Volovua	80	" "	" "
45		March:	8th: Joint meeting between GHOC/Downstream CLAs	Compass Lounge, Honiara Hotel	13	Issues clarified/understood	Help chiefs and CLA understand issues and pass them on to their communities afterwards.

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46			10th: Malango House of Chiefs Discuss land Id	Grassland	More than 10	Agreed on 7 criterions for land id process	MHOC and BHOC met separately to agree on the 7
47			19th: Horohotu pilots Focus Group/mapping	Horohotu	9 men, 13 females	Empowered, learned new way of identifying issues	criterions for primary owners, 4 for land users Trial was held after a three-day training on Focus Group Discussions
48		April	9th: Updates	Komuporo	100+	Informed/updated	General updates on latest progress of the project
49			19th: Updates	Antioch	-20	Updated/informed	Land id, 3rd feasibility study, ESIA studies, government support continues in classroom project, call for cooperation from communities; focus of awareness in Bahomea; benefit expert to arrive in the year
50		May	1st: 1st Updates for Katihana village	Katihana village	15	Updated/informed	Land Id, ESIA, Feasibility studies expected within the month; water supply, road improvement, school support through whole of govt support

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51			7th: 1st update for Namanu Settlement village	Namanu School	30+	“ “	“ “
52			8th: update for Namopila	Namopila church	-20	“ “	“ “
53			9th: update for New Koleula Settlement	New Koleula village	20+	“ “	“ “
54			23rd: Meeting with landowners to discuss land concerns	PO	15	Discussed/agreed	A group of LOs led by Chris Tabea visited the office to discuss land ID process
55			25th: 1st Benefits Workshop	Flamingo, Honiara Hotel	80+	Discussed/updated	General workshop on potential benefits for landowners and landowners given opportunity to indicate their top priorities

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56			25th: Land acquisition meeting with downstream CLAs	Papangu village, GPOOL 1	10	Discussed/updated	Explained what the issues were, how to go about acquiring for the power lines, who to sign.
57			29th: Briefing for members of the Solomon Islands Chamber of Commerce and Industries, CC&I	Kitano/Mendana	100+	Briefed/updated	General info/updates about the project
58		June	5th: Updates at Marava	Marava Hall	15	Informed/updated	PO to upgrade road from Marava to Managi; WB experts to visit Dam Site ;geological mapping to start in July; conduct geotech works in Aug; drilling in Sept
			6th: Update for Antioch	Extension of Rate space	20+	Informed/updated	" "
59			10th: update for Managi	Managi	25	Informed/updated	" "
			17th: PO reps meet with Rocky/Litani about BLIC process	Sea King Restaurant	7	Briefed/informed	1st briefing for PO staff about the progress of the BLIC Process
60 61			25th: CLA assisted PO reps to map out communities on Google Earth	PO	12	Mapped all communities	The mapping was to help the PO develop an animated tour starting from the Airport to Blackpost going inland to all communities ending up at the dam site

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62							
63		July	30th: Awareness	Burns Creek Hall		Briefed, updated	General presentation for the executive members of the G Province – 1st one
64		August	13th: updates for Verakuji	Managikiki	More than 20	Updated, aware	Informed about a Safeguards team to visit later in the Month
65			21st: Safeguards Team visits	Namopila	Less than 30 men, women and children	Discussed, updated, aware	Visit followed team's flying to proposed dam area then discussions about their trip
66			21st: Safeguards Team Visit	Antioch	40+	Discussed, updated, aware	"
67			21st: Safeguards Team Visit	Marava	-20	"	"
68			21st: Safeguards Team Visit	Tina	80+	"	"

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69							
70			22nd: Safeguards Team Visit	Belaha	70+	"	" "
71			23rd: Safeguards Team Visit	Mataruka 1	150+ (Chiefs 28; women 45;	" "	" "
			23rd: Safeguards Team Visit	Vuramali	56	" "	" "
72		September	4th: Driller meets Charana	Marava Hall	7	Briefing/update	First consultation about drilling on 6e
73			17th: Land meeting	Saba village, Ngalibiu	8	Negotiation progressed	Consultation was led by acquisition Officer Jerry Tanito
74			20th: Verakuji updates	Managikiki	73	Updated, aware	Updates on progress of project activities
75			27th: CLA Training	PO	11	Informed/educated	Training was on Geospatial * Social mapping using Google earth to map out the different communities of Bahomea and Malango

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76		October	8TH: Helicopter flies equipment in	Chaunahue	3	Site ready for drilling	The first day in the geotech studies for option 6e.
77			9th – 2nd visit to see drilling	1st hole on river bed	10	Started	1st hole drilled on the riverbed.
78			15th: another visit to see the drilling	Chaunahue riverbed		Drilling progressed	2nd drill on the river bed; visited and interviewed residents of Senge, Koropa, Choro
79		November	22nd & 23rd: LOC Members extended Access Agreement	Kitano/Mendana	27	Discussed/agreed/signed	Discussion on extension to access agreement
80		December	16th: first workshop on benefits	Flamingo, Honiara	60 (LOC, HOC, elite LOs, Women and youth)	Exchanged ideas on benefits	Discussion of landowner benefits

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8`	2013: Land Id, Land Acquisition, Process Agreement	January	25th: Updates for Tina Village	Tina meeting venue	30+	Informed/Updated	
82		February	8th: Taskforce Team members visit	Marava, Managi, Antioch	3	Familiarized/informed	A familiarization trip
83			21st: WB(SI) presentation	HP Hotel	30+	Presented/promoted	PO staff presented about the TRHDP in this one-day workshop hosted by the WB (S) office
84			23rd: BLIC Meeting	Hilltop	7	Discussed/agreed	BLIC Members agreed they were on a good thing and should continue to the end
85		March	3rd : Translation workshop for CLAs	Ngongoti	8	Educated/informed	This was to equip CLAs to translate difficult terms into the language

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86			7th: 3 Taskforce members visited communities	Managi, Antioch	5	Visited/discussed	This was the first such visit by members of the Taskforce (J Muria Jr, AG Chambers; S Wale, PS Lands and Acquisition Officer Jerry Tanito with PO staff). The team proceeded to Managi and Antioch to meet the communities and discuss the Project.
87			8th: Ngongoti CLA translation half day workshop	Ngongoti Kindy	10	Trained/empowered	Workshop to train the CLAs understand how to translate the big English terms used in the constant updates.

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88			19th: Updates	Antioch			
89			21st: Updates	Mataruka village			

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90			21st: Updates	Mataruka	30	Updated	Quick informal updates: road upgrading. Concentrated on water supply, road upgrades for Bahomea and status of land id process.
91							Informal updates: road upgrade, water supply, status of land id process.
92		April	8th – Updates	Komuporo, downstream community	8	Updated	Seek the views of leaders about the need to install a river gauge at the mouth of Ngalimbiu, the downstream part of Tina River
93			22nd: Updates	Managi	19	Informed/updated	Informal updates: road upgrade, . water supply, status of land Id process
			24th: Updates	Antioch	19	Informed/updated	Informal updates: road, water supply, status of land id process

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94							
95			25th: Updates	Tina	20	Informed/updated	Informal updates about progress; residents expressed worry about the extension of SPL from Gold Ridge. They said they support the project, not Gold Ridge
			30th: Updates	Vuramali	11	Informed/updated	Quick informal updates about progress/activities
96			30th: Updates	Marava	26	Informed/updated	Quick informal updates about progress of the project: Road improvement, water supply, status of land Id process update
97							
98							
99		May	1st: Updates	Katihana		Informed/updated	Updates for Katihana villagers who were very happy about the visit and updates.
100							

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101			7th: Updates	Areatakiki/Namanu	30+	Informed/updated	Informed settlers from the weather coast of Guadalcanal about the project.
102			8th: Updates	Namopila	17	Informed/updated	Quick informal updates about progress: road, water supply, status of land id process
			9th: Updates	New Koleula	55		Discuss project with settlers from the Weather coast of Guadalcanal.
103		June	6th: Updates	Antioch village	20+	Informed/updated	Quick updates on progress
104			10th: Updates	Managi village	25+	Informed/updated	Quick updates on progress

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105		July	11th: updates	Mataruka village	20+	Informed/updated	Members were happy about hydro as it may bring tourism.
106			17th: updates	Antioch village	15+	Informed/updated	Community members very happy about the updates. They said they were tired of hearing updates – they want work.
107			18th: Updates about ESIA	Mataruka village	20+	Informed/updated	Community happy to hear about the latest updates, looked forward to supporting the ESIA when it comes around their area.
108			24th: Updates on ESIA	Hotohotu village	20+	Informed/Updated	Community members happy but most important point raised was benefits for the communities; BLIC land Id process. This is another settlement by weather coast people of Guadalcanal.

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109		August	1st: Meeting of BLIC chiefs	Hilltop	10	Progressed work	CLO and Communications Officer called in to visit the BLIC team
110			7th: updates	Hilltop	43	Informed/updated	Briefing about the BRL Environment Impact Assessments for leaders of the BLIC process. Pledged to support the project.

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111 112			Wed 21st: BLIC Members Discussions	Doma	12	Brought to Doma/informed/updated	Chiefs were brought out of Bahomea to work with the PO and government agencies on the BLIC outcome to enable sensitive land discussions to take place. Met and discussed with J Muria Jr of the AG Chambers on 21st to understand the land acquisition process. Phase 2 discussed in the afternoon after arrival; finalized criterions for primary owners
113			Thur 22nd: BLIC members leave Bahomea	Doma – am;		Arrived/settled	Endorsed/agreed on criterions for Sister tribes. Chiefs returned to Bahomea.

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114			Fri 23rd: Sister Tribe Criterions	Doma		Discussed/endorsed	
			Sat 24th: BLIC meeting	Doma		Met/discussed/educate	Tribal chiefs aware/informed about the Land Id process and its outcomes
115			Mon 26th: Outcomes presentations to SIG	PO		Presented/discussed/agreed	Govt endorsed/agreed on outcomes of the Land Id process, prepared for next stage.
116			28th: Road inspection	Bahomea road upgrades	2	Visited/seen	Hydrologist and CO driven to check on road upgrading at Bahomea
117			30th: Benefit Share workshop	Heritage Park Hotel	50+	Informed/updated	Benefit Share discussion by Raul of south America.

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118		September	2nd: BLIC updates Chiefs	Guadalcanal Women's Resource Centre beside the Honiara International Airport	20+	Informed/updated	Members of the BLIC process informed/updated tribal chiefs about the land identification process. PO explained about the land acquisition and 50-50 ownership between SIG and core land tribes.
119			11th: updates	Chichinge venue	27	Informed/updated	ESIA Feasibility Studies Land Acquisition Benefit Share
120			12th: Updates	Mataruka	61	Informed/updated	Feasibility Studies Land Acquisition Benefit Share

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121			17th: Updates	Ado	70	Updated	" " (Note: While these updates were being carried out the Social Impact Assessment of the Bahomea region was being advanced, Malango area was to start two weeks after these updates for the Malango communities.
122		October	10th: updates	Antioch	40	Updated	ESIA Feasibility Studies Land Acquisition Benefit Share
123			11th: updates	Marava	17	Updated	" "
124			21st: WB team visit	PO		Visited/discussed	Team visited and chatted with the Project Manager
125			23rd: Updates	Horohotu 2	44	"	" "

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126		November	4th: updates	Rate 1	100+	Informed/updated	Community partnership projects dam safety panel visit and work and gave advice about safety of the dam; ESIA.
127			5th: updates	Rate 2	100+	" "	
128			6th: meeting with Roha tribe reps	Hilltop	-10	" "	BLIC Sec explained findings about land by their id process to Roha reps
129			7th: meeting with Charana reps	Marava hall	10+	Discussed/updated	" "
130			8th: meeting with Buhu/Garo	Hilltop	-10	Discussed/updated	" "
131			11th: Meeting with core tribes	Ginger Beach, northwest Guadalcanal	19	Discussed/updated	Roha, Charana, Salasivo
132			14th: presentation of outcomes of BLIC work to Core tribes	Kitano Mendana	-10	Discussed/agreed	Presented the details of the findings of BLIC to the potential core tribes

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133			17th: Core land tribe meeting	Antioch	-10	" "	" "
134 135			18th: Roha Sign Drilling agreement 21st: Ngongoti Kindy closing	Kokonat Cafe Ngongoti Kindy	4 1	Agreed/signed Invited/attended	The Community Liaison Officer represented the PO in the closing of this community kindy as part of the outreach programs of the office.

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136			22nd: Clarification meeting	PO	8	Discussed/agreed	Meeting was to sort out confusions etc of Kochiabolo, Uluna/Sutahuri, Vatuviti and Lasi. The issues were in relation to a letter submitted by Vatuviti claiming it should be included in the Betigolo/Barahau Land. In the end the meeting agreed the claim was not correct and therefore dismissed.
137			24th: Drilling started on new dam site	7C dam	10+	Almost a month long work started.	The work was supported by locals at the site
138			25th: Buhu/Garo signs Process agreement	Volovua village	20+	Discussed/agreed/signed	The members signed after a meeting at Volovua village during which they asked questions and received clarifications from the PO.

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139			29th: Land meeting	Parole Board Room	15+	Discussed/agreed	Meeting convened to discuss claims and disputes by Kaipalipali, Koenihao and Roha over the Nala land in the dam site being drilled at the time. Roha agreed to pay money to a family whose relative was buried on the site
140		December	1st: final briefing for community champions	PO	7	Briefed/updated	Poster with different work streams of the project for community champions to take and update communities with.
			11th: Drilling on 7c completed	7C	10+	Completed	Drilling completed and drill equipment flown out from site

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141			12th: meeting with tribes	Bisivotu Beach	10+	Discussed/briefed	Roha, Kaipalipali and Koenihao briefed about the BLIC outcome
142			13th: meeting with additional tribes	" "	4	" "	Kochiabolo, Kaokao, Uluna get same briefing
143			14th: PM Lilo flew over the dam site, visited Bahomea House of Chiefs in their meeting	7C, Marava,		Seen/discussed/informed	Prime Minister GD Lilo Minister Mines, Energy and Rural Electrification and Environment flew to the drilling site to see the work and landed at Marava to meet members of the Bahomea House of Chiefs who were having a meeting.
144	2014: Land Acquisition/ESIA consultations	January	22nd: Updates for downstream CLAs/champions	Kairos Conf Centre	7	Informed/empowered	Feasibility Studies /Land Id and ESIA consultations to start in Feb

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145			23rd:Updates disturbed	Marava	6	Discussed/agreed	Discussion of BHOC election and role in land ID process
146							
147			24th: updates	Najilaku (Old Selwyn College)	16	Updated/informed	Dam site confirmed; underground tunnel; 3.5km down to power house

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148			25th: sorted Marava grievances/disturbance , then updates for Tina Community	Marava	20	Reconciled/agreed	Before proceeding for an update at Tina village, the PO team including some Malango chiefs and supporters stopped at Marava and presented a chupu to the chiefs and people of Marava to allow updates at Tina village
149			25th: Updates	Tin	50+	Updated/informed	Updates on progress of work : dam site confirmed; underground tunnel; road upgrades
150			27th: Updates	Horohotu	25	Updated/informed	Dam site confirmed; underground tunnel to link powerhouse 3.5km downstream; road
151							

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			28th: discussion	PO	3	Discussed/informed	Reconciliation between Bahomea House of Chiefs and BLIC.

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152		February	10th: Core Land discussion	PO	6	Discussed/updated	Meeting between F Conning, J Leua, E Gorapava,
153			11th: Meeting between Eric, Jefferson and D Una	PO	3	Discussed/updated	Update meeting for Roha rep on the progress of a cabinet paper;a TOR for the BLIC
154			11th: Roha senior tribe agree to register Roha				
155		May	14th: Initial discussion of Process Agreement with Roha	Honiara Hotel Conference Room Jacob Kinai (lawyer from LALSU) with Jen Radford (JR), Jefferson Leua (JL), Eric Garopova (EG) from PO	8 tribal representatives (at least one woman)	Amendments to draft Process Agreement	- Process of landowner identification discussed. - Each clause of the draft process agreement read out and discussed in pijin. - Tribe requested that rain gauge, flow gauge and road sites be treated separately to Core land. - Some changes requested to draft including: - Increase in goodwill payment - Exclusion of secondary LO tribes and flow and rain gauge site tribes from agreement
156			15th: Initial discussion of Process Agreement with Uluna Sutahuri	Honiara Hotel Conference Room	8 tribal representatives	Amendments to draft Process Agreement	- Process of landowner identification discussed. - Each clause of the draft process agreement read out and discussed in pijin.

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				Jacob Kinai (lawyer from LALSU) with Jen Radford (JR), Jefferson Leua (JL), Eric Garopova (EG) from PO			- Some changes requested to the draft. Other clauses supported. Changes requested included: - Change in ownership of TCLC from 51/49 to 50/50 - Greater clarity on benefit share clause - Assistance in compensation distribution – no good spendim lo quaso
157			16th: Initial discussion of Process Agreement with Buhu Garo	Honiara Hotel Conference Room Jacob Kinai (lawyer from LALSU) with Jen Radford (JR), Jefferson Leua (JL), Eric Garopova (EG) from PO	6 representatives (4 men and 2 women)	Amendments to draft Process Agreement	- Process of landowner identification discussed. - Each clause of the draft process agreement read out and discussed in pijin. - Some clauses supported. Changes requested included: • Change Garo Buhu to Buhu Garo • More time is needed for tribes to consider and negotiate • Only 5 tribes are real LOs • Roha and Buhu Garo overlap to be resolved • Future payments from agreement should be paid by developer rather than SIG • LALSU support is good • Corporations will need training or support • Secondary LO tribes should not be in clause 13

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							• 50/50 rather than 51/49 TCLC share • Need to hold tribal meetings before signing • Increase goodwill payments
158			19th: Initial discussion of Process Agreement with Vuralingi	Honiara Hotel Conference Room	Small Group	Amendments to draft Process Agreement	- Each clause of the draft process agreement read out and discussed in pijin. - Some changes requested to the draft. Other clauses supported. - Increase goodwill payment
159			19th: Initial discussion of Process Agreement with Charana	Honiara Hotel Conference Room	7 tribal representatives including 1 woman	Amendments to draft Process Agreement	- Each clause of the draft process agreement read out and discussed in pijin. - Some changes requested to the draft. Other clauses supported. - Tribe noted that they have only one block of land (Tulahi) and this is the block that would be given up for the project
160			20th: Initial discussion of Process Agreement with Kochiabolo	Honiara Hotel Conference Room Jacob Kinai (lawyer from LALSU) with Jen Radford (JR), Jefferson Leua (JL), Eric Garopova (EG) from PO	6-8 tribal representatives	Amendments to draft Process Agreement	- Each clause of the draft process agreement read out and discussed in pijin. - Some changes requested to the draft. Other clauses supported. - 51/49 TCLC shareholding not acceptable - Need to finalise tribes before acquisition - Increase goodwill payment - The number of tribes involved should not be allowed to increase, the three extras

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							should come out. Only tribes with proven claims should be included. - PS and Ministers should conduct negotiations to show their status - Flow gauge land should be treated separately.
161			21st: Initial discussion of Process Agreement with Kaipalipali	Honiara Hotel Conference Room Jacob Kinai (lawyer from LALSU) with Jen Radford (JR), Jefferson Leua (JL), Eric Garopova (EG) from PO	6 tribal representatives (and 4 observers)	Amendments to draft Process Agreement	- Each clause of the draft process agreement read out and discussed in pijin. - Some changes requested to the draft. Other clauses supported. • Discussions related to the flow gauge land • Benefit share needs more detail • Trust the BLIC process
162			22nd: Meeting with Wilson Suharu of Koenihao	Project Office	1	Discussion	Land ID: Evidence and claims for Nala Land discussed
163		June	3rd: Meeting with Kochiabolo	Project Office	Tribal Representatives	Discussion	Discussion of Process Agreement terms
164			5th: Meeting with all Core Land Tribes to discuss Process Agreement	Project Office	15+ Tribal Representatives	Amendments to Draft Process Agreement	- Each clause of the Process Agreement was read through and discussed in pijin. - Changes made since last meeting emphasised

No.	Year	Month	Activity	Venue	No of Participants	Output	Issue discussed
							- Request from tribes for a royalty payment - Agreement for compulsory acquisition to proceed subject to finalising terms of PA
165			12th: Meeting with the 4 Core Land Tribes to discuss Process Agreement	Project Office	15+ tribal representatives	Amendments to Draft Process Agreement	- Each clause of the Process Agreement was read through and discussed in pijin. - Changes made since last meeting emphasised - Requested a minimum compensation value
166			18th: Process Agreement and investment/management advice with Roha	Project Office PO and Martin Housanau	6-8 Tribal Representatives	Amendments to Draft Process Agreement and provision of management investment advice	- Martin Housanau discussed development and investment opportunities in other projects incl malaitia. - Discussed Process Agreement terms
167			18th: Process Agreement and investment/management advice with Kochiabolo and Virulingi	Project Office PO and Martin Housanau	Tribal reps and PO	Process Agreement and provision of management investment advice	Discussion of Process Agreement with powerpoint
168			19th: Process Agreement and investment/management advice with Buhu Garo	Project Office	Tribal reps and PO	Process Agreement	Discussion of Process Agreement with powerpoint
169			19th (approx.): Process Agreement and Land ID discussion with Vuralingi	Project Office	Tribal Reps	Discussion	Discussed signing Discussed nature of Vuralingi ownership as trust arrangements

No.	Year	Month	Activity	Venue	No of Participants	Output	Issue discussed
170			23rd (approx.): Process Agreement discussion with 4 Core Land Tribes (Viurulingi, Kochiabolo, Buhu Garo and Roha)	Project Office	Tribal Reps	Amendments to Process Agreement Draft	Each clause of the Process Agreement read and discussed in pijin, emphasising amendments made based on previous negotiation
171			25th: Discussion of Process Agreement and Land ID with Roha	Project Office	Tribal Reps	Discussion	- Discussing land ownership boundaries within the Core - Planning full tribe meeting to discuss Process Agreement
172			26th: Full Roha Tribe meeting to confirm process agreement and land ID	Malango	70-100 including women, youth and men	Agreement to proceed with process agreement	- Power Point discussing terms of the agreement presented - Questions and answers - Consent of tribe sought to proceed
173			23rd – 26th: Roha Tribal Representatives signing Process Agreement	Project Office	7 Tribal Reps (5 men and 2 women)	Process Agreement signed	
174			23rd – 26th: Virulingi trustees signing Process Agreement	Project Office	4 named trustees and 3 witnesses (including 2 women)	Process Agreement signed	
175			28th: Buhu Garo full tribe meeting to discuss Process Agreement	Don Bosco (near residence of	40-50 women, men and children		Power Point presentation of process agreement and land boundaries

No.	Year	Month	Activity	Venue	No of Participants	Output	Issue discussed
				Sir Paul Tovua)			
176			29th: Meeting with family and witnesses of Vuralingi trustee to discuss Process Agreement	Residence of Napter Noveti, Bahomea	40-50 men, women and children	Confirmation of Project Agreement signing and awareness of content and next steps	- Presentation of Power Point discussing terms of agreement - Questions and answers - Traditional feast
177			30th: Meeting with Roha Tribal Reps to discuss boundary with Buhu Garo	Project Office	Approx 4	Discussion of internal land boundary location	- Land ID (internal boundary between Roha and Buhu Garo)
178		July	2nd: Signatures to Process Agreement from Kochiabolo Trustees	Project Office	Tribal representatives (5 men and 2 women) – signed over differed dates leadin gup to 2/7	Signed Process Agreement	- Kochiabolo Reps signing Process Agreement
179			4th: meeting between Roha and Buhu/Garo	Don Bosco Technical Institute	50+		Both tribes met to discuss a way forward on claims by Buhu/Garo parts of their land were included in those of Roha's. Both parties agreed to find their own time to settle the issue and then focused

No.	Year	Month	Activity	Venue	No of Participants	Output	Issue discussed
							on when to sign the Process Agreement. After the meeting members of the Roha tribe presented a Chupu (traditional gift) to the chief and members of Buhu/Garo as a mark of respect.
180			9th (approx.): Buhu/Garo Chief and leader Signed Process Agreement in PM's Residence		PM Gordon Darcy Lilo Residence, Vavaya Ridge	30+	
181			12th: Updates	GP Women's Resource Centre, Henderson	30+	Discussed/agreed	Proposed updates for communities of Bahomea disturbed by individuals from Marava. However, many interested members of the community dropped by into the PO to get the updates.
182			14th: Meeting between Roha and Buhu Garo tribal representatives, elders and story tellers to discuss land boundary	Bisivotu at Poha	25	Land boundary discussed and negotiated	- Old court cases and custom stories discussed - Agreement reached on part of boundary
183			22nd, 23rd: distributed updates	Various			

No.	Year	Month	Activity	Venue	No of Participants	Output	Issue discussed
184		August	18th: Discussion of compensation claim preparation with Virulingi Tribe	Project Office		Discussion of compensation claim boundaries	- Confirm customary boundaries for claim - Tribe confirmed no dispute as to boundary between Kochiabolo and Virulingi.
185			22nd: Meeting with representatives of the 4 Core Land Tribes to discuss tribal awareness of acquisition process	Project Office		Discussion	- Need for awareness of acquisition and claims process to go down to community level - Jacob Kinai to assist tribes to prepare compensation claims
186		Septembe r	9th: Meeting with all Core Land Tribes (date approx.)	LALSU/Hyund ai Mall	Jacob Kinai from LALSU, PO and reps of 4 tribes	Discussion of compensation claim process and legal rights to appeal	- JK explained public purpose quashing appeal option - JK explained that he will assist Core Land Tribes to prepare claims but not competing tribes (conflict of interest) - Compensation claim process - How to prepare compensation claims - Right of appeal from COL to High Court
187			25th: Meeting with representatives for Core Land Tribes to discuss compensation claim preparation	LALSU	Jacob Kinai, Chris Tabea, Paul Tovua, Jen Radford and Jefferson Leua	Discussion	- Tribes asked to start preparing claim evidence

No.	Year	Month	Activity	Venue	No of Participants	Output	Issue discussed
188		November	3rd: Meeting with Daniel Una to discuss compensation claim boundary for Roha	Project Office	1	Discussion of claim	Land boundaries (internal)
189			17th: Meeting between Buhu Garo and Roha to discuss internal boundary	Project Office	13	Internal Boundary Resolution	Settlement discussion
190			20th: Meeting with Daniel Una of Roha to assist with compensation claim preparation	Project Office	1	Completed claim	Discussion of draft claim and customary evidence
191		December	2nd – 9th: Team of 11 community reps carried out community consultations in Bahomea and Malango on behalf of the PO	2nd: Namoraoni 3rd: Kaimomosa 3rd: Marava 4th: Pamphylia Mataruka 5th: Chichinge 6th: Namopila Managi 8th: Antioch 8th: Tina 9th: Horohotu	30 39 34 25 29 21 27 39 72 42 67	Updated, Educated of project's progress	Project still progressing Benefits JSDF support Build confidence and trust for communities
	2015: Core Land Tribes	January					

No.	Year	Month	Activity	Venue	No of Participants	Output	Issue discussed
	Cooperative Companies						
192		March	30th: Update of claims process	Project Office	Reps from Core Land Tribes		- Option for land in place of monetary compensation - Strength of partnership - Core Land Tribes confirmed preference for compulsory acquisition process
193		June	10th: Discussion with Uluna Sutahuri rep re protection of customary lands	Project Office		Discussion of catchment and Protected Area	- Protected areas on customary land need the approval of the tribes - Uluna could lead the way to setting up a PA on undisputed land - Benefit share discussed and the opportunity to focus it towards a PA
194		July	1st: Meeting with representatives from Kochiabolo, Viurulingi and Buhu Garo (Roha not present). Date Approx.	Project Office		Compensation Officers disucssed	- Valuation of land - Plan for transfer of title to joint venture company - Confirming timing of offer - Legal appeal options discussed
195			29th: briefing for Tina Hydro Champions	PO	14	Briefed	Livelihood Restoration; Core land Company structure: Community Benefit Share Arrangement; Tribal Registration; PPA; JSDF – water/sanitation project

No.	Year	Month	Activity	Venue	No of Participants	Output	Issue discussed
196		August	11th: Meeting with Kochiabolo reps re compensation offers	Project Office	Tribal reps – 7 men, women reps requested but did not attend	Compensation offer discussed	- Terms of offer discussed - Land swap not accepted - Legal appeal options and timing discussed
197			11th: Meeting with Roha reps re compensation offers	Project Office	Tribal reps – 4 men and 2 women	Compensation offer discussed	- Terms of offer discussed - Legal appeal options and timing discussed - Land swap not favoured - Process Agreement provisions for compensation discussed
198			11th: Meeting with Buhu Garo reps re compensation offers		Tribal reps – women not available due to church camp	Compensation offer discussed	- Terms of offer discussed - Legal appeal options and timing discussed - Land swap not favoured. Tribe already has abundant land.
199			12th: Meeting with Vuralingi reps re compensation offers		trustees	Compensation offer discussed	- Terms of offer discussed - Legal appeal options discussed - Land swap not favoured.

No.	Year	Month	Activity	Venue	No of Participants	Output	Issue discussed
200		August	13th: two Senior WB Social Development officer and Environment Consultant visit communities	Manangi, Antioh	-20	Discussed briefly/informed/seen communities	First visit to familiarize themselves with the area and communities
201 202			13th: " " 25th: Roha meeting	Marava Haimomosa	11	" "	
203			28th: Meeting with Uluna Sutahuri to discuss offer of compensation	Project Office	6-8 male reps	Compensation offer discussed	Update and responses to questions
204		September	7th: Registration of Sarahi Members	Managi	35+	Discussed/registered	Sarahi now agreed to register all tribe members after Paramount Chief Peter Rocky had refused this earlier
205			9th: updates for Uluna/Sutahuri	Red House, Grassland	80+	Informed/updated	Inform members about their being the 5th tribe in the Core Land

No.	Year	Month	Activity	Venue	No of Participants	Output	Issue discussed
206		October	8th: Updates	Marava	20+	Updated/informed	Inform about the A Developer; Road and asset recording/payments; JSDF
207			7th: Meeting with Roha rep re co-operative society	Project Office	1	Initial consultation on co-ops	- Overview of co-op ideas - Lifetime shareholding/ matrilineal committee for new members/possible spending allocations - A manager or administrator is essential. Tribe does not have accountants. - Not enough trust for people within the tribe to handle the money. Tribe can handle a milling operation if someone external handles money.
208			9th: Meeting with Roha Reps for co-op formation consultation	Project Office	4	Consultation on tribal corporation	Power Point presentation given on the proposed tribal corporation Comments: - Rights to land have gone but we now see the benefits - Important that people understand the rules/finances/audit guidelines - Business is important to the future. But our understanding doesn't go beyond a small canteen. We need to leave money aside to grow this and we need rules that prevent people borrowing or taking money from

No.	Year	Month	Activity	Venue	No of Participants	Output	Issue discussed
							the fund. Hard to say no in custom.
209			13th: updates	Antioch	42	Updated/informed	Developer; Route, asset record/payments; JSDF
210			14th: Updates	Zimri Launi House, top floor	18	Informed/updated	" "
211			15TH: Updates/Clarifications	Managi	35	Discussed/updated	Residents confused about pegs put by surveyors – anticipated relocation. PO stressed there wouldn't any relocation
212			20th: updates	Namopila	55	Updated/informed	Developer/ Route, records, payments; JSDF
213			21st: Meeting with Kochiabolo Reps for co-op formation consultation	Project Office	4	Consultation on tribal corporation	Power Point presentation given on proposed corporate structure Comments: - Need an appeal option for any tribal members not on register

No.	Year	Month	Activity	Venue	No of Participants	Output	Issue discussed
							- Could leaders have special shares/special provisions - Like the idea of a corporation based in custom - Directors need to change regularly. Too long and things go wrong - A corp will remove the pressure leaders receive from tribal members asking for money. Want this in place before we sign/receive compensation - Can't sign to accept offer without support of tribe. When we signed the process agreement our authority came from the tribe. Not from us. This needs to be the same.
214			22nd: Meeting with Uluna Sutahuri Reps for co-op formation consultation	Project Office	6-7	Consultation on tribal corporation	Power Point presentation given on proposed corporation structure Comments: - Core Area Committee had previously agreed to open an account with POB for the money. - Tribe previously divided Gold Ridge money as 50% dividends, 40% business, 10% administration costs. 40% for a business is still in the tribes term deposit account.
			27TH: Updates	Tina	53	Updated/informed	Developer/ Route, records, payments; JSDF

No.	Year	Month	Activity	Venue	No of Participants	Output	Issue discussed
215							
216			30th: Meeting with women of Roha Tribe	Project Office	20 women	Consultation on co-operative society	Power Point presentation given on proposed corporation structure
217		November	3rd: Updates	Vuramali	28	Updated/informed	Developer/ Route, records, payments; JSDF
218			10th: Updates	Horohotu	22	" "	" "
219			14th: Updates	Marava	18	" "	" "
220			17th: Updates	Horohotu 2	20+		
221			25th: Meeting with Roha Tribe for co-op workshop	Anglican Church of Melanesia Hall, Honiara	10 male and 10 female representatives. Project Office team: FC, BT, LF, JM, JR	Consultation on Co-ops	Updated Power Point presentation by JR on proposed corporate structure. James from GPPOL discussed challenges and successes of the GPPOL LOs corporate business and social benefits entities. Small group break out activity with 2 groups of women and 2 of men to discuss objectives and outcomes for the corporation. Comments:

No.	Year	Month	Activity	Venue	No of Participants	Output	Issue discussed
							- Invest for future generations - Provide employment opportunities - Gender balance and female leadership (from both women and men) - Access to higher income - Access to a clinic or health facility closer than Honiara - Invest in education - Start with small business and build up using current skills - Training needed for successful business
222		December	2nd: Meeting with Roha Reps to finalise co-op rules	Project Office	5 men, 2 women	Roha Co-operative Rules agreed and co-operative establishment documents prepared	- Consulting with reps on the co-operative rules - Discussion re percentage of profits for discretionary cultural requirements as distinct from evenly distributed dividends - Women requested a higher percentage of profit to go into evenly distributed dividends. - External administrator considered best person to make a final decision on whether to proceed with a business investment
223			4th: Updates	Grassland	21	Updated/informed	Developer/ Route, records, payments; JSDF

No.	Year	Month	Activity	Venue	No of Participants	Output	Issue discussed
224	2016: Cooperative Societies for Core Landowners	January	19th ; Banks meet Roha tribe members	Grassland	100+	Updated/informed	A first time ever for the ANZ and POB banks to get out to meet communities of Central Guadalcanal where they promoted themselves to the tribe members in readiness for the payment of their individual dividends into their personal accounts.
225			25th: First Roha Tribe AGM/Id photo session	"	150+	Discussed/ agreed/informed	Tribe members discussed about and elected an executive to lead their Cooperative Society and approved their method of sharing their money. Members also had their id photos taken by the PO team.
226			27th: Awareness about sharing their dividends and funds/id photo session	"	100+	Discussed/agreed/informed	Members discussed and agreed on sharing of their money from the government. Those yet to get id photos had theirs taken.
227			28th: Banks and Roha members meet/id photo session	"	100+	Discussed/agreed	Members listened and chose what bank to register with for their dividends.

No.	Year	Month	Activity	Venue	No of Participants	Output	Issue discussed
228		February	3rd: 1st Roha Coop Exec Meeting	PO	7	Discussed/agreed	Discussed about accounts, corrected names on the list, review of registration names, bank account and so forth.
229			4th: Id photo session	Red House	100+	Photographed	Continuation of id photo sessions for individual bank accounts for the Cooperative Society
230			8th: Uluna/Sutahuri exec meeting	"	11	Discussed/agreed	Discussion about tribal sharing of money from the government for their land
231			12th: Michael Litani explained about land to Uluna/Sutahuri members.	Red House	160	Discussed/informed/educate	Mr Litani requested this meeting from the PO to explain about the handover of the Barahau Longa land to his mother by Labuchovi.
232							

No.	Year	Month	Activity	Venue	No of Participants	Output	Issue discussed
233			16th: Briefing for Uluna/S tribe members/id photo session	Red House	170	Discussed/updated/informed	Tribe members informed of how much money was coming to them from the government, sharing formula and other information about the Coop. Also done photo ids for members for their bank accounts.
234			19th: Roha Exec meet Administrator	PO	7	Discussed/updated	Introductory meeting, constitution, distribution methods etc.
235			23rd: Banks/ Id photo session for Uluna/Sutahuri 26th: Id Photo sessions/Banks with Uluna/Sutahuri	Red House	100+	Ids photos taken	Continued to take Id photos for Uluna/Sutahuri tribe members
236		March	3rd: Roha AGM	Red House	120+	Discussed/agreed	To allow members approve two new clauses and take 10 non tribe members out of the dividend list.
237			4th: Roha given Chupu	Kaimomosa village	200+	Witnessed/recorded	Tribes gave and were given chupu to and from the members of the Roha Tribe in readiness for receiving their dividends.

No.	Year	Month	Activity	Venue	No of Participants	Output	Issue discussed
238			9th: Roha Exec Meet	PO	7	Discussed/agreed	Culture Obligation Sharing formulae ANZ outstanding bills Verify final membership list
239			9th: Roha Special Meeting with Administrator	Morris/Soj conference room			ANZ Arrears on individual members savings discussed. Familiarization with the Administrator by the 7 executive members. Commissioner of Lands was also present to sign and deliver the $6.973m for distribution.
240		April	5th: Una Meki Reconcile	Marava village	43	Apologised/reconciled	D Una provided record of this where Roha and Charana members reconciled on differences over Tulahi land.
241			7th: Meki and sons apologize	PO	4	Discussed/agreed	Marava leaders to explain their involvement in an incident at Marava in March and offer their apologies and recommendations for a way forward.
242			9th: Uluna/Sutahuri meeting	PO	10+	Discussed/agreed	List of tribal registration Awareness on what co-operation is and how it will administer money for the tribe

No.	Year	Month	Activity	Venue	No of Participants	Output	Issue discussed
243							Customary obligation fund. Election of executive committee.
			10th: Uluna/Sutahuri AGM	Red House	200+	Discussed/agreed/elected	Tribe elected its executive to manage their affairs in their Cooperative Society.
244			12th: Gender Meeting	Tina Village	20	Updated/informed	Gender Consultant Jen Scott met and discussed about gender issues in the Project
245			20th: Uluna/Sutahuri exec meeting	PO	7	Discussed/agreed	Their preparations to work on their members' bank accounts and other matters.
246			20th: Water Survey team	PO	4	Discussed/agreed	Deputy Project Manager Fred Conning met/discussed with two appointed people to head the water project for the Malango/Bahomea communities.

No.	Year	Month	Activity	Venue	No of Participants	Output	Issue discussed
247			20th: Roha Exec committee meeting	PO	7	Discussed/agreed	The meeting was purposely to hear a presentation of a representative of the Value Added Timber Association to help the Roha Executive have a clear idea about how to proceed with their investment in timber milling.
248		May	06th: Special Uluna/Sutahuri Meeting	Red House	150+	Discussed/agreed	To finalize outstanding issues that needed fixing so members could work on accounts for their money.
249			24th: MID Awareness	Tina village	15+	Informed/updated	Update about 50m road concept design by Cardno of Australia. Team leader was Primo Chapa.
250		July	23rd: Uluna/Sutahuri Meeting	Red House			Announcements; Review membership list; Breakdown of Cultural Obligation component

No.	Year	Month	Activity	Venue	No of Participants	Output	Issue discussed
251		August	22nd: update for Community Champions	PO	10+	Updated/informed	To plan out a review of the project could be best displayed; Updated and mentored champions about Benefits for the Community through the JSDF. Preparing them for community consultations about this component that should happen before construction of the dam.
252			24th: Community Champions meeting	PO	10+	Empowered/educated	A thorough discussion about the different components of the Benefit Share to empower the champions equipped for their community consultations later.

Annex 15 : Local community perceptions

PROJECT IMPACT CONCERNS

Each village community surveyed for the SIA raised issues that could require attention. The following table presents the key points for each village community that relate to Option 7C [74]. These were recorded in the participatory workshops and in the follow-up mitigation workshops. [The villages within each community, and the clan affiliations of the households, are listed in the Baseline Report.]

Table 2 Tina catchment communities concerns relating to Option 7C

COMMUNITIES	PROJECT CONCERNS
SENGE COMMUNITY (DIA)	Restricted access to fishing, hunting, and gardening areas in project area Decline in fishing in river if reduced flow. Impact on valuable wild plants (e.g. for food, medicine, magic, hunting etc) in project area. Loss of forest materials from project area, e.g., new access roads. Cultural sites permanently lost or damaged (tambu pool, sacred streams, grave sites, former habitation sites). Construction noise, vibration, etc from construction activities, e.g. tunnelling. Water pollution downstream of the dam construction. Reduction in river and stream water supplies for future use Possible disruption to culture, customs, and way of life by outside workers. Potential landowner and tribal conflicts over compensation, royalties etc. Fear of permanent loss of traditional cultural quiet way of life, income, and health.
PACHUKI COMMUNITY (DSA)	Loss of utility and amenity of the river due to reduced/unreliable river flow. Noise, dust etc from construction of powerhouse, and access road, especially for Habusi (approx. 500 metres away). Long term reduction in ability to transport float timber from upstream due to diversion of flow Dangers to river users from tailrace flow from the power station. Loss of clean water supply, washing places, recreation, and fishing during construction of dam and nearby powerhouse. Anxiety about danger of dam failure/earthquakes, and possible need to relocate.
NAMOPILA COMMUNITY (DSA)	Loss of utility and amenity of the river due to reduced/unreliable river flow ; Long term reduction in ability to float timber from upstream due to diversion of flow, with possible loss of income; Loss of fishing holes, and reduced access to hunting & gathering areas in upper catchment Loss of clean water supply during construction. Anxiety about danger of dam failure/earthquakes Few benefits to indigenous owners of the resources (river and land) being exploited by the project. Possible cumulative impacts with mining and logging Need for separate land and mitigation agreements for different communities and owners; Family problems arising from increased access to money.
VERAKUJI /MANAGIKIKI COMMUNITY (ISA)	Physical effects of road development (dust, noise , vibration) and road use Damage or disturbance to homes/buildings adjacent to road from roadworks and road use- may require re-siting of some buildings Disturbance to gravesites Danger to children, pedestrians and local traffic from project transport Loss of fishing holes, reduced access to hunting & gathering areas Damage to/loss of food gardens and forest resources from building damsite access road Possible damage to water supply sources from road building etc

[74] The village workshops looked at the potential impacts of Option 6E and a notional design for Option 7C; the concerns that were specific to Option 6E have been omitted here.

COMMUNITIES	PROJECT CONCERNS
	Disturbances to way of life from outsiders.
ANTIOCH COMMUNITY (DSA)	Reduced amenity of the river due to reduced/unreliable river flow and water quality; Long term reduction in ability to float timber from upstream of the power station, with possible loss of income; Loss of fishing holes, and reduced access to hunting & gathering areas in upper catchment Loss of clean drinking water supply during construction Inappropriate behaviour, social disorder, new diseases, changes in lifestyle and potential loss of culture and customs if outside workers live in the area.
TINA COMMUNITY (DSA)	Loss of utility and amenity of the river due to reduced/unreliable river flow and reduced water quality; Loss of drinking water supply during construction Long term reduction in ability to float milled timber from upstream of the power station Loss of fishing/diving holes Loss of access to fishing, hunting and gathering areas upstream of dam and reduced availability of bush materials Negative impact of outside workers – disrespect for culture and for women (as seen at Gold Ridge), and reduced personal and home security Potential water pollution from project facilities (sewerage etc) due to presence of outsiders Problems of rubbish disposal and sanitation (ref to Gold Ridge), and possible increased gastrointestinal infections. Cultural inappropriateness of female workers' clothing (shorts/trousers) Fear of dam failure or overtopping due to earthquake and landslide Distrust of government re agreements and promises of benefits to local people.
VURAMALI COMMUNITY (DSA)	Loss of utility and amenity of the river due to reduced/unreliable river flow and water quality; Long term reduction in ability to float milled timber from upstream of the power station Loss of fishing, hunting & gathering areas upstream of dam Pollution of drinking water supply Loss of forest resources in project area/s Lifestyle change / influence from construction-related outsiders and others Social and behavioural problems associated with outside workers (disrespect to locals and women), Safety of children from project traffic Increased risk to children from river level fluctuations Fear of devastation from dam failure – with possible need to relocate away from river. Contamination of hunting / fishing areas from oil & chemicals Fear of conflict over compensation and landowners' access to project benefits.
MARAVA COMMUNITY (ISA)	Physical effects of road development (dust, noise , vibration etc.) and Negative impact on households of increased road use Disturbance to local gravesites and tambu areas. Damage or disturbance to homes, facilities, and gardens adjacent to road from roadworks Damage and/or loss of access to fishing, hunting & gathering areas upstream of dam. Reduced fish stocks in river generally Danger from traffic and heavy vehicles on Tina Road Possible damage to water supply streams from road building etc. Social and cultural problems from outside workers, including safety of women and children, increased drugs and alcohol in community etc., Damage to nearby riverside picnic & recreational areas

COMMUNITIES	PROJECT CONCERNS
	Potential social problems among local families arising from increased availability of cash from projected-related employment.
VERA-ANDE COMMUNITY (ISA)	Dust, noise, and fumes from increased road use – with possible health effects Possible damage to water supply areas and wells from road building and road use Damage or disturbance to homes, facilities, and gardens adjacent to road from roadworks and road use. Possible need to re-site houses back from the road. Danger from traffic and heavy vehicles speeding past villages Disturbances to way of life from outsiders Fear of increased social disorder due to alcohol use.

Table 3 Bahomea Settler and Ghaobata Communities downstream communities concerns relating to Option 7C

COMMUNITIES	PROJECT CONCERNS
VERAKABIKABI COMMUNITY (ISA)	Physical effects of road development (dust, noise , vibration etc.) and increased road use on local households Potential for damage to gardens areas and a cemetery near road Risk of road accidents involving project vehicles - especially safety of school children Lack of own transport Fear of dam failure General concerns about negative impact on incomes and food security. Need more information on project.
HOROHUTU I (DSA)	Increased noise and dust from traffic/trucks on the road Social problems and bad influences from outsiders coming to the area, and from badly behaved drunk young people and associated disturbance Negative cultural influences from project workers
OLD SELWYN COMMUNITY (DSA)	Loss of utility and amenity of the river due to reduced/unreliable river flow and water quality; Fear of reduction in natural supply of river gravel, and associated loss of income from sales Fear of decrease in ground water levels, especially in dry season Fear of dam failure and its consequences Water pollution from oil and fuel spills Potential conflict with project and government over water ownership, royalties and compensation Lack of inclusion of downstream communities in project planning to date.
RAVU COMMUNITY (DSA)	Water pollution and reduced river flow, especially during construction and during dry season, with negative impact on all river water uses. Fear of reduction in natural supply of river gravel, and associated loss of income from sales Fear of decrease in ground water levels (wells), especially in dry season Water pollution from oil and fuel spills, especially during construction Fear of dam failure and flooding during big cyclone or earthquake. Potential conflict with government and other communities over water ownership, royalties, compensation , and access to project benefits Lack of inclusion of downstream communities in project planning to date.

Table 4 Indigenous Landowners outside Project area concerns relating to Option 7C

COMMUNITIES	PROJECT CONCERNS

MATARUKA COMMUNITY	Potential social and cultural problems from outsiders and expats working on the project or others coming attracted to the Bahomea and Malango area. Potential conflicts over ownership rights, royalties, compensation, and access to project benefits, including construction jobs. Loss of fishing spots and access to hunting areas etc in project area Damage to Tenaru River catchment from routing and construction of dam access road Conflicts over land identification and ownership Damage to/loss of cultural sites from construction and storage reservoir
BELAHA COMMUNITY	Loss of hunting / fishing areas (at dam site and above) to which they have access rights Loss of medicinal and cultural plants in project areas Reduced supply of timber from their own lands for building Demand on time for consultations and negotiations with developers Potential conflicts over compensation and access to project benefits, including construction jobs Potential social and cultural problems from outsiders and expats working on the project.

PROJECT BENEFITS ANTICIPATED BY LOCAL COMMUNITIES

The anticipated or perceived local-level benefits or positive impacts of the TRHDP are presented below. Many of the anticipated benefits derive from (assumed) access and compensation payments, government benefit sharing programmes or projects, and TRHDP-related infrastructure development.

Table 5 Tina Catchment communities' views of project benefits

COMMUNITY	PROJECT BENEFITS
SENGE COMMUNITY (DIA)	Electricity supply and associated benefits to quality of life, and small business opportunities. Protected forest area. Possible employment on the project. More accessible and improved health and educational facilities and services. New business opportunities involving the lake/reservoir (e.g. ecotourism, sightseeing)
PACHUKI COMMUNITY (DSA)	New houses, with road access and water supply (assuming relocation required for Habusi and Pachuki).
NAMOPILA COMMUNITY (DSA)	Income from royalties and compensation, with flow on benefits such as improved housing, consumer goods, and business creation.
VERAKUJI /MANAGIKIKI COMMUNITY (ISA)	Income from royalties and compensation, with flow on benefits. Electricity supply - with significant improvement in the quality of life e.g. lighting, refrigeration, entertainment, use of home appliances and creation of home industries such as sewing and joinery workshop). Improved road transport and associated access to services.
ANTIOCH COMMUNITY (DSA)	Creation of protected forest area (eliminating risk of mining and/or further logging in the catchment). Local electricity supply and associated opportunities. Improved water supply. Improved roads. Direct and indirect project employment opportunities.
TINA COMMUNITY (DSA)	Direct and indirect employment opportunities on the project for local men and women, with job training. Local electricity supply and associated livelihoods opportunities and improved quality of life

COMMUNITY	PROJECT BENEFITS
	New business opportunities involving the lake/reservoir. More income and investment opportunities from anticipated royalties/rents or other payments from the developer. Improved water supply Improved road and transport services Improved social and other services and facilities (e.g. schools & clinics) from government support programmes.
VURAMALI COMMUNITY (DSA)	Local electricity supply and associated livelihoods opportunities and improved quality of life. Improvement to water supply. Employment and small business opportunities for men & women. Improved roads and transport. Improved social and other services and facilities.
MARAVA COMMUNITY (ISA)	Local electricity supply and associated livelihoods opportunities and improved quality of life. Direct project and indirect employment and small business opportunities, and associated increased incomes Opportunity for job training Improved standard of living and services (e.g. schools). Potentially improved relationship between communities and central government.
VERA-ANDE COMMUNITY (ISA)	Local electricity supply and associated livelihoods opportunities and improved quality of life (e.g. water pumping, appliances, electrical equipment, lighting, entertainment). Improved roads and associated better access to public transport, health services, markets etc. Employment opportunities and Improved income. Government improvement to services and facilities.

Table 6 Bhaomea Settler communities and Ghaobata Communities downstream views of project benefits

COMMUNITY	PROJECT BENEFITS
HOROHUTU I (DSA)	Direct and indirect employment opportunities, especially for young people. Improved road and transportation, and associated better access to services. Alternative and better water supply. Electricity supply. Indirect improvement to standard of living.
VERAKABIKABI COMMUNITY (ISA)	Direct and indirect employment opportunities, and associated improvements in income. Improved roads and transportation and associated better access to services. Alternative and better water supply. Electricity supply Overall improvement to standard of living and economic circumstances.
OLD SELWYN COMMUNITY (DSA)	Direct and indirect employment opportunities. Electricity supply re-established. Assistance with improving village water supply or re-establishing reticulated supply improved roads.
RAVU COMMUNITY (DSA)	Possible better flood control for flood-prone Ravu area. Electricity supplies (free) and associated improvement in the quality of life. Employment opportunities with possible job training and capacity building. Participation in benefit sharing programmes.

Table 7 Indigenous Landowners outside the Project area

COMMUNITY	PROJECT BENEFITS
MATARUKA COMMUNITY	Improvements to quality of life and standard of living for kinsmen in the Tina catchment Electricity supply to the landowners, and associated benefits. Improved water supply. Employment, small business, and training opportunities for the landowners. Income earning opportunities for women.
BELAHA COMMUNITY	Employment and training opportunities for the land owners. Electricity supply (free) to the land owning communities. Government improvement to services and facilities. Improved roads. Improved water supply local villages. Improved standard of living and quality of life.

Annex 16: A summary of the situation of women in the Solomon Islands and the Project Area

OVERVIEW OF KEY ISSUES

Reports of the situation of women since 2003 (i.e., the post-Tension period) paint a grim picture by international standards. In 2005, UNICEF summarised the situation as follows:

The status of women in Solomon Islands tends to be low, as are contraceptive prevalence levels. This contributes to high fertility levels that stretch the capacity of rural people engaged in subsistence to provide for their families. Domestic violence is widespread, as are sexually transmitted infections, and girl children and the disabled tend to be disadvantaged compared with healthy boys. . . The major concerns for children, youth and women are under-resourced health services and schools, especially in rural areas, scarcity of cash earning opportunities for both men and women, and scarcity of employment opportunities and lack of career structures for youth. (McMurray, 2005,:viii)

Women have little say in family decision-making. Even where land is inherited matrilineally, as in Guadalcanal, decisions as to the management and allocation of the land still tend to be made by men, and female landowners are not expected to oppose the wishes of their menfolk (McMurray, 2005:40)

In the absence of village level data from the 2009 census, it is difficult to get the full picture of the social and economic situation of women in the project area. However, data is available at the provincial and ward level. The key indicators of women's situation and development in Guadalcanal (and Malango ward) are as follows:

- females make up 48% of Guadalcanal province's population;
- their life expectancy is 73 years (c.f. 66 years for males);
- the average annual female population growth rate is 4.5% (c.f. 4.3% for males)
- 14% of private households are headed up by females;
- the median age for females is comparatively low at 19.4 years (c.f. 19.1 years for males);
- the median age at first marriage is 23 (c.f. 27 for males), and 14% married as teenagers;
- The labour force participation rate for females is 63%, the same as for males, although only 28 % of the economically active females are in paid employment (32% in Malango ward). 46% of economically active females aged 14 and over are engaged in subsistence production (24% in Malango), and 14% produce goods for sale (18% in Malango);
- 25% of females aged 12 and over have either had no school or very limited primary education (c.f. 15% of males). Females have a lower literacy rate than males, and;
- In Malango Ward the majority of females and males-
    - live in houses that they own, and located on land that that they 'own' freehold or by custom. These houses typically have 1-2 rooms, traditional thatched roofs, wooden floors, and wooden or traditional bush material walls;
    - 30% rely on rivers and streams for their drinking water supply, 13% on wells, and 24% on community of individual tanks;
    - 57% rely on rivers, streams, ponds etc to do their washing, and
    - for sanitation, 44% use private or shared pit latrines, and 15% have no toilet facilities, and
    - over three quarters reply on kerosene lamps for lighting (although low wattage solar lighting has recently become available to most householders), and 90% rely for cooking on wood and coconut shells.

The data on household facilities is highly relevant when considering the workload of women in the villages of the project area (see below) and when considering potential impact mitigations and benefits sharing.

The 2007 national demographic and health survey provides basic indicators of the situation for women in the Solomon Islands:

- among women aged 15 to 49, 21% were recorded as not being able to read compared with 11% of men;
- in terms of paid employment only 42% of married woman had been employed in the previous 12 months compared with 87% of men. Over half of the woman who were employed were not paid in either in cash or kind;
- 21% of adult females are not able to read (of 11% of males), with illiteracy higher in rural areas;
- only 28% of married woman reported they were able to make their own healthcare decisions independently;
- only 20% reported they had the main decision-making power regarding their visits to their family and friends;
- only 55% of married woman usually participate in household decisions about major purchases, healthcare, and family relationships, and;
- 69% of women believe that physical violence against them by their partner is justified in some case. 63% of men believe that violence against women is justified for a range of reasons – with younger men more likely to justify such violence.

A 2012 report by the National Council of Women (in association with 10 national NGOS) confirmed the poor socio-economic situation for most women, noting that the critical issues for women are violence, corruption and its effects, and the lack of support and services for women with disabilities:

The conflict in Solomon Islands from 1999-2003 was a period of increased violence against women, both in public and private. Although there are many cultural taboos against women talking about sexual violence, the Women's Submission to the Solomon Islands Truth and Reconciliation Commission reports that a high number women and young women, married and single, were raped during the tension, resulting in physical and psychological trauma and unwanted pregnancies… Domestic violence also increased during the tension, with women reporting regular physical abuse resulting in fractured arms, legs and bodies and the destruction of personal belongings and clothing. Violence against children, including girls, also increased. Other women were forcibly detained. The levels of violence against women and girls have remained high following the tensions. (National Council of Women, 2012:9).

Such observations were confirmed during our discussions with women in the project communities.

With respect to women's status in decision making about land and resources, the 2012 report from the National Council of Women noted:

In all provinces, regardless of customary law, in practice men exercise decision-making rights over land use and over income generated from the land (e.g. royalties from logging and mining operations) … Young women are particularly discriminated against in community decision-making processes about land use. In most communities, women and especially young women are not permitted to speak during community meetings about land use. Despite the fact that women are concerned about the impacts that unrestricted logging is having on traditional land, and that they have land ownership rights, women are prevented from participating in decision-making about the use of that land (National Council of Women, 2012:35)

Monson (2010) has researched the situation of women in matters of ownership and resource management in a northern Guadalcanal community, and summarised it as follows:

While it is common for Guadalcanal people to assert that "women are the real landowners of land on Guadalcanal", land records and court records generally record the names of a small number of male leaders thus solidifying their formal control over land. The state legal system tends to recognize the small number of individuals that have customary authority to speak about land inside a public arena, therefore turning the customary 'right to speak' into effective ownership. This has operated to the detriment of many landowners, particularly women, who often lack the formal education or customary authority required to speak in public arenas (Monson, 2010:5).

As seen in the SIA Baseline Report, the same issues for women and young people are present in the communities of the project area, and there seem to be few if any programmes designed to improve their situation.

WOMEN'S HEALTH

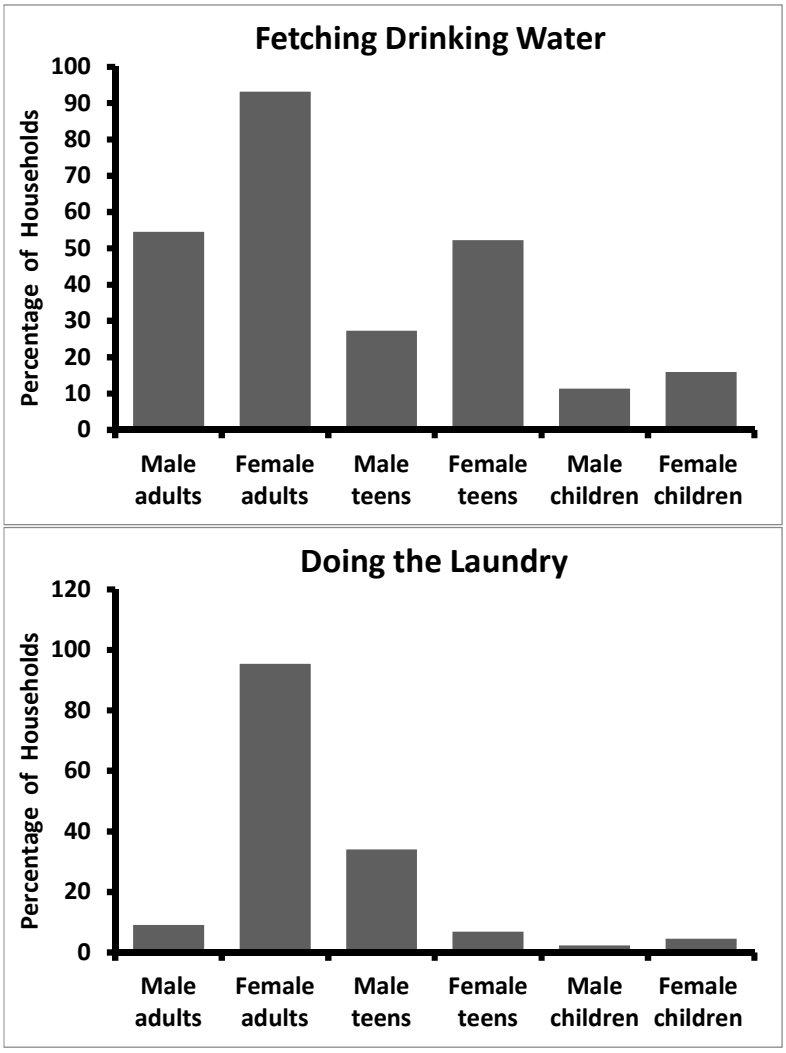
While national fertility levels have been decreasing over the past 20 years, rural Solomon Islands woman still have an average of 4.8 children in the course of their lives. Child bearing starts early, and in 2007, young woman from Guadalcanal were more likely than others to have begun child bearing in their teenage years. The median age for a woman having her first child is 21 years, compared with 22 years for Solomon Islands as a whole. Women in Guadalcanal were also more likely than others to have their children at home (29%) rather than at hospital, and only 69% of births were likely to be attended by skilled provider compared with 86% nationally. Among rural Guadalcanal women aged 15-49, 52% were found in 2007 to be anemic (Demographic and Health Survey, 2007). 97% of women Guadalcanal in the 2007 survey reported at least one serious problem in accessing health care, typically concern about having no provider, no transport, or not having sufficient money for treatment.

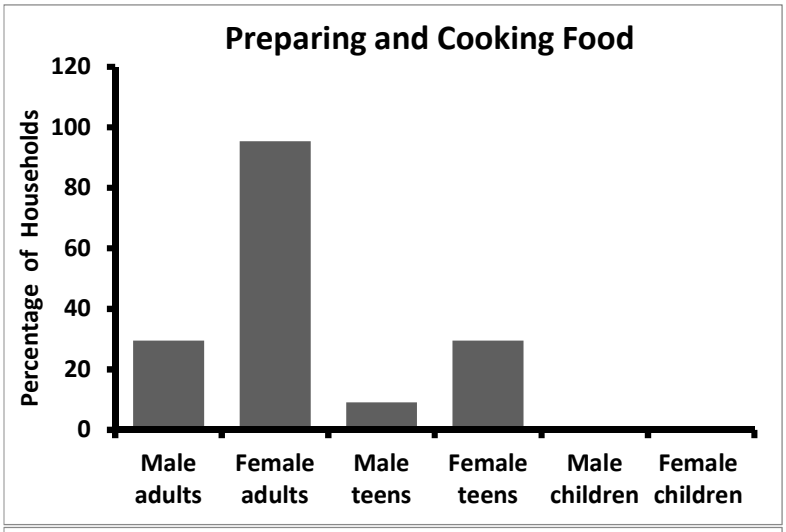
DIVISION OF LABOUR

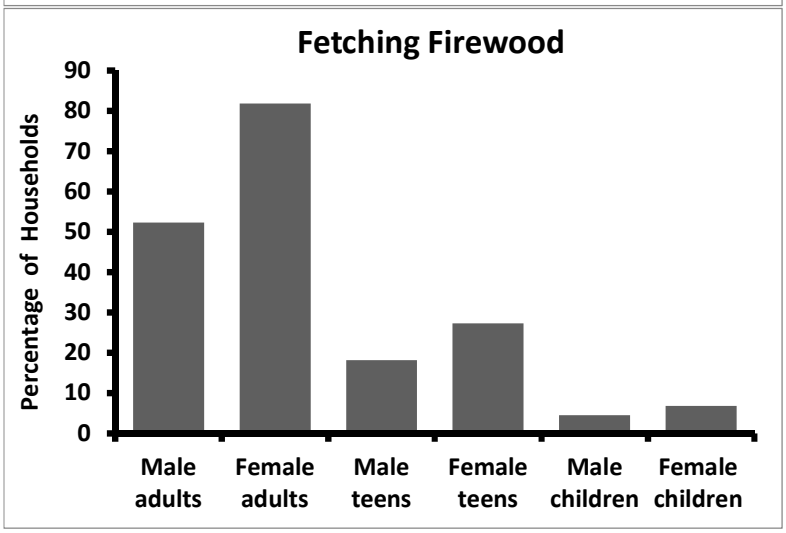
Table 8 Percentage of households in which each group is involved in the activity.

	Male adults	Female adults	Male teens	Female teens	Male children	Female children
Fetching Drinking Water	55%	93%	27%	52%	11%	16%
Doing the Laundry	9%	95%	34%	7%	2%	5%
Preparing and Cooking Food	30%	95%	9%	30%	0%	0%
Fetching Firewood	52%	82%	18%	27%	5%	7%
Caring for the Yard	25%	95%	11%	32%	2%	2%
Cleaning the House	9%	89%	5%	30%	5%	5%
Building and Maintaining House	91%	9%	11%	0%	5%	0%
Feeding Pigs and Chickens	25%	52%	11%	20%	5%	2%
Child Minding	45%	98%	14%	25%	2%	5%
Taking Children to School	11%	36%	0%	2%	5%	5%
Clearing Forest for Gardens	86%	50%	5%	2%	5%	5%
Cultivating the Gardens	66%	82%	9%	9%	2%	2%
Harvesting Planted Crops	48%	93%	5%	14%	2%	2%
Hunting	48%	2%	5%	0%	2%	0%
Catching Fish/Eels in the River	61%	32%	20%	9%	9%	2%
Collecting Wild Fruit etc.	45%	50%	18%	20%	5%	7%
Selling Produce/Cash Crops	18%	86%	5%	7%	0%	0%
Looking after Household Finances	50%	82%	0%	0%	0%	0%
Buying Food/Supplies	45%	82%	2%	5%	0%	0%
Attending Community Meetings	68%	93%	2%	2%	0%	0%
Deciding on Land Issues	75%	41%	0%	0%	2%	2%

Figure 1 Division of Labour-Percentage of households in which each group is involved in the activity




Preparing and Cooking Food
Percentage of Households
120
100
80
60
40
20
0
Male adults
Female adults
Male teens
Female teens
Male children
Female children


Fetching Firewood
Percentage of Households
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80
70
60
50
40
30
20
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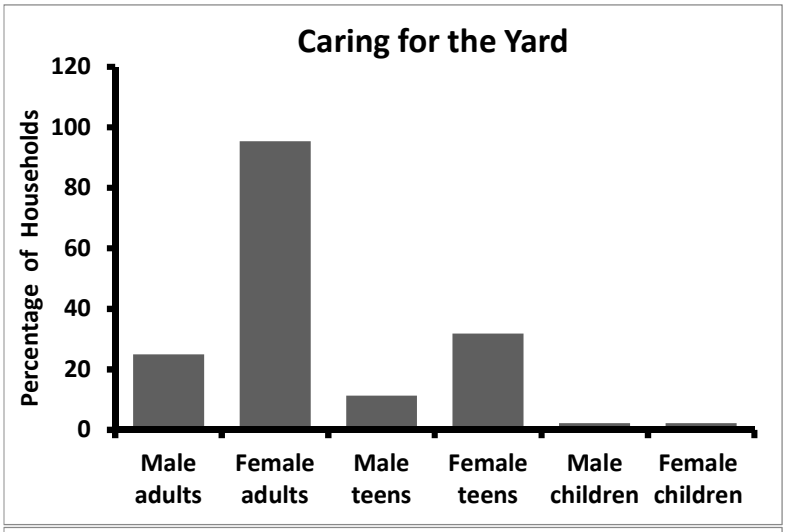
Male adults
Female adults
Male teens
Female teens
Male children
Female children


Caring for the Yard
Percentage of Households
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100
80
60
40
20
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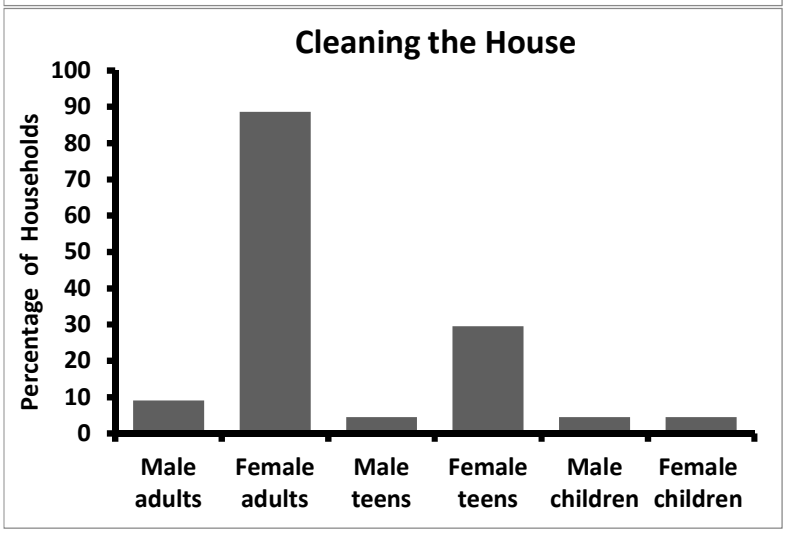
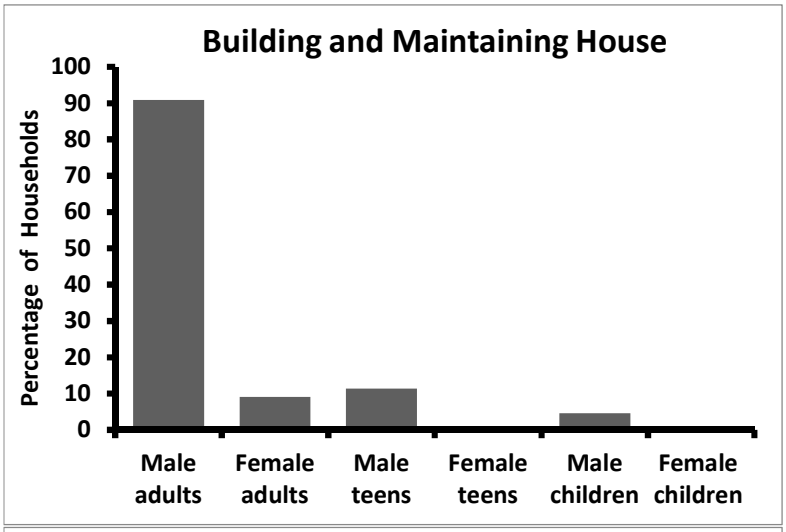
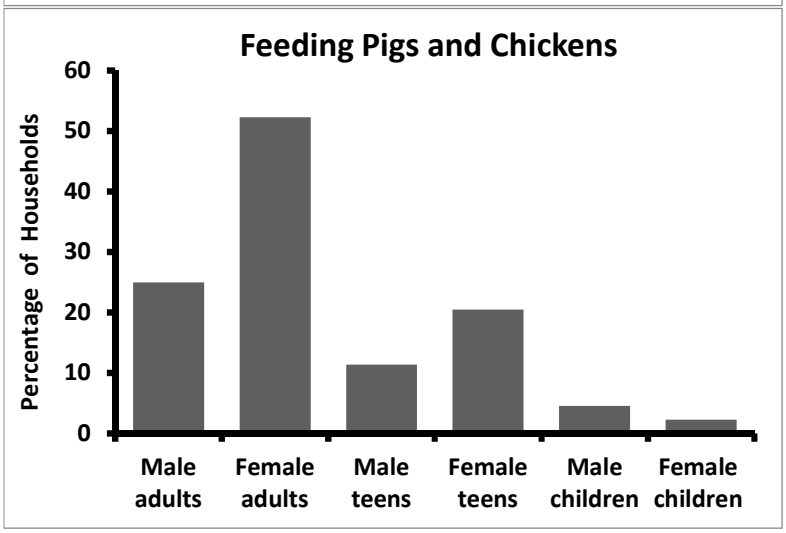
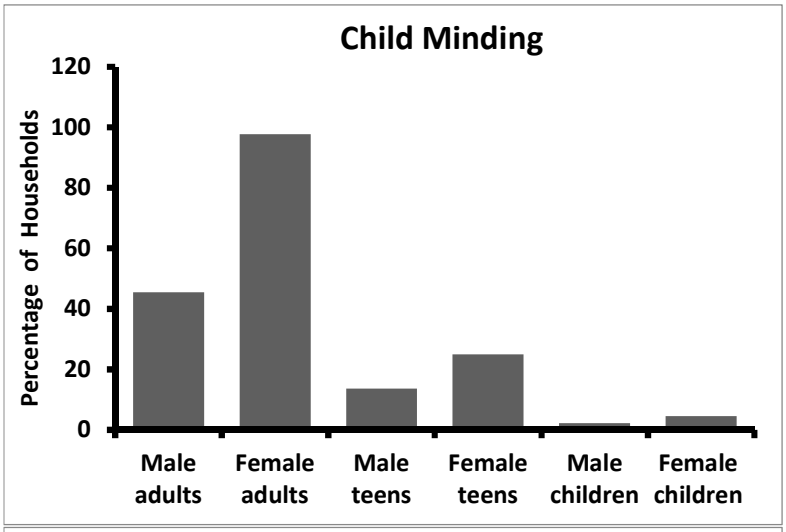
Male adults
Female adults
Male teens
Female teens
Male children
Female children


Cleaning the House
Percentage of Households
100
90
80
70
60
50
40
30
20
10
0
Male adults
Female adults
Male teens
Female teens
Male children
Female children


Building and Maintaining House
Percentage of Households
100
90
80
70
60
50
40
30
20
10
0
Male adults
Female adults
Male teens
Female teens
Male children
Female children


Feeding Pigs and Chickens
Percentage of Households
60
50
40
30
20
10
0
Male adults
Female adults
Male teens
Female teens
Male children
Female children


Child Minding
Percentage of Households
120
100
80
60
40
20
0
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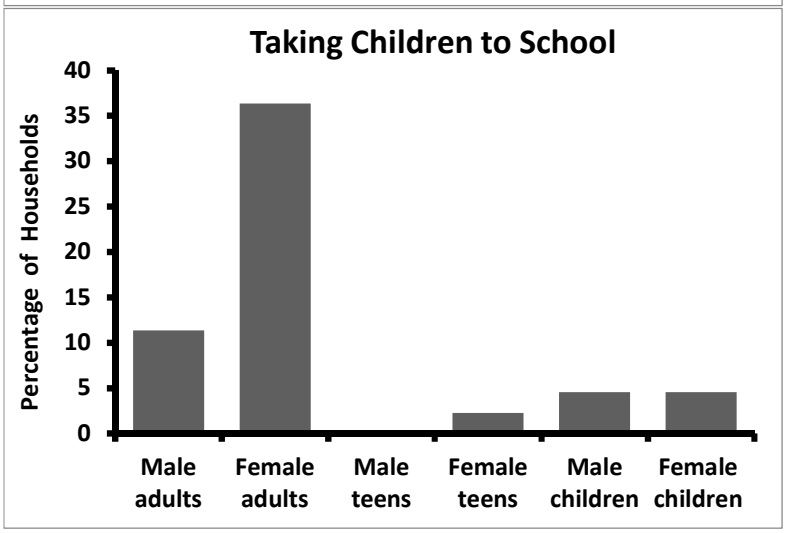
Female adults
Male teens
Female teens
Male children
Female children


Taking Children to School
Percentage of Households
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35
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25
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15
10
5
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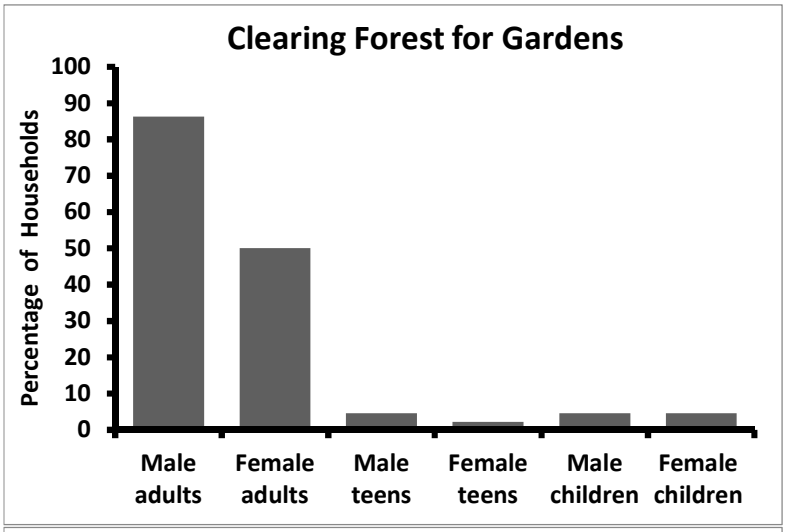
Female adults
Male teens
Female teens
Male children
Female children


Clearing Forest for Gardens
Percentage of Households
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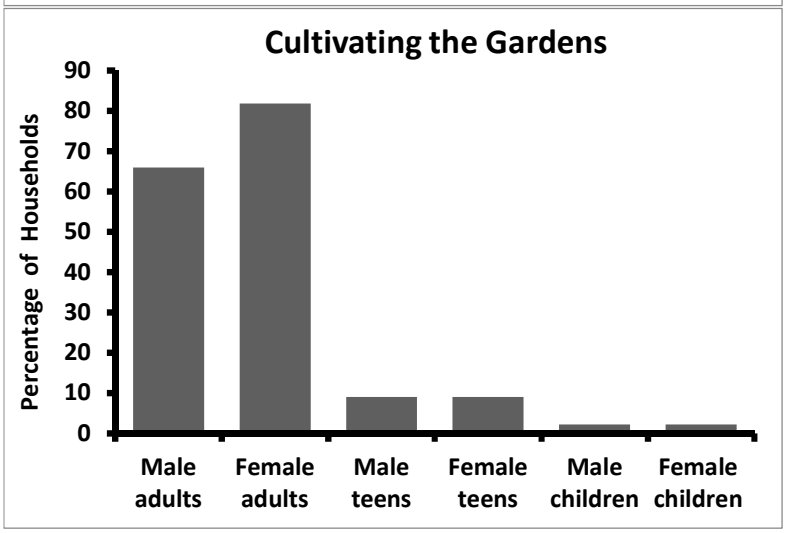
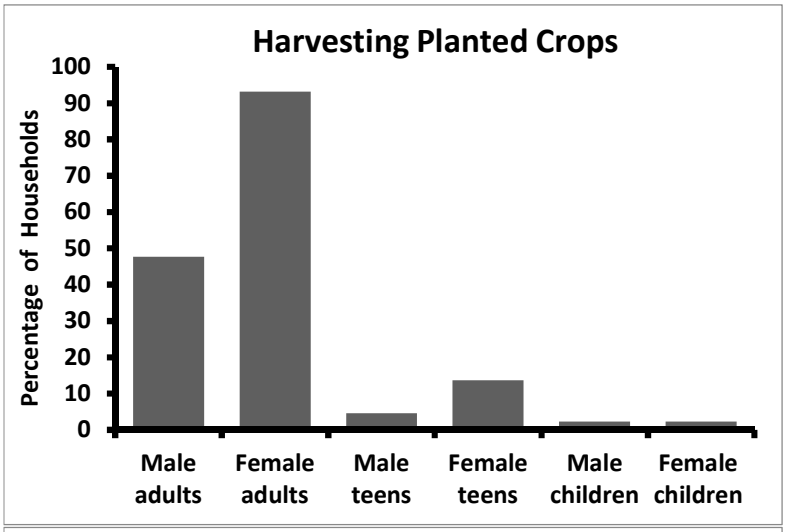
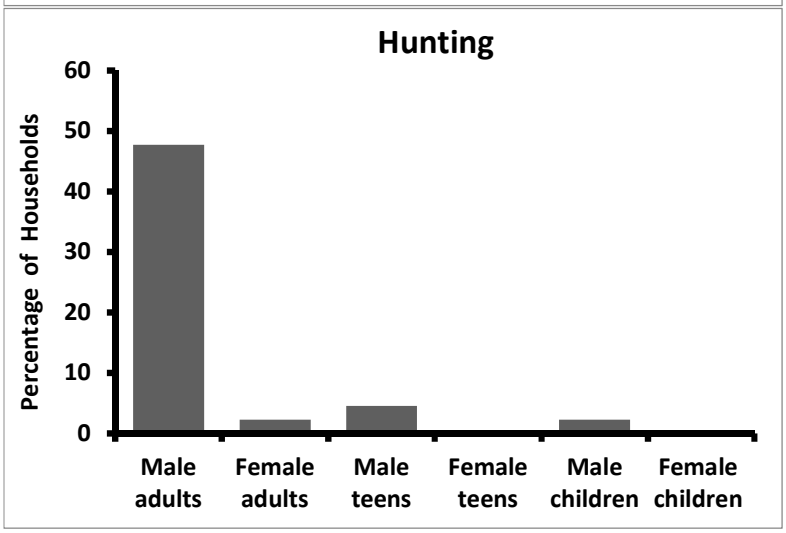
80
70
60
50
40
30
20
10
0
Male adults
Female adults
Male teens
Female teens
Male children
Female children


Cultivating the Gardens
Percentage of Households
90
80
70
60
50
40
30
20
10
0
Male adults
Female adults
Male teens
Female teens
Male children
Female children


Harvesting Planted Crops
Percentage of Households
100
90
80
70
60
50
40
30
20
10
0
Male adults
Female adults
Male teens
Female teens
Male children
Female children


Hunting
Percentage of Households
60
50
40
30
20
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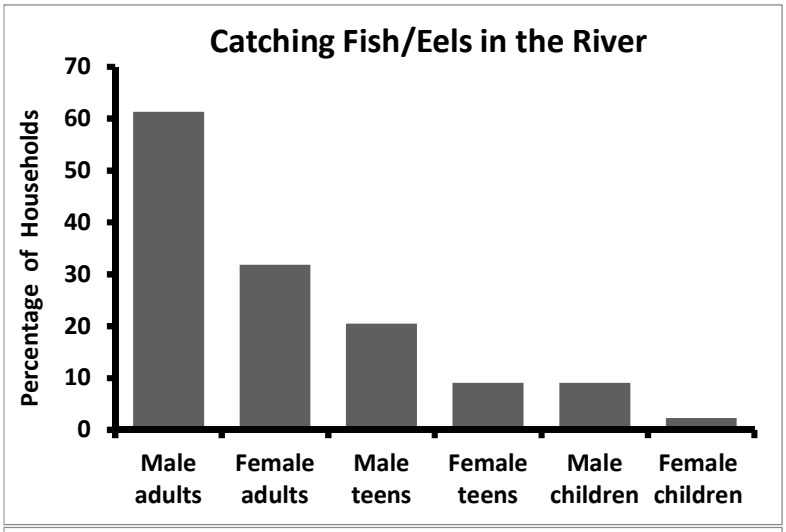
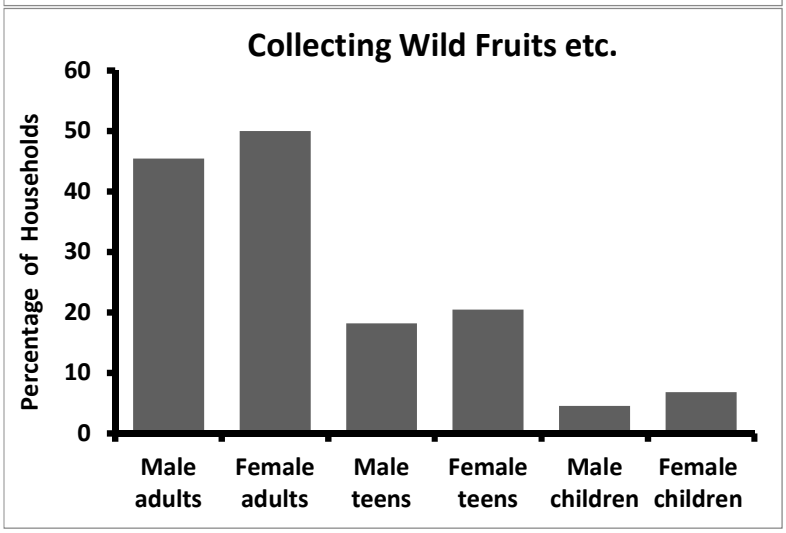
Male adults
Female adults
Male teens
Female teens
Male children
Female children


Catching Fish/Eels in the River
Percentage of Households
70
60
50
40
30
20
10
0
Male adults
Female adults
Male teens
Female teens
Male children
Female children


Collecting Wild Fruits etc.
Percentage of Households
60
50
40
30
20
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0
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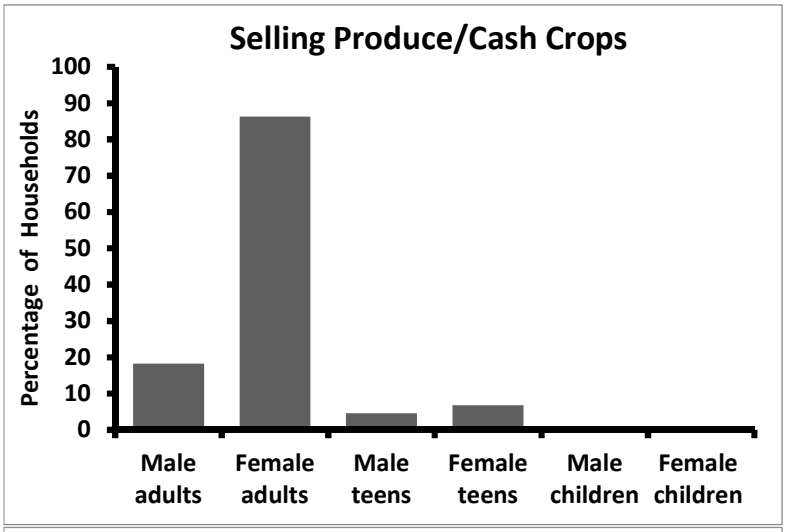
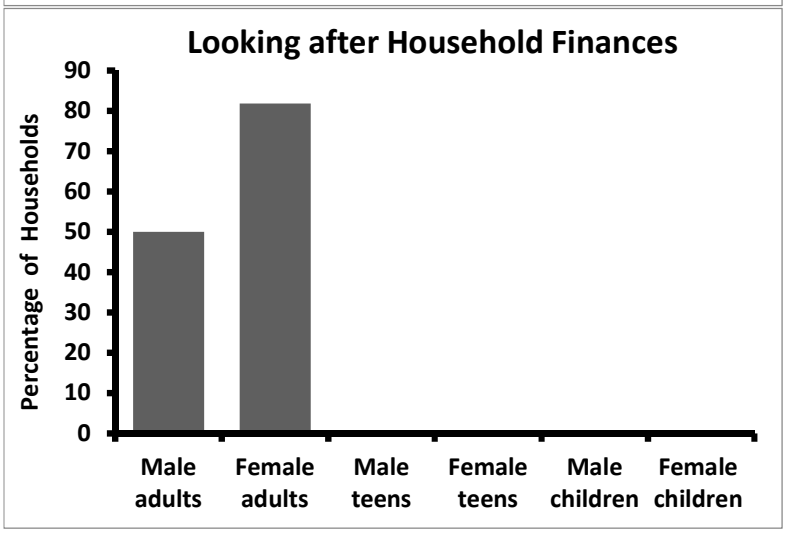
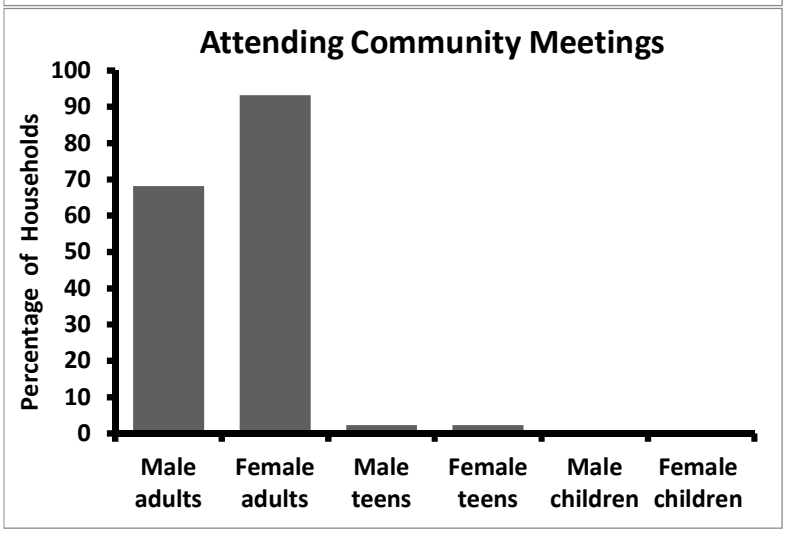
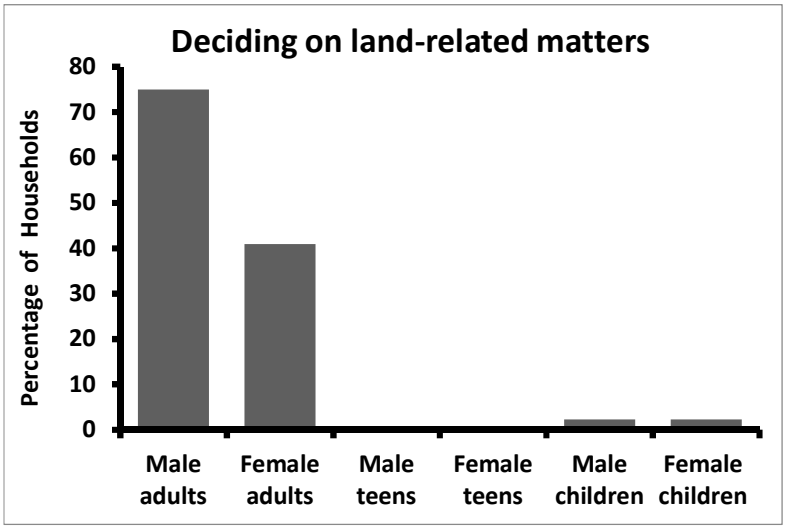
Female adults
Male teens
Female teens
Male children
Female children


Selling Produce/Cash Crops
Percentage of Households
100
90
80
70
60
50
40
30
20
10
0
Male adults
Female adults
Male teens
Female teens
Male children
Female children


Looking after Household Finances
Percentage of Households
90
80
70
60
50
40
30
20
10
0
Male adults
Female adults
Male teens
Female teens
Male children
Female children

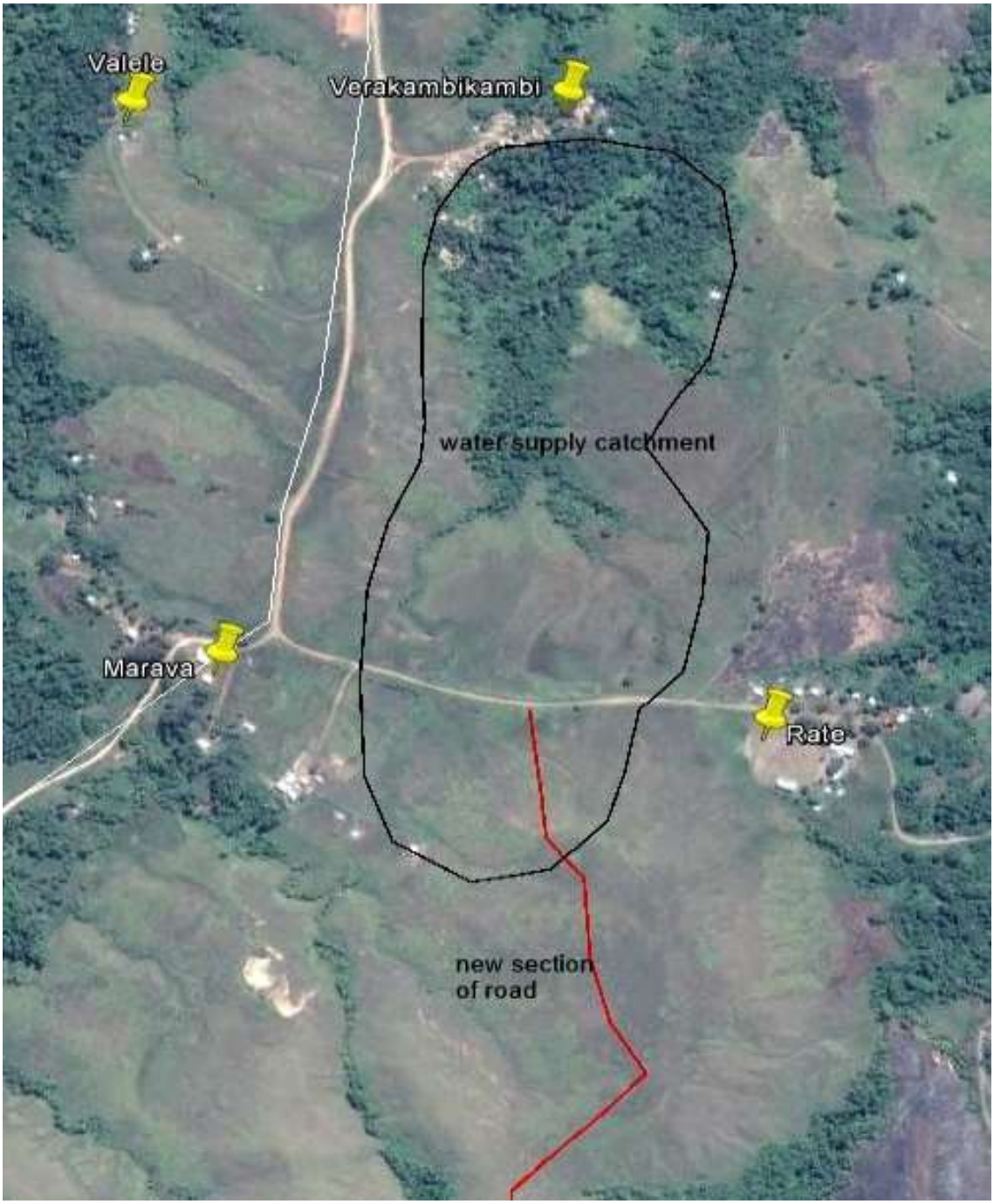

Buying Food/Supplies
Percentage of Households
90
80
70
60
50
40
30
20
10
0
Male adults
Female adults
Male teens
Female teens
Male children
Female children


Attending Community Meetings
Percentage of Households
100
90
80
70
60
50
40
30
20
10
0
Male adults
Female adults
Male teens
Female teens
Male children
Female children


Deciding on land-related matters
Percentage of Households
80
70
60
50
40
30
20
10
0
Male adults
Female adults
Male teens
Female teens
Male children
Female children

Annex 17 : Water supplies

Figure 2 The locations of the water supply for Verakabikabi and the proposed road at Rate



Annex 18 : Protocol and Guidelines for Cultural Heritage Management for the TRHDP and code of conduct for workers

These Protocol and Guidelines Prepared by Lawrence Foana'ota, Solomon Islands National Cultural Heritage Expert.

PROTECTION OF TAMBU SITES PRIOR TO CONSTRUCTION

The following is provided by way of guidance in the preparation of a cultural heritage policy and procedure by the future TRHDP developer and contractor/s.

i. First, talk with the members of the Landowners Core Group (LCG – the representatives of the landowners of the "core" project area) concerning the need to identify someone among them who has the knowledge of any tambu site(s) and their location(s) in the Project Impacted area(s).
ii. An expert with experience in recording the information associated with the tambu sites should be deployed from within or outside of the LCG to assist the knowledgeable person(s) they have identified and selected.
iii. Such knowledgeable and experience persons must be approved by the representatives from the LCG prior to involving them in this task.
iv. After the known tambu sites within the Project Impacted areas have been identified and the data collected and recorded, it must be stated clearly whether they will be completely or partly destroyed or only disturbed during the construction work on the Project.
v. It is of paramount importance that any tambu sites that are certain to be completely or partly destroyed should be prioritized for documentation while those that may be only disturbed could be clearly marked by using red and white painted posts erected around them to show that they are tambu sites and to be avoided.
vi. Any tambu sites located within the construction areas that the LCG really feels should not be destroyed should be demarcated with fence, and worked around where possible. This will help avoid any disagreements or demands for huge compensation payments which might delay the construction programme.
vii. Any decisions or agreements to move, relocate, or destroy any sacred objects from tambu sites must come either from the LCG or the heritage protection expert. This should be done before the construction work on the Project starts.
viii. For unknown tambu sites, it is important that, prior to construction, a clear understanding and written agreements (in the form of an accidental discovery protocol) between the LCG and the contractor should be made. This should specify how a contractor will act if a site is discovered , e.g., work will stop, the nominated LCG representative contacted (if not already on site supervising the work), the site owner identified, a scientific examination and/or cultural rituals performed, and any additional actions carried out to protect the rest of the site if required.
ix. The current compensation rates for disturbance or damage to tambu sites depend on the scale of destruction, and the distances between the sites and where the construction work is being carried out.
x. The following table provides some examples as a guide highlighting the different rates being paid by either loggers, miners or any development projects for the destruction of tambu sites:

Destruction or Disturbance of Tambu Sites	Compensation rates (Solomon Dollars)
Major Scale	$50,000
Minor Scale	$20,000
Disturbances: 50 meters from Sites 100 meters from Sites	 $10,000 $15,000
Graves in Cemetery (per grave)	$10,000

Note that disturbances are caused when trees fall into nearby tambu sites, and machines or employees pass through these sites during construction work even though they might not cause any physical damage to them.

CODE OF CONDUCT FOR LOCAL AND NON-LOCAL PROJECT WORKERS

The project developer and construction contractors will be expected, in advance of any construction work commencing on the project, to prepare and promulgate a code of conduct for its workers (and related visitors), including locals, other Solomon Islanders, and immigrants/expats. Induction training should include a cultural induction, delivered with the help of local knowledgeable elders.

WORKERS CODE OF CONDUCT FOR LOCAL AND NON-LOCAL PROJECT WORKERS

The project developer and construction contractors will be expected, in advance of any construction work commencing on the project, to promulgate this code of conduct for its workers (and related visitors), including locals, other Solomon Islanders, and immigrants/expats. Induction training shall include a cultural induction, delivered with the help of local knowledgeable elders.

The following is the code of conduct :

- Prior to entering a village or hamlet for the first time, the Chief, a leader from a church, or the head of a family (usually the father) shall be met for the construction contractor to show his respect.
- All workers must always consult the Chiefs, and community leaders (such as a church pastor or an elder) about any issues that may not be clear in the local culture.
- If no male members of the community are present, the outsider/visitor must not enter and talk to women, especially young girls and married women. This will help avoid any unnecessary arguments arising between a man and his wife or parents with their daughters.
- When talking or shaking hands with someone (whether a man or woman) do not look straight at them in the eyes or press their hands strongly because to some it is disrespectful, shameful or could mean something different, especially to a woman.
- Custom requires that women visitors who enter a village publically are suitably attired, that is, in clothing traditionally associated with women. Male-style work clothing (overalls, trousers, boots, and shorts) on women is not acceptable to many. This does not apply to female construction workers where safety is prevailing.
- Do not criticize someone openly but always call the person aside and talk to him or her separately to avoid any ill feelings. Such incidents may even escalate to a stage where other relatives may become involved.
- Saturdays and Sundays are days when some people in the communities go to Church and so there will be no work. Death and funerals are also times when work and other activities stop in the community. Always seek advice and clearance from the Chiefs or community leaders in such cases whether work should continue on or temporarily stop.

- No alcohol or any form of drugs shall be consumed in the communities by any project employees. The contractor/developer should have and enforce an alcohol and drug-free policy (in the work place, while driving vehicles, or use of the access roads). The company policy should develop a position on the use of betel nut in the workplace.
- All employees should respect the local custom or culture of the people. For example one must always ask before taking any produce growing in the area, such as bananas, kumara, cassava/root crops, nuts, fruits from trees, and coconuts etc. There is always someone in the community who owns them. Picking something without asking first is regarded as disrespect for the owner, or stealing, and may require payment of compensation to the owner.
- Workers and visitors should not make any disrespectful gestures or use any swearing words to anyone either in the community, or along the access road, especially to women or co-workers in the company workforce. These may lead to demand for compensation fees from communities.
- No unlicensed person shall drive work vehicles. Drivers shall be tested prior to starting work on the project, and have a valid license.
- Construction Company vehicles or trucks shall not be permitted to pick up anyone who is not an employee of the Project, except in case of an emergency.
- Heavy machinery shall only be operated by those who have the license and proven skills to use those types of machines. This shall be embedded in the recruitment and other policies of the contractor/s. This will help avoid health and safety problems and the unnecessary destruction of property, resources, and tambu sites.
- Workers and visitors shall drive slowly when passing villages that are very close to the access roadside or a pedestrian walking along the side of the road.
- Drivers and passengers shall watch out for domesticated animals or people crossing the access road.
- Take Prior Consultation, Careful Listening, and Paying Respect (PC-CL-PR) seriously because they are the key to avoiding conflict. Such incidents can easily escalate into company-community conflicts..

IMPLICATIONS OF THE PROJECT FOR THE MORO FOLLOWERS IN THE HAMLETS IN THE IMPACT AREA

The Moro (or Gaena'alu) Movement's has two main ongoing objectives:

- the establishment of a socio-political organization (initially headed by Moro) based on their traditional belief, and;
- the launching of a number of co-operative economic enterprises aimed at elevating the standard of living of the movement's followers.

The followers of the Moro/Gaena'alu Movement in the hamlets located in the project area regard the TRHDP as fulfilling these objectives. Today, even though they still keep some of their traditional way of life, they also depend on outside material goods such as money, clothes, cooking utensils, medicines, and some imported foods. They are also members of one of the Christian churches. They only wear the traditional attire when visitors call in their hamlets.

The general view the Movement's followers, including those in these hamlets in the Project Impact Area, is that such development should proceed as long as their traditional beliefs, practices, lifestyle, tambu sites, and personal property and resources are respected, and the impacts, if any, are mitigated or compensated for.

It is important that, along with other communities in the project area, that:

- this particular cultural minority are well informed of the consequences and impacts of this kind of development in their area prior to the project proceeding;
- that the Government and the Developer must keep all of the promises they make with the people, regarding any form of assistance they decide to provide;

- that the Government and the Developer must respect local culture, and;
- respond quickly to any grievances that may arise due to the construction and operation of the project.

The project needs to take into consideration the wish of those followers who are present in the Impact Area for having alternative income generating activities that will mitigate or compensate some of the losses they may have because of the project. One example would be to assist them with ecotourism or home-stay type operations (such as at Senge). When they see there is something good coming out of such development that will benefit them, they would certainly be happy because this will be in line with their Movement's objectives.

The late Moro, who founded this movement, regarded development as a means through which the people can improve and raise their living standard but only in accordance to their culture and beliefs. Any development that goes against these they will not accept. The Moro people in the project area strongly believe, from their founders' teaching, that if people can get the material goods they need, they can bring together the two customs (the Western and the island Melanesian) in a new unity of prosperity and progress.

The implication for the Project of the followers of the Moro/Gaena'alu Movement residing in the Impact Area would be that the project could offer a path to an improved standard of living, including better schools, health facilities and material wealth. The Project Office/developer should continue to brie f local Moro followers and consult on the kinds of benefit they would derive from the TRHDP when it is completed and operating. This will require a targeted awareness raising and ongoing consultation by the developer.

Annex 19 : Impact significance method for environmental components

Impacts significance is studied using a standardized method based on the integration of 6 criteria:
1. identification of impact sources
2. determination of affected components' value
3. Impact duration
4. Impact extent
5. Impact intensity
6. Impact occurrence probability

Criteria #1 Impact sources

An impact identification matrix presents activities (in lines) as well as components (in columns) and identifies all sources of impacts.

Criteria #2 Environmental and Social Components value

Each component of the natural environment will be analysed according to their value in the study area. Value assessment will be based on Experts' knowledge on the component, field surveys, public consultation, etc.

Value analysis does not take into account foreseen impacts, it is purely based on the component intrinsic value.

Three threshold levels are defined : Low, Moderately and Highly valued components.

Criteria #3 Impact duration

Each impact is identified according to its duration. Temporary and permanent impacts can be distinguished based on their reversibility: temporary are reversible and permanent are irreversible (or will last all through the Project lifespan).

Criteria #4 Impact extent

Each impact is defined by its geographical extent. Three levels are established: point source impact (punctual), local impact and regional impact.

Point source impacts affect a component on a very small scale of the study area, i.e. a small proportion of the study area species population.

Local impacts affect a component on the entire or the majority of the detailed study area in opposition to regional impacts that affect a component on a larger scale such as the entire extended study area or outside its boundaries.

Criteria #5 Impact intensity

Impact intensity refers to level of disruption on the component. Disruption of natural component refers to death of species, displacement, fragmentation and loss of habitats.

Three threshold levels of intensities are defined: Minor, Moderate and Major.

Impact significance determination

Impact significance is based on the four previous criteria. The following table presents the impact significance determination.

Positive impact are assessed using the same four criteria.

Intensity	Extent	Duration	Environmental and Social Component value		
			Low	Moderate	High

Major	Regional	Permanent			
		Temporary			
	Local	Permanent			
		Temporary			
	Punctual	Permanent			
		Temporary			
Moderate	Regional	Permanent			
		Temporary			
	Local	Permanent			
		Temporary			
	Punctual	Permanent			
		Temporary			
Minor	Regional	Permanent			
		Temporary			
	Local	Permanent			
		Temporary			
	Punctual	Permanent			
		Temporary			

Impact significance
Major
Moderate
Minor
Negligible

Major impacts represent high level of perturbation of the component, these impacts are seldom mitigable and most of the times require compensation or offsets, followed by measurable monitoring measures.

Moderate impacts represent noticeable perturbation of the component, however these impacts can be mitigated and need to be monitored.

Minor impacts most of the time only require mitigation measures without the need for monitoring.

Negligible impacts do not require any particular measures.

Criteria #6: Impact occurrence probability

Assessment of the probability that an impact will take place will be based on the expert's experience on similar assignments.

Three thresholds will be used.

High probability	Analysis of the baseline coupled with Project characteristics concludes that the impact will take place
Potential occurrence	Based on previous experiences, it is possible that the impact will occur.
Risk (low probability)	Analysis of baseline coupled with Project characteristics only reveals a risk of impact occurrence.

Residual impact

After the implementation of measures, residual impact is assessed and impact significance reevaluate.

Annex 20 : Land Acquisition Process

SOLOMON ISLANDS GOVERNMENT
Ministry of Mines and Energy and Rural Electrification
Tina River Hydropower Development Project (TRHDP)

MEMO: Summary of the Land Acquisition Process and FPIC

The land needed for the Tina River Hydropower Development Project was compulsorily acquired by the Commissioner of Lands under Division 2, Part V, of the *Land and Titles Act*. The land acquired is referred to as the Core Land. It includes all of the land needed for the construction and operation of the project including the access road.

Although the process used was a 'compulsory' process under the legislation, the acquisition was contingent on first obtaining the consent of all identified landowning tribes. This consent was obtained through the negotiation of a written 'process agreement'.

The steps involved in the acquisition process are discussed in more detail below.

Bahomea Land Identification Committee

Before starting negotiations for the process agreement, the Project Office needed to identify the customary landowners of the land. Land is owned by tribes and as such negotiations for land cannot be done on a community/village level in the same way as general project awareness. Villages and communities are made up of a mixture of tribes.

Landowner identification was principally carried out by the Bahomea Land Identification Committee (**BLIC**). This Committee was made up of traditional knowledge holders (known as story tellers), chiefs and elders from different tribes and communities within the Bahomea and Malango regions of Central Guadalcanal. BLIC members are highly regarded in their own communities and tribes, and are considered to possess historical and traditional knowledge about land ownership, tribal groupings, and evidence of ownership (including tabu sites, boundaries, devils, migration routes and genealogies).

The Committee used traditional Central Guadalcanal methods to determine land ownership. This process took more than 12 months and involved more than 50 meetings between different elders, chiefs and tribal representatives. The Permanent Secretary of the Ministry of Lands, Housing and Survey and the Permanent Secretary of the Ministry of Mines, Energy and Rural Electrification formally endorsed the BLIC process and findings.

The Project Office discussed BLIC's findings through a series of discussions with representatives from different tribes. Representatives from several tribes came to the Project Office to discuss written and verbal landownership claims. Claims included customary evidence, Court decisions, surveyed boundaries, and the support of neighbouring tribes.

This process resulted in the identification of a number of tribes as holding primary interests within the area of land known as the Core Land.

Process Agreement

The Project Office negotiated the process agreement from 14 May 2014 to 11 July 2014.

A series of meetings were held between project office and representatives of each tribe identified as owning land within the Core Land. Representatives constituted between 6 to 10 individuals. Tribes were asked to bring male and female representatives.

The project engaged a lawyer for the Landowner's Advocacy and Legal Support Unit (**LALSU**) to represent the tribes during the negotiations.

Six to seven rounds of negotiations were held with each tribe. After each round, further amendments were made to the text of the process agreement ahead of the next round. Some negotiations took place with each tribe separately, and others with representatives of all tribes together.

When the final text was agreed by representatives of all tribes, Project Office staff held community awareness meetings inviting all members of each tribe. At the meetings the Project Office presented on the key clauses of the process agreement, explained the acquisition, and showed and provided maps of the Core Land to be acquired. Tribal members were given an opportunity to comment and to ask questions. No tribal members spoken to at these meetings objected to the project or to the acquisition of the land.

Four tribes signed the Process Agreement. These tribes were Buhu Garo, Vuralingi, Roha and Kochiabolo. The Process Agreement provided for later inclusion of any additional tribe identified through the statutory land acquisition process. Each of the four tribes chose seven representatives, including 2 women, to sign the final agreement. The final signing ceremony took place at a public function with Prime Minister Gordon Darcy Lilo.

Statutory Land Acquisition Process

The process agreement provided the written consent of the identified Core Land Tribes to proceed with a statutory acquisition process. The statutory land acquisition process included the following key steps:

- The Core Land was acquired by publication of a notice, from the Minister of Lands and Housing, in the Government Gazette. The notice acquiring the Core Land was published on 21 August 2014.
- The Project Office took the following steps to bring awareness of the acquisition process and rights to claim compensation to potential Core Land interest holders:
    - Publishing a full page notice, map and FAQs in the Island Sun and the Solomon Star (the two largest of Solomon Islands' newspapers);
    - Posting A3 notices and maps at the boundary to the Core Land and in key locations in villages in Bahomea and Malango;
    - Posting A3 notices and maps at Guadalcanal Provincial headquarters;

- Training community educators to speak in villages in and around the area about the acquisition process and providing educators with A3 laminated graphic information sheets;
- Delivering letters to representatives of each of the 27 tribes registered in Bahomea and Malango setting out the acquisition and compensation claim process (statutory requirement).

- Tribes claiming an interest in the land were given 3 months to submit written claims for compensation for the value of their interest in the land. The statutory process provides that claimants may seek assistance from the Provincial Secretary for Guadalcanal Province. The Project Office provided the following assistance for compensation claimants:
  - Legal assistance for the identfied Core Land Tribes through LALSU;
  - Legal assistance for all other claimants through the Project Office funding an independent private lawyer, chosen and engaged by the Provincial Secretary for Guadalcanal Province; and
  - Funds for an independent valuer, engaged by the Core Land Tribes, to value the compensation payable for primary ownership interests in the Core Land.
- The Commissioner of Lands received nine claims from eight tribes. Four of these claims were prepared by the tribes who were signatories to the Process Agreement, of which three sought assistance from LALSU. Five claims were prepared by four tribes who were not identified through the BLIC process. These tribes received assistance from an independent private lawyer engaged through the Provincial Secretary for Guadalacanal.
- In accordance with the statutory process, the Commissioner of Lands assessed each claim and determined:
  (a) the customary owners of interests in the acquired land; and
  (b) the value of each interest.
- The Commissioner of Lands assessment provided an offer of compensation to five tribes. These tribes were the four process agreement signatory tribes, as well as one additional claimant, Uluna Sutahuri.
- In accordance with the statutory process, Claimants were provided with notice of their offer of acceptance or rejection. Notices set out the Claimants rights to accept or reject the determination, and of the three month High Court appeal period.
- No tribes elected to appeal the Commissioner of Lands' determination.
- Process complete 1 January 2016.

Uluna Sutahuri

Extensive consultations were held with the Uluna Sutahuri tribe following their statutory endorsement and offer of compensation under the statutory process. Uluna Sutahuri were also customary owners of a rain guage monitoring site and were extensively involved in the Project for many years. Uluna Sutahuri representatives signed the Process Agreement in December 2015.

APPENDICES

This report includes all Appendices to the ESIA Main Report. It contains valuable information such as analysis of mitigation measures, analysis of protected area opportunities, and a review of the adoption of community feedback, etc. Appendix sequence in this report is classified in a chronological order and reflect the time at which information was gathered or obtained.

APPENDICES

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Appendix A

Terrestrial Ecosystem Sampling Stations

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Appendix A
Terrestrial Ecosystem Sampling Stations

A.1 General Description of Habitats Along Sampling Stations

Coordinates of each terrestrial ecology sampling station are described herein, and coincide with the map below - Location of Aquatic, Fauna and Flora sampling Stations. Station numbers are related to their spatial distribution. Station #1 is the most upstream station and station #24 is the farthest from the TRHDP.

A.1.1 Upper Stream Sampling Area

Upper Stream areas were primarily covered by undisturbed forests; most terrain was quite steep.

Fauna & Flora #1: Primary lowland forest - Riparian vegetation; site is located adjacent to a cliff area and is surrounded by undisturbed forest and the river.

Fauna & Flora #2: Primary lowland forest - Riparian vegetation; site is located at a confluence of Vohara and Mbeambea rivers; surrounding areas were forested however there is evidence of past village settlement.

Fauna & Flora 3: Primary lowland forest - Riparian vegetation; site is located close to Njarimbisu River.

Conditions during the sampling of these stations were wet to cloudy and were deemed not optimal for observing fauna as the conditions would limit the movement of species.

A.1.2 Middle Tina River Sampling Area

Fauna & Flora #4: Lowland forest - Riparian vegetation; site is located in forest with slight disturbance and evidence of timber extraction.

Fauna & Flora #5: Lowland forest - Secondary regrowth; site is located on a steep slope and covered by forest, with evidence of disturbance through timber harvesting and past garden use.

Fauna & Flora #6: Lowland forest overlapping secondary vegetation; site is located adjacent to a village area and is surrounded by gardens and remnant forest.

Fauna & Flora #7: Lowland forest - Secondary regrowth and riparian vegetation; site is located on a flat area that is forested. However, there is evidence of disturbance through timber harvesting.

Fauna & Flora #8: Lowland forest and riparian vegetation; site is located in a very steep area that is forested, with evidence of past timber harvesting.

Fauna & Flora #9: Secondary lowland forest; is located in forested areas, with disturbance due to current timber harvesting.

Fauna & Flora #10: Cliff areas are mainly covered in distinct cliff vegetation that lacked larger canopy trees but covered with smaller plants such as ferns and shrubs. The site is located on a very steep slope adjacent to the water.

Fauna & Flora #11: Old Garden Area - Secondary forest; site is located on a slight slope and covered with gardens and fallow brush land from past garden use.

Fauna & Flora #12: Lowland forest on ridge top; site is located on a ridge adjacent to a steep slope to the Tina River. It is surrounded by relatively undisturbed forest with the presence of large canopy trees.

Fauna & Flora #13: Riparian Vegetation; site is located on a steep slope that is forested. However, there is evidence of disturbances through past timber harvesting.

Fauna & Flora #14: Cliff areas are mainly covered in distinct cliff vegetation that lacks larger canopy trees. It is covered with smaller plants such as ferns and shrubs. The site is located on a very steep slope adjacent to the water.

Fauna & Flora #15: Lowland forest on ridge top; site is located in Sengue old Tina meander.

Fauna & Flora #16: Lowland forest - Secondary Vegetation; site is located in disturbed forest, with evidence of past and current timber harvesting.

Fauna & Flora #17: Lowland forest; site is located on a small hill covered by forest with evidences of timber harvesting and some relatively undisturbed areas.

Fauna & Flora #18: Lowland forest - secondary and riparian vegetation; site is located on a flat areas that is surrounded by gardens with crops of betelnut, banana and coconut. Fallow brush land is also evident.

Fauna & Flora #19: Lowland rainforest on ridgetop; site is located on a hill slope surrounded by forest with evidence of disturbance such as past timber harvesting.

Conditions during sampling were clear to cloudy and were deemed optimal for observing fauna.

A.1.3 Transmission Line Sampling Area

Fauna & Flora #20: Secondary vegetation on open ridgetop overlapping grasslands; Site is located in remnant forest.

Fauna & Flora #21: Lowland forest - open vegetation - secondary regrowths; site is located between grassland, gardens and remnant forest dominated by Canarium nut trees. Site is located along the future transmission line.

Fauna & Flora #22: Open grassland - Secondary vegetation; site is located on roadside. Site located along the future transmission line.

Fauna & Flora #23: Secondary vegetation on grassland; site is located between oil palm plantations and grassland inter-mixed with gardens. Site is located along the future transmission line.

Fauna & Flora #24: Secondary vegetation on grassland; Site is located between oil palm plantation and fallow bush dominated by paper mulberry trees. Site is located along the future transmission line.

Conditions during sampling were clear to cloudy and were deemed optimal for observing fauna.

A.1.4 Previous Stations: Site A, B, C

Fauna and Flora was also characterized in the ESIA Scoping Study prepared by Entura (2013) during a rapid flora assessment. Results were obtained for the current ESIA. The following station description comes from the ESIA Scoping.

Site A: The vegetation cover in this site is comprised of lowland primary forest trees, riparian species and elements of steep ridge forests decorated by different species of palms, grass and shrubs. The overall forest canopy cover is about 80%.

Site B: This site appears to be disturbed by human activities such as gardening and is located next to Koropa village. As such, the vegetation cover is mainly lowland secondary forest with some big, old trees, colonized with ferns and palms. The overall forest canopy cover is about 60%.

Site C: Contains a thin riparian forest belt about ten metres wide next to a very steep ridge with recent land slide on the lower part of Senge village. The site appears to be a flood plain and is occupied by secondary regrowth of small to medium size trees. The overall canopy cover is about 50%.

The ESIA Scoping report provides a list of plant species identified at these three sites. These plants were added to the ESIA flora survey list (see table next section). However, it did not specify in which plants were observed by sample site, in the flora table next section they are all gather under “ES stations” (ESIA Scoping Stations).

A.1.5 Coordinates

The following table lists all stations coordinates. Since these stations are terrestrial, river chainage is not shown

Table 1 Station Coordinates

Full name	Short name	Coordinate*	Full name	Short name	Coordinate*
Fauna & Flora 24	F&F24	S09,44763 E160,10069	Fauna & Flora 10	F&F10	S09,55326 E160,07375
Fauna & Flora 23	F&F23	S09,46438 E160,10502	Fauna & Flora 9	F&F9	S09,55332 E160,08220
Fauna & Flora 22	F&F22	S09,48518 E160,11072	Fauna & Flora 8	F&F8	S09,55342 E160,07919
Fauna & Flora 21	F&F21	S09,52470 E160,09351	Fauna & Flora 7	F&F7	S09,55546 E160,07742
Fauna & Flora 20	F&F20	S09,53821 E160,08854	Fauna & Flora 6	F&F6	S09,55573 E160,07180
Fauna & Flora 19	F&F19	S09,54159 E160,08024	Fauna & Flora 5	F&F5	S09,55717 E160,06947
Fauna & Flora 18	F&F18	S09,54177 E160,08936	Fauna & Flora 4	F&F4	S09,55823 E160,06667
Fauna & Flora 17	F&F17	S09,54286 E160,08677	Fauna & Flora 3	F&F3	S09,59459 E160,03574
Fauna & Flora 16	F&F16	S09,54466 E160,08835	Fauna & Flora 2	F&F2	S09,59487 E160,03055
Fauna & Flora 15	F&F15	S09,54511 E160,08156	Fauna & Flora 1	F&F1	S09,59513 E160,03469
Fauna & Flora 14	F&F14	S09,54994 E160,08048	Station Site C	Station Site C	S9,32.812 E160,05.060
Fauna & Flora 13	F&F13	S09,55086 E160,08124	Station Site B	Station Site B	S9,33.557 E160,03.805
Fauna & Flora 12	F&F12	S09,55143 E160,07822	Station Site A	Station Site A	S9,35.487 E160,01.802
Fauna & Flora 11	F&F11	S09,55270 E160,08060			

Appendix B

List of Amphibian Species Occurring in TRHDP Study Area

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Appendix B

List of Amphibian Species Occurring in TRHDP Study Area

Amphibians of the Study area

Species name	Common name	Observed at station	Potential Presence	Migratory	Endemic	IUCN Red List Category	CITES Appendix	1998 Act	Population Trend	Local Uses	River Dependent
***Bufonidae* TRUE TOADS**											
Bufo marinus	Cane Toad	F&F24, F&F7, F&F6, F&F5, F&F4, F&F9, F&F1	PP	-	I	LC	-	-	I	-	-
Ceratobatrachidae											
Batrachylodes vertebralis	Fauro Sticky-toed Frog	F&F6, F&F5, F&F4, F&F9, F&F11	PP	-	-	LC	-	II	S	-	-
Batrachylodes elegans	Elegant Sticky-toed Frog		SSa, SSb	-	-	LC	-	-	S	-	-
Ceratobatrachus guentheri	Solomon Islands Eyelash Frog	F&F5, F&F9	PP, GR	-	-	LC	-	II	S	-	-
Discodeles guppyi	Giant Webbed Frog		PP, SSa, SSb, GR, LK	-	-	LC	-	-	S	F	X
Discodeles malakuna	Malakuna Webbed Frog	F&F1	SSa, SSb	-	SI	DD	-	-	S	-	-
Platymantis guppyi	Solomon Islands Giant Treefrog	F&F1	SSa, SSb, GR, PP	-	-	LC	-	-	S	-	-
Platymantis solomonis	Solomon Wrinkled Ground Frog		SSa, PP	-	-	LC	-	I	S	-	-
Platymantis weberi	Weber's Wrinkled Ground Frog	F&F6, F&F9	SSa, PP	-	-	LC	-		S	-	-
***Hylidae* TREEFROGS**											
Litoria lutea	Solomon Island's Treefrog		SSa	-	-	VU	-	-	S	-	-
Litoria thesaurensis	Treasury Island Treefrog	F&F6	PP	-	-	LC	-	-	S	-	-
Litoria sp.		F&F5	SS, GR	-	-	-	-	-	S	-	-

Species name	Common name	Observed at station	Potential Presence	Migratory	Endemic	IUCN Red List Category	CITES Appendix	1998 Act	Population Trend	Local Uses	River Dependent
***Ranidae* TRUE FROGS**											
Hylarana kreffti	San Cristobal Treefrog	F&F1	GR, PP	-	-	LC	-	-	S	-	X

Potential Species: TRHDP ESIA Scoping Study = SSa=site A, SSb=site B, SSc=site C; Frogs of the SI = PP, Gold Ridge Report = GR, Local Knowledge = LK

Endemic: Guadalcanal = G, Solomon Islands = SI, Introduced = I

IUCN Red List Category: Least Concern = LC, Vulnerable = VU & Data Deficient = DD

Population Trend: Increasing =I & Stable =S (according to IUCN Red List Category)

Local Uses: Food =F (bush meat)
1998 Act = Wildlife Protection and Management Act 1998 Schedule I lists the species that are prohibited to export, Schedule II lists the regulated and controlled species for which a valid permit to export such specimen is required

Appendix C

List of Reptile Species Occurring in the TRHDP Study Area

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Appendix C

List of Reptile Species Occurring in the TRHDP Study Area

Reptiles of the Study area

Species name	Common name	Observed at station	Potential Presence	Migratory	Endemic	IUCN Red List Category	CITES Appendix	1998 Act	Population Trend	Local uses / Venomous	River Dependent
***Gekkonidae* GECKOS**											
Cyrtodactylus salomonensis	Solomons Bent-toed Gecko		MM, GR	-	SI	NT	-	II	S	-	-
Cyrtodactylus biordinis	Guadalcanal Bow-fingered Gecko		MM, LK	-	G	LC	-	-	S	-	-
Gehyra oceanica	Oceanic Gecko		MM,	-	-	LC	-		S	-	-
Gekko vittatus	Sago Gecko		MM	-	-	LC	-	II	S	-	-
Nactus multicarinatus	Solomons Slender-toed Gecko	F&F4, F&F9	MM	-	-	LC	-	-	S	-	-
***Scincidae* SKINKS**											
Corucia zebrata	Prehensile-tailed Skink		SSa, SSb MM, LK	-	SI	NT	II	II	D	F	-
Emoia cyanogaster	Greeen-Bellied Tree Skink		MM, SSa, SSb	-	-	LC	-	-	S	-	-
Emoia cyanura	Brown-tailed Copper-striped Skink	F&F21, F&F19	MM, SSa, SSb, SSc, GR	-	-	LC	-	II	S	-	-
Emoia nigra	Pacific Black Skink	F&F24, F&F19, F&F1, F&F13, F&F9	MM, SSa, SSb, SSc, GR, LK	-	-	LC	-	-	S	-	-
Emoia pseudocyanura	Solomons Blue-tailed Skink	F&F20, F&F19, F&F18, F&F17, F&F13, F&F2, F&F1	MM, SS, GR	-	SI	LC	-	-	S	-	-
Eugongylus albofasciolatus	White-banded Giant Skink		MM	-	-	LC	-	-	S	-	-
Lipinia noctua	Moth Skink		MM	-	-	LC	-	-	S	-	-
Lamprolepsis smaragdina	Emerald Tree Skink		MM, SSb, SSc	-	-	LC	-	II	S	-	-
Prasinohaema virens	Green-blooded Skink		MM, GR	-	-	LC	-	II	S	-	-

Species name	Common name	Observed at station	Potential Presence	Migratory	Endemic	IUCN Red List Category	CITES Appendix	1998 Act	Population Trend	Local uses / Venomous	River Dependent
Sphenomorphus bignelli			MM	-	SI	LC	-	-	S	-	-
Sphenomorphus concinnatus	Elegant Forest Skink		MM, GR	-	-	LC	-	II	S	-	-
Sphenomorphus solomonis			MM, GR	-	-	LC	-	II	S	-	-
Sphenomorphus cranei	Crane's Skink		MM, GR	-	-	LC	-	-	S	-	-
Tribolonotus schmidti	Schmidt's Crocodile Skink		MM, GR	-	G	LC	-	-	S	-	-
***Boidae* BOAS**											
Candoia paulsoni	Solomons Ground Boa		MM, SS, GR, LK	-	-	LC	II	-	S	-	-
***Colubridae* COLUBRID SNAKES**											
Boiga irregularis	Brown Tree Snake		SSa, GR	-	-	LC	-	-	S	V	-
Dendrelaphis salomonis	Solomons Tree Snake	F&F20	MM, GR, LK	-	-	LC	-	-	S	-	-
***Elapidae* ELAPID SNAKES**											
Salomonelaps par	Solomons Red Krait		MM, SSa, GR, LK	-	-	LC	-	-	S	V	-

Potential Species: TRHDP ESIA Scoping Study = SSa=site A, SSb=site B, SSc=site C; Reptiles of the Solomon Islands = MM, Gold Ridge Report = GR, Local Knowledge = LK

Endemic: Guadalcanal = G, Solomon Islands = SI

IUCN Red List Category: Least Concern = LC, Near Threatened = NT

CITES Appendix for international trade of species: II = may be authorized by the granting of an export permit

Population Trend: Decreasing =D & Stable =S (according to IUCN Red List Category)

Local Uses / Venomous, Food =F (bush meat), V= Venomous
1998 Act: Wildlife Protection and Management Act 1998. Schedule I lists the species that are prohibited to exports, Schedule II lists the regulated and controlled species for which a valid permit to export such specimen is required

Appendix D

List of Bird Species and Subspecies Occurring in the TRHDP Study Area and Their Status / Vulnerability

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Appendix D

List of Bird Species Occurring in the TRHDP Study Area and Their Status / Vulnerability

Birds of the Study area

Species name	Common name	Observed at station	Potential Presence	Migratory	Endemic	IUCN Red List Category	CITES Appendix	1998 Act	Population Trend	Local uses	Habitat
***Ardeidae* HERONS**. Diet: mainly fish, but also amphibian, reptile, small mammal, insect											
Nycticorax caledonicus mandibularis	Nankeen Night Heron	F&F6, F&F5, F&F4, F&F10	SSa, SSb, SSc, GD, MT	-	-	LC	-		S	-	R
Egretta s. sacra	Pacific Reef Heron	F&F22	GD	-	-	LC	-		S	-	R
***Phalacrocoracidae* CORMORANTS**. Diet: mainly fish, but also amphibian and aquatic insects											
Microcarbo m. melanoleucos	Little Pied Cormorant	F&F7, F&F6, F&F5, F&F4, F&F2	SSa, SSb, SSc GD	-	-	LC	-		S	-	R
***Anatidae* DUCKS**. Diet: detritivores											
Anas superciliosa	Pacific Black Duck		SSa, SSb, SSc, MT, GD	-	-	LC	-		S	F	R
***Accipitridae* HAWKS and EAGLES**. Diet: fish, large insects, birds, mammals, amphibians											
Haliastur indus flavirostris	Brahminy Kite	F&F5, F&F12	SSb, SSc, MT, GD, GR	-	SI	LC	II		D	-	U
Aviceda subcristata proxima	Pacific Baza		MT, GD, LK	-	SI	LC	II		S	-	U
Accipiter novaehollandia e pulchellus	Variable Goshawk	F&F2	MT, GD	-	G	LC	II		D	-	U

Species name	Common name	Observed at station	Potential Presence	Migratory	Endemic	IUCN Red List Category	CITES Appendix	1998 Act	Population Trend	Local uses	Habitat
Accipiter meyerianus	Meyer's Goshawk	F&F22	MT, GD, GR	-	-	LC	II	I	D	-	U
Haliaeetus sanfordi	Solomon Sea-Eagle	F&F20, F&F2	MT, GD	-	SI	V U	II	I	D	-	U
***Megapodiidae* MEGAPODES**. Diet: fruits, seeds, insects and other invertebrates											
Megapodius eremita	Melanesian Scrub Fowl		SSa, SSb, MT, GD, LK	-	-	LC	-		D	F	F
***Turnicidae* BUTTONQUAILS**. Diet: invertebrates											
Turnix maculosa salamonis	Red-backed Button-Quail		MT, GD	-	SI	LC	-		D	F	-
***Rallidae* RAILS**. Diet: herbivores, omnivores											
Gallirallus philippensis christophori	Buff-banded Rail	F&F22	MT, GD, LK	-	SI	LC	-		S	F	-
Nesoclopeus w. woodfordi	Woodford's Rail	F&F24, F&F22	MT, GD, LK	-	G	N T	-	I	D	F	F
Amaurornis moluccanus sp.	Pale-vented Bush-hen	F&F6	MT, GD, LK	-	SI	LC	-		S	F	F
Porphyrio p. samoensis	Purple Swamp hen	F&F22	GD, SSb, SSc, LK	-	-					F	R
***Scolopacidae* SANDPIPERS and CURLEWS**. Diet: Small fish, crustaceans, frogs											
Actitis hypoleucos	Common Sandpiper	F&F7, F&F5, F&F4	MT, GD, LK	X	-	LC	-		D	CI	R
***Columbidae* PIGEONS**. Diet: Seeds and fruits											
Ptilinopus s. superbus	Superb Fruit-Dove		MT, GD, GR	-	-	LC	-		S	F	F

Species name	Common name	Observed at station	Potential Presence	Migratory	Endemic	IUCN Red List Category	CITES Appendix	1998 Act	Population Trend	Local uses	Habitat
Ptilinopus solomonensis ocularis	Yellow-bibbed Fruit-Dove		MT, GD, GR	-	G	LC	-	I	S	F	F
Ptilinopus viridis lewisii	Claret-breasted Fruit-Dove		MT, GD, GR	-	-	LC	-		S	F	F
Ducula rubricera rufigila	Red-knobbed Imperial Pigeon	F&F21, F&F19, F&F12, F&F18, F&F17, F&F6, F&F5, F&F9, F&F16	SSa, SSb, MT, GD, GR, LK	-	SI	NT	-		D	F	F
Ducula p. pistrinaria	Island Imperial Pigeon		MT, GD	-	-	LC	-		S	F	F
Gymnophaps solomonensis	Pale Mountain Pigeon		MT, GD	-	-	LC	-		S	F	F
Macropygia mackinlayi arossi	Mackinlay's Cuckoo-Dove	F&F8, F&F2, F&F1	SSa, SSb, MT, GD	-	-	LC	-		S	F	F
Reinwardtoena crassirostris	Crested Cuckoo-Dove	F&F16	SSa, MT, GD	-	-	NT	-		D	F	F
Chalcophaps stephani mortoni	Stephan's Dove		SSb, SSc, MT, GD, GR	-	SI	LC	-		S	F	F
***Cacatuidae* COCKATOOS**. Diet: seeds and fruits											
Cacatua ducorpsi	Ducorp's Cockatoo	F&F20, F&F19, F&F2, F&F1	SSa, SSb, SSc, MT, CD, GR	-	-	-	II	II	S	-	U
***Psittacidae* PARROTS**. Diet: seeds, nuts, fruits											

Species name	Common name	Observed at station	Potential Presence	Migratory	Endemic	IUCN Red List Category	CITES Appendix	1998 Act	Population Trend	Local uses	Habitat
Chalcopsitta cardinalis	Cardinal Lory		SSa, SSb, SSc, MT, GD, GR, LK	-	SI	LC	II	II	S	-	U
Trichoglossus haematodus massena	Coconut Lorikeet	F&F21, F&F16, F&F2, F&F1	SSa, SSb, SSc, MT, GD, LK	-	-	LC	II	II	D	-	U
Lorius chlorocercus	Yellow-bibbed Lory	F&F18, F&F17, F&F7, F&F5, F&F9, F&F1	SSa, SSb, MT, GD, GR, LK	-	SI	LC	II	II	S	-	F
Charmosyna margarethae	Duchess Lorikeet		MT, GD, GR	-	-	NT	II	I	D	-	F
Micropsitta finschii aolae	Finsch's Pigmy Parrot	F&F16	MT, GD, GR, LK	-	SI	LC	II	I	S	-	F
Eclectus roratus solomonensis	Eclectus Parrot	F&F1	SSa, SSb, MT, GD, GR, LK	-	-	LC	II	II	D	-	U
Geoffroyus h. heteroclitus	Song Parrot		MT, GD, GR	-	-	LC	II	I	S	-	U
***Cuculidae* CUCKOOS**. Diet: insect											
Cacomantis variolosus addendus	Brush Cuckoo		MT, GD, GR	-	-	LC	-		S	-	U

Species name	Common name	Observed at station	Potential Presence	Migratory	Endemic	IUCN Red List Category	CITES Appendix	1998 Act	Population Trend	Local uses	Habitat
Centropus m. milo	Buff-headed Coucal	F&F22, F&F21, F&F20, F&F19, F&F18, F&F9	SSa, SSb, MT, GD, GR	-	SI	LC	-		S	-	F
***Strigidae* OWLS**. Diet: insect and small mammal											
Ninox jacquinoti granti	Guadalcanal Boobook		MT, GD, GR	-	G	LC	II		S	-	U
***Apodidae* SWIFTS**. Diet: insect											
Aerodramus vanikorensis lugubris	Uniform Swiftlet	F&F24, F&F22, F&F9, F&F1,	MT, GD	-	-	LC	-		S	-	U
Collocalia esculenta becki	Glossy Swiftlet	F&F6, F&F5, F&F4, F&F9, F&F8, F&F14, F&F10, F&F2, F&F1	SSa, SSb, SSc, MT, GD, GR,	-	SI	LC	-		S	-	U
***Hemiprocnidae* TREESWIFTS**. Diet: insect											
Hemiprocne mystacea woodfordiana	Moustached Tree-Swift		MT, GD, GR	-	-	LC	-		S	-	G
***Coraciidae* ROLLERS**. Diet: insect											
Eurystomus orientalis solomonensis	Dollar Bird		MT, CD, GR	-	-	LC	-		D	-	U
***Bucerotidae* HORNBILLS**. Diet: fruits (figs) and small animals											
Aceros plicatus mendanae	Blyth's Hornbill	F&F7, F&F5, F&F18, F&F9, F&F11, F&F8, F&F2, F&F1	SSa, SSb, SSc, MT, GD, GR, LK	-	SI	LC	II		D	-	F
***Alcedinidae* KINGFISHERS**. Diet: mainly fish but also wetland insects											

Species name	Common name	Observed at station	Potential Presence	Migratory	Endemic	IUCN Red List Category	CITES Appendix	1998 Act	Population Trend	Local uses	Habitat
Alcedo atthis salomonensis	Common (River) Kingfisher	F&F1	SSa, SSb, SSc, MT, GD, GR	-	-	LC	-		S	-	R
Ceyx lepidus nigromaxilla	Variable Dwarf Kingfisher	F&F5, F&F8	MT, GD, GR	-	G	LC	-		D	-	R
Todiramphus chloris alberti	Collared Kingfisher		MT, GD, GR	-	-	LC	-		D	-	R
Todiramphus leucopygius	Ultramarine Kingfisher		MT, GD, GR	-	-	LC	-		S	-	R
***Hirundinidae* SWALLOWS**. Diet: insect											
Hirundo tahitica subfusca	Pacific Swallow		SSb, SSc, MT, GD	-	-	LC	-		I	-	G
***Campephagidae* CUCKOOSHRIKES and TRILLERS**. Diet: insect											
Coracina lineata pusilla	Barred Cuckoo-shrike		MT, GD, GR	-	-	LC	-		S	-	U
Coracina papuensis elegans	White-bellied Cuckoo-Shrike	F&F21	SSb, SSc, MT, GD, GR	-	SI	LC	-		I	-	U
Coracina h. holopolia	Solomon Cuckoo-Shrike		MT, GD, GR	-	-	NT	-		D	-	U
Coracina tenuirostris erythropygia	Common Cicadabird	F&F6	MT, GD, GR	-	SI	LC	-		S	-	F
***Rhipiduridae* FANTAILS**. Diet: insect											

Species name	Common name	Observed at station	Potential Presence	Migratory	Endemic	IUCN Red List Category	CITES Appendix	1998 Act	Population Trend	Local uses	Habitat
Rhipidura leucophrys melaleuca	Willie Wagtail	F&F5, F&F4, F&F8, F&F14, F&F2, F&F1	SSa, SSb, SSc, MT, GD, GR	-	-	LC	-		I	-	G
Rhipidura c. cockerelli	Cockerell's Fantail		MT, GD, GR	-	G	NT	-		D	-	F
Rhipidura rufifrons rufofronta	Rufous Fantail		MT, GD, GR	-	G	LC	-		D	-	F
***Monarchidae* MONARCHS**. Diet: insect											
Monarcha c. castaneiventris	Chestnut-bellied Monarch	F&F5, F&F8	SSa, SSb, MT, GD, GR, LK	-	SI	LC	-		D	-	U
Monarcha b. barbatus	Solomons Monarch	F&F5, F&F9	MT, GD, GR, LK	-	SI	NT	-		D	-	F
Myiagra f. ferrocyanea	Steel-blue Flycatcher	F&F5, F&F1	MT, GD, GR	-	SI	LC	-		S	-	U
***Pachycephalidae* WHISTLERS**. Diet: insect											
Pachycephala pectoralis cinnamomea	Golden Whistler	F&F17, F&F6, F&F4, F&F9	SSa, SSb, MT, GD, GR, LK	-	G	LC	-		S	-	F
***Dicaeidae* FLOWERPECKERS**. Diet: insect and fruits											
Dicaeum aeneum becki	Midget Flowerpecker	F&F12, F&F7, F&F5, F&F4, F&F9, F&F14, F&F10, F&F1	MT, GD, GR	-	G	LC	-		S	-	U
***Nectariniidae* SUNBIRDS**. Diet: nectar and insect											

Species name	Common name	Observed at station	Potential Presence	Migratory	Endemic	IUCN Red List Category	CITES Appendix	1998 Act	Population Trend	Local uses	Habitat
Nectarinia jugularis flavigastra	Olive-backed Sunbird	F&F21, F&F2	SSa, SSb, SSc, MT, GD	-	-	LC	-		S	-	U
***Meliphagidae* HONEYEATERS**. Diet: nectar											
Myzomela melanocephala	Black-headed Myzomela	F&F9, F&F8, F&F1	MT, GD, GR	-	G	LC	-		D	-	U
***Sturnidae* STARLINGS**. Diet: insect and fruits											
Aplornis cantoroides	Singing Starling		SSa, SSb, MT, GD, GR	-	-	LC	-		S	-	U
Aplornis grandis macrura	Brown-winged Starling	F&F6, F&F5, F&F10	MT, GD, GR	-	G	LC	-		S	-	U
Aplornis metallicus nitida	Metallic Starling	F&F5, F&F9	SSa, SSb, MT, GD	-	-	LC	-		S	-	U
Aplornis brunneicapilla	White-eyed Starling		MT, GD, GR	-	SI	E N	-		D	-	U
Acridotheres tristis	Common Myna	F&F22	MT, GD	-	I	LC	-		I	-	U
Mino kreffti sanfordi	Long-tailed Myna	F&F21, F&F20, F&F19, F&F17, F&F5	SS, MT, GD, GR	-	SI	LC	-		S	-	U
***Corvidae* CROWS**. Diet: omnivores											
Corvus woodfordi	White-billed Crow	F&F12, F&F18, F&F16, F&F1	SSa, SSb, MT, GD, GR, LK	-	SI	LC	-		S	-	F

Potential Species: TRHDP ESIA Scoping Study = SSa=site A, SSb=site B, SSc=site C; Birds of Melanesia = GD, Guadalcanal Island Bird Checklist = MT, Gold Ridge Report = GR, Local Knowledge = LK

Endemic: Guadalcanal = G, Solomon Islands = SI, Introduced = I

IUCN Red List Category, Least Concern = LC, Near Threatened = NT, Vulnerable = VU, Endangered = EN & Data Deficient = DD

CITES Appendix for international trade of species, II = may be authorized by the granting of an export permit

Population Trend: Increasing =I, Decreasing =D & Stable =S (according to IUCN Red List Category)

Local Uses: Food =F (bush meat) & Cultural Importance = CI

1998 Act: Wildlife Protection and Management Act 1998. Schedule I lists the species that are prohibited to exports, Schedule II lists the regulated and controlled species for which a valid permit to export such specimen is required

Habitat: R: river dependent, U : Ubiquist (forest edge, grassland, riverine), F : forest interior, G :Grassland

The most important bird species and subspecies based on their CITES or IUCN (Red List) status, or endemicity, are identified below, along with their relative vulnerability to the Project:

Nankeen Night Heron (*Nycticorax caledonicus mandibularis*) - This bird is deemed ecologically important because of its dependence on the river system, where it feeds on small fish and shrimp, and because the sub-species is also a Solomon Islands endemic (Dutson, 2011). This heron is found close to water, especially along rivers with forested margins, such as the Tina River, and is found in riparian habitats. The following photo of a heron footprint was observed during the field sampling. Loss of habitat for breeding and feeding for this species may occur due to Project construction activities. However, the creation of a reservoir may increase micro-habitats for feeding.

Nankeen Night Heron footprint

Little Pied Cormorant (*Microcarbo m. melanoleucos*) - This bird is deemed ecologically important because of its dependence on the river system, where it feeds on small fish and shrimp. It is found along large rivers and nests in large trees beside water (Dutson, 2011). This cormorant is found in riparian habitats. Loss of habitat for breeding and feeding for this species may occur due to project construction activities. However, the creation of a reservoir may increase micro-habitats for feeding.

Pacific Black Duck (*Anas superciliosa*) - This bird is deemed ecologically important because of its dependence on the river system for feeding and breeding (Dutson, 2011). This duck is also hunted opportunistically as a source of food by inhabitants of local communities. It is found in riparian habitats. Loss of habitat for this species may occur due to project construction activities. However, the creation of a reservoir may create micro-habitats for feeding.

Brahminy Kite (*Haliastur indus flavirostris*) - This bird is deemed ecologically important because of its CITES protection status (UNEP-WCMC, 2013), and because it is also a Solomon Islands endemic (Dutson, 2011). It is the commonest raptor in the Solomon Islands and is found throughout a wide range of habitats, including the entire study area. This raptor feeds mainly on smaller birds. It is not threatened. The Project will likely have only minimal impact on this species of bird.

Pacific Baza (*Aviceda subcristata proxima*) - This bird is deemed ecologically important because of its CITES protection status (UNEP-WCMC, 2013) and because it is also endemic to the Solomon Islands (Dutson 2011). It is a common species found in forest habitats, but may also be observed throughout the entire range of the study area. This raptor feeds mainly on smaller birds and lizards. It is not threatened. The Project will likely have only minimal impact on this species of bird.

Variable Goshawk (*Accipiter novaehollandiae pulchellus*) - This bird is deemed ecologically important because of its CITES protection status (UNEP-WCMC, 2013), and because it is also endemic to Guadalcanal (Dutson, 2011). The commonest hawk in the region, it is found in forest habitats, and is often be seen throughout the entire range of the study area. This raptor feeds mainly on smaller birds and lizards. It is not threatened. The Project will likely have only minimal impact on this species of bird.

Meyer's Goshawk (*Accipiter meyerianus*) - This bird is deemed ecologically important because of its CITES protection status (UNEP-WCMC, 2013). It is an uncommon species found in forest habitats (Dutson, 2011) but is can be seen throughout the entire range of the study area (see photo). This raptor feeds mainly on smaller birds and lizards. It may be locally threatened. The Project will likely have only minimal impact on this species of bird.

Meyer's Goshawk

Solomon Sea-Eagle (*Haliaeetus sanfordi*) - This bird is deemed ecologically important because of its CITES protection status (UNEP-WCMC, 2013) and its vulnerability based on the IUCN Red List assessment (IUCN 2013). It is also important due to it being endemic to the Solomon Islands (Dutson, 2011). This eagle is wide ranging, from coast to upland forests, and is found throughout the entire study area. It feeds mainly on pigeons, doves, fish, possums and lizards. It is considered to be rare. The Project will likely have only minimal impact on this species of bird.

Red-backed Button-Quail (*Turnix maculosus salomonis*) - This species of quail if found in grassland(Dutson, 2011). It is locally common, but may also be locally threatened due to habitat disturbance and opportunistic hunting by inhabitants of local communities for food. The Project will likely have only minimal impact on this species of bird.

Guadalcanal Rail (*Hypotaenidia woodfordi*) - This bird is deemed ecologically important because endemic to Guadalcanal (Dutson, 2011), and is classified as being Near Threatened by IUCN's Red List (IUCN, 2013). It is opportunistically hunted by inhabitants of local communities as a source of food. The impacts of the hydropower project on this rare and threatened rail should be minimal due to minimal impacts that project is expected to have on the grassland habitat where this species occurs.

Common Sandpiper (*Actitis hypoleucos*) - This bird is deemed very ecologically important because it is a migratory species, and also because it is dependent on the river system (Dutson, 2011). It breeds in the northern hemisphere from May to June, when it is absent from the Solomon Islands. Possible breeding destinations for this species of bird includes Russia, Korea and Japan (BirdLife, 2013). This sandpiper is water dependent and feeds on larval insects, spiders, mollusks, snails, crustaceans, annelids, frogs, toads, tadpoles and small fish, as well as plant material, including seeds). This bird is also a culturally important as its feathers are believed to give extra strength or luck if obtained. This common species is usually solitary and is also territorial (see photo). Loss of habitat for this species may occur due to the Project. However the creation of a reservoir may increase micro-habitats for feeding.

Common Sandpiper

Yellow-bibbed Fruit-Dove (*Ptilinopus solomonensis ocularis*) - This bird is deemed ecologically important because it is endemic to Guadalcanal (Dutson, 2011). It is also opportunistically hunted by inhabitants of local communities as a source of food. This dove is found in upland habitats and feeds on fruits and nuts. It is not threatened. The Project will likely have only minimal impact on this species of bird.

Ducorp's Cockatoo (*Cacatua ducorpsi*) - This bird is deemed ecologically important because of its CITES protection status (UNEP-WCMC, 2013), and also because it is endemic to the Solomon Islands (Dutson, 2011). This common cockatoo is found in most areas where large trees are found, so all habitats except grassland and oil palm plantations should contain this species. This cockatoo feeds on fruit, nuts and seeds of trees. It is not threatened. The Project will likely have only minimal impact on this species of bird.

Cardinal Lory (*Chalcopsitta cardinalis*) - This bird is deemed ecologically important because of its CITES protection status (UNEP-WCMC, 2013), and also because it is endemic to the Solomon Islands (Dutson, 2011). This common lory is found throughout all habitat types in the study area, and has a preference for large flowering or fruiting trees. This bird is not threatened. The Project will likely have only minimal impact on this species of bird.

Coconut Lorikeet (*Trichoglossus haematodus massena*) - This bird is deemed ecologically important because of its CITES protection status (UNEP-WCMC, 2013) (Dutson, 2011). This abundant lorikeet is found throughout all habitat types in the study area, and has a preference for large flowering or fruiting trees. This bird is not threatened. The Project will likely have only minimal impact on this species of bird.

Yellow-bibbed Lory (*Lorius chlorocercus*) - This bird is deemed ecologically important because of its CITES protection status (UNEP-WCMC, 2013), and also because it is endemic to the Solomon Islands (Dutson, 2011). This common lory is found throughout all habitat types in the study area, and has a preference for large flowering or fruiting trees. This bird may be threatened by logging, and possible impacts from the hydropower project could result from forest clearing along the access roads.

Duchess Lorikeet (*Charmosyna margarethae*) - This bird is deemed ecologically important because of its CITES protection status (UNEP-WCMC, 2013) (Dutson, 2011). This species is also listed as Near Threatened by IUCN's Red List (IUCN, 2013). This lorikeet is common in upland habitats especially on flowering trees. Therefore, it may be affected by forest clearing along the access roads.

Finsch's Pygmy Parrot (*Micropsitta finschii aolae*) - This bird is deemed ecologically important because of its CITES protection status (UNEP-WCMC, 2013), and also because it is endemic to the Solomon Islands (Dutson, 2011). This parrot is found in forest habitats and feeds on small termites found in the bark of large forest trees. This common species is not threatened. The Project will likely have only minimal impact on this species of bird.

Eclectus Parrot (*Eclectus roratus solomonensis*) - This bird is deemed ecologically important because of its CITES protection status (UNEP-WCMC, 2013). This is a common parrot that can be found in a wide variety of habitats, from forests to gardens, and feeds on wild and cultivated fruits, such as banana's (Dutson, 2011). It is not threatened. The Project will likely have only minimal impact on this species of bird.

Song Parrot (*Geoffroyus h. heteroclitus*) - This bird is deemed ecologically important because of its CITES protection status (UNEP-WCMC, 2013). This is an uncommon parrot that can be found in a wide variety of habitats from forests to gardens, and feeds on fruits and seeds of trees (Dutson, 2011). It is not threatened. The Project will likely have only minimal impact on this species of bird.

Guadalcanal Boobook (*Ninox granti*) - This bird is deemed ecologically important because of its CITES protection status (UNEP-WCMC, 2013), and also because it is endemic to Guadalcanal (Dutson, 2011). This owl is common in forest habitats, where it feeds on insects. It is globally vulnerable. The Project will likely have only minimal impact on this species of bird.

Blyth's Hornbill (*Aceros plicatus mendanae*) - This bird is deemed ecologically important because of its CITES protection status (UNEP-WCMC 2013), and also because it is endemic to the Solomon Islands (Dutson 2011). This common hornbill is found in forest habitats and is not considered as threatened. It feeds on forest fruits and nuts. The Project will likely have only minimal impact on this species of bird.

Common (River) Kingfisher (*Alcedo atthis salomonensis*) - This bird is deemed ecologically important because of its dependence on the river system for feeding on fish (Dutson 2011). This kingfisher is relatively uncommon and can be found beside streams and large rivers in the riparian habitat. It is not threatened. Loss of micro-wetlands downstream of the dam due to project operation, and loss of fish productivity upstream of the dam if fish passage is not maintained, may result in the disappearance of this kingfisher from the upper catchment, since its diet is mainly comprised of fish.

Variable Dwarf Kingfisher (*Ceyx lepidus nigromaxilla*) - This bird is deemed ecologically important because of its dependence on the river system and also because it is endemic to Guadalcanal (Dutson, 2011). This kingfisher is relatively common and can be found beside streams in riparian habitats (see photo). It is not threatened. Loss of micro-wetlands downstream of the dam due to project operation, and loss of fish productivity upstream of the dam if fish passage is not maintained, may result in the disappearance of this kingfisher from the upper catchment, since its diet is mainly comprised of fish.

Variable Dwarf Kingfisher

Cockerell's Fantail (*Rhipidura c. cockerelli*) - This bird is deemed ecologically important because it is endemic to Guadalcanal island (Dutson, 2011). This uncommon fantail requires undisturbed forest habitat, where It feeds on insects. It is threatened by habitat degradation. Therefore, impacts arising from project construction activities are possible.

Rufous Fantail (*Rhipidura rufifrons rufofronta*) - This bird is deemed ecologically important because is endemic to Guadalcanal (Dutson, 2011). This fantail is common in forested habitats, where it feeds on insects. It appears not to be threatened. However, impacts from project construction activities are possible.

Oriole Whistler (*Pachycephala orioloides cinnamomea*) - This bird is deemed ecologically important because it is endemic to Guadalcanal (Dutson, 2011). The whistler is common in forest habitats, where it feeds on insects. It may be threatened due to habitat loss. Impacts from project construction activities are possible.

Midget Flowerpecker (*Dicaeum aeneum becki*) - This bird is deemed ecologically important because is endemic to Guadalcanal (Dutson, 2011). This bird is very common in forest habitats especially on flowering plants and "ant" plants, where it feeds on insects living in the ant plants. It is not threatened. Impacts from project construction activities are possible.

Black-headed Myzomela (*Myzomela melanocephala*) - This bird is deemed ecologically important because it is endemic to Guadalcanal (Dutson, 2011). It is common in forest habitats, especially on flowering plants and "ant" plants, where it feeds on nectar from flowers. It is not threatened. Impacts from project construction activities are possible.

Brown-winged Starling (*Aplornis grandis macrura*) - This bird is deemed ecologically important because it is endemic to Guadalcanal (Dutson, 2011). This common starling is found in a wide range of habitats, from gardens and settlements, to forest habitats, where it feeds on insects, flowers and fruits. It is not threatened. Possible impacts accruing due to the Project are likely minimal, since it is a widely distributed species.

White-eyed Starling (*Aplornis brunneicapilla*) - This rare bird is deemed ecologically important, based on its classification as Endangered by IUCN's Red List (IUCN, 2013). It is also a Solomon Islands endemic (Dutson, 2011), where it is found in forested habitats, feeding on insects, flowers and fruits. It is threatened by habitat loss and will be affected by project construction activities, especially forest clearing.

Appendix E

List of Mammal Species Occurring in the TRHDP Study Area and Their Status / Vulnerability

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Appendix E

List of Mammal Species Occurring in the TRHDP Study Area and Their Status / Vulnerability

Mammals of the Study area

Species name	Common name	Observed at station	Potential Presence	Migratory	Endemic	IUCN Red List Category	CITES Appendix	1998 Act	Population Trend	Local uses	River Dependent
***Pteropodidae* FRUIT BATS**											
Macroglossus minimus	Northern Common Blossom Bat		GR, SSa, SSb, SSc	-	-	LC	-	-	S	F	-
Melonycteris fardoulisi	Fardoulis's Blossom Bat		GR	-	SI	LC	-	-	D	F	-
Nyctimene major	Island Tube-nosed Fruit Bat	F&F6, F&F5, F&F4	GR	-	-	LC	-	-	S	F	-
Pteropus rayneri	Solomon's Flying Fox	F&F5, F&F11	SSa, SSb, LK	-	-	NT	II	I	D	F	-
Pteropus admiralitatum	Island Flying Fox		SSa, SSb, LK	-	-	LC	II	I	D	F	-
Rousettus amplexicaudatus	Rousette Bat	F&F5, F&F4	GR	-	-	LC	-	-	S	F	-
***Hipposideridae* LEAF-NOSED BATS**											
Aselliscus tricuspidatus	Trident Leaf-nosed Bat		GR	-	-	LC	-	-	S	F	-
Hipposideros cervinus	Fawn Leaf-nosed Bat	F&F5		-	-	LC	-	-	S	F	-
Hipposideros diadema	Diadem Leaf-nosed Bat		GR	-	-	LC	-	-	S	F	-
***Muridae* RODENTS**											

Species name	Common name	Observed at station	Potential Presence	Migratory	Endemic	IUCN Red List Category	CITES Appendix	1998 Act	Population Trend	Local uses	River Dependent
Rattus exulans	Polynesian Rat		GR	-	I	LC	-	-	S	-	-
Rattus rattus	House Rat		GR	-	I	LC	-	-	S	-	-
Uromys rex	King Rat		SSa, LK	-	G	EN	-	I	D	-	-
Uromys imperator	Emperor Rat		LK	-	G	CR	-	I	D	-	-
***Suidae* PIGS**											
Sus scrofa	Wild Pig	F&F17, F&F16, F&F5	LK	-	-	LC	-	-	S	F	-
***Phalangeridae* NOCTURNAL MARSUPIALS**											
Phalanger orientalis	Northern Common Cuscus		LK	-	-	LC	-	-	S	F	-

Potential Species: TRHDP ESIA Scoping Study = SS, SSa=site A, SSb=site B, SSc=site C; Local Knowledge = LK, Gold Ridge Report = GR

Endemic: Guadalcanal = G, Solomon Islands = SI, Introduced = I

IUCN Red List Category: Least Concern = LC, Near Threatened = NT, Endangered = EN & Critically Endangered = CR

CITES Appendix for international trade of species: II = may be authorized by the granting of an export permit

Population Trend: Decreasing =D & Stable =S (according to IUCN Red List Category)

Local Uses: Food =F (bush meat)

1998 Act: Wildlife Protection and Management Act 1998. Schedule I lists the species that are prohibited to exports, Schedule II lists the regulated and controlled species for which a valid permit to export such specimen is required

Appendix F

Habitat Value Analysis

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Appendix F
Habitat Value Analysis

The following table provides an analysis of habitat value by habitat type, defines the habitat vegetation and characteristics, and provides photographs to illustrate how habitat typically appears in Guadalcanal.

Habitat value analysis

Habitat	Ecological value	Explanation	Photograph of the habitat in the study area
Grassland	Moderate	Grassland refers to habitats that are dominated by grasses and cover the lower lying hills toward the plain. These are natural habitats formed from the locally dryer climate and less fertile soils. Since human density is higher in grassland, and plant species of concern are rarer, they have moderate ecological value. However, they support unique wildlife and bird species that are adapted to open spaces not found in forests. The most common species (indicator species) identified during plant survey were Pennisetum polystachyon, Pueraria lobata, Sida rhombifolia and Mimosa pudica. The invasive species Mikania Micanthra is also present. Grassland dominates the landscape along the existing Black Post road, future access road to the Project site and where the transmission line will be installed. In the Tina River catchment, this habitat is however only present at its Northernmost end.	

Habitat	Ecological value	Explanation	Photograph of the habitat in the study area
Undisturbed forest (primary lowland forest)	High	Refers to forested areas that have undergone relatively no disturbance by human activities. These forest areas are in pristine condition and have a high ecological value. They are home to a wide variety of species and the intactness of the forest supports great biodiversity. From Sengue upstream, the Project area is solely made of lowland forests. Primary forest (undisturbed forest) becomes increasingly important moving upstream as logging company encroachment becomes scares. Primary forest is characterized by tall canopy trees. However, regrowth species are also common due to occasional cyclones which make canopy uneven. Most fruit trees are found in lowland forests (FAO, 2009). Indicator species include: Ficus sp., Dysoxylum excelsum and Cyathea sp. (Tree Fern). As shown in the previous section, plant survey stations carried out in undisturbed forests, have a high proportion of plant species of concern. This habitat covers the majority of Tina River's catchment at altitude below 600 m.	

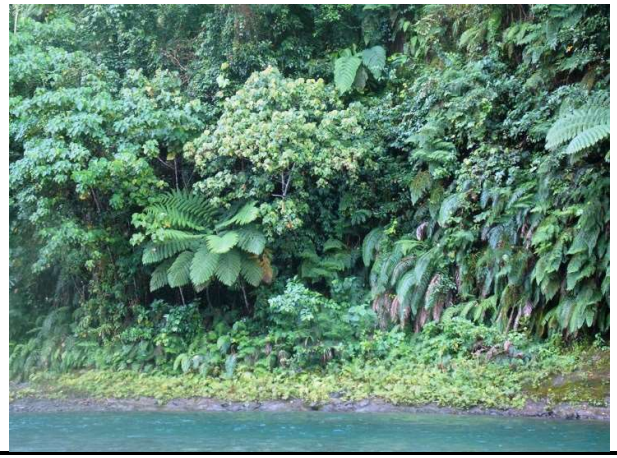
Habitat	Ecological value	Explanation	Photograph of the habitat in the study area
Undisturbed forest, montane forest	High	Montane forest refers to habitats further inland and of a higher altitude (starting at 600masl). Upland areas are usually of a pristine nature due to the distance from human habitation and influence. They also are home to many unique and rare species and this habitat is therefore of high ecological value. Recent studies in Malaysia suggest that montane forests in the region are better at sequestering carbon than lowland forest since montane forests have moister and richer organic soils due to higher rainfall. This gives montane forests an additional ecological value (Jeyanny et al., 2013). Indicator species include: Syzygium sp, Metrosideros sp., Ardisia sp., Ficus, Rhododendron, Dacrydium spp ,Podocarpus pilgeri (WWF, 2005) There is no montane forest that will be directly impacted by the Project. In Tina River's catchment, this habitat is the most important one in terms of surface coverage.	

Habitat	Ecological value	Explanation	Photograph of the habitat in the study area
Disturbed forest (secondary lowland forest)	Moderate	Refers to forested areas that have undergone relatively recent disturbance by human activities, such as timber extraction. These forest areas are not in pristine condition and have a moderate ecological value mainly because of logging disturbances. Secondary forest (disturbed forest that have regenerated) were affected by logging activities in the study area. These forests are dominated by regrowth species such as Ficus sp., Pometia pinnata and Calophyllum sp. Shrubs include the Macaranga species. Common non-ligneous species include Alpinia purpurata, Calamus sp. These are indicator species. This habitat becomes important from Choro moving downstream. Regeneration in the Solomon Islands is fast as long as soil remains available. In disturbed forests, logging roads are quickly colonized by regrowth species of shrubs, plants and trees. However, in such forests some of the key functions of primary forest are degraded due to deforestation: Forests are guardian of water catchment integrity: forested areas protect water sources and ensure water quality by providing soil stability. Unfortunately, deforestation brings erosion, and soil losses in watercourses.	

Habitat	Ecological value	Explanation	Photograph of the habitat in the study area
		Forests are important for biodiversity conservation. Deforestation opens the canopy and fragmentize habitats, locally increasing temperature and reducing humidity which reduces the attractiveness for many species that thrive in moist habitat such as amphibians. Fragmentation also exposes wildlife to predators and feral animal, exposes soils to erosion, etc. Degraded lowland forests have lower bird diversity and other "strict-interior species" as shown in fauna surveys and scientific articles (Hossein et al., 2009) Forests are important nutrient pools not only for tree regeneration but for all plants regeneration through topsoil recycling and tree decaying. Unfortunately, deforestation deplete soil from its nutrients as well as its capacity to sequester carbon (Imai et al. 2010, Lal, 2005).	

Habitat	Ecological value	Explanation	Photograph of the habitat in the study area
Remnant forest (secondary forest colonized by pioneer species)	Moderate	This habitat refers to forested areas that have undergone extensive disturbance with remaining large trees such as Canarium nut trees left on purpose. These forest areas are not in pristine condition and have moderate ecological value. They are home to a variety of species but are highly modified landscapes by people. Increasing light has modified plant composition under the canopy.	

Habitat	Ecological value	Explanation	Photograph of the habitat in the study area
Riparian	High	Riparian refers to habitats along and adjacent to Tina River and other waterways. These habitats are of high ecological value because they are home to many unique species that are dependent on the water ecosystems such as aquatic insects and amphibians. Riparian habitats at a greater distance from settlement areas are in pristine conditions. This habitat is typical along rivers such as Tina River. It is made of many epiphytic plants and orchids, vines (climbers and creepers shrubs) as well as fern trees that are indicator species. Many medium sized trees and shrubs are present. The natural water regime of rivers allows many microwetlands to be created, trapped by large boulders or sand bars, which add value to riparian habitat. Their extent and location regurarly change with Tina flows. Along Tina River, riparian habitats only cover limited areas due to the rivers steep slopes.	

Habitat	Ecological value	Explanation	Photograph of the habitat in the study area
Cliffs	High	Cliff refers to habitats on and adjacent to very steep areas (vertical slopes), usually adjacent to the river as well. Cliffs seem to be habitats that are created by the river systems and are fed by many small waterfalls (small tributaries). They are of high ecological value because they house unique species that may use the cliffs as feeding and breeding habitats. They are of a relatively pristine nature because cliff areas are hard to be modified by local peoples. Tree fern (Cyathea), ficus, palm, epiphytic orchids and ferns are common on cliffs. Other indicator species include : Pholidota sp., Macaranga sp., Timonius timon, Alpinia purpurata, etc.	

Habitat	Ecological value	Explanation	Photograph of the habitat in the study area
Garden	Low	Garden refers to human cultivated habitats such as food crops. These habitats are of low ecological value as they are human created landscapes. However, they do provide certain feeding habitats for some species, mainly opportunistic species, insects and reptiles.	

Habitat	Ecological value	Explanation	Photograph of the habitat in the study area
Fallow brush land	Low	Refers to habitats that were cultivated in the past but have been left to fallow in recent years. These are areas similar to remnant forest however, they have undergone complete cultivation as in the form on a garden and have been left to fallow/regrow. They are of a weak ecological value because they host a minimal number of species.	

Habitat	Ecological value	Explanation	Photograph of the habitat in the study area
Oil palm	Low	Refers to habitats that are homogenously cultivated with oil palm. These areas are of low ecological value as they are human created landscapes and are dominated by introduced palms. However, some wildlife species have learned to adapt and take advantage of this habitat such as bats and birds. Plant composition under palm plantation are uniform and made of several heliophilous plants.	

Habitat	Ecological value	Explanation	Photograph of the habitat in the study area
Settlements	Low	Refers to habitats in and around village areas. These areas are of a low ecological value and the presence of domesticated animals such as cats, dogs and pigs threaten wildlife native species. Opening in the canopy allows for invasive plant species to settle such as the Mikania micrantha and colonize nearby natural habitats.	

Appendix G

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Appendix H

Mitigation Measures for Protecting Downstream Migrating Fish

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Appendix H

Mitigation Measures for Protecting Downstream Migrating Fish

H.1 Rationale for Installing a System for Protecting Downstream Migrating Fish

Gobies spawn on substrate in the area in which they live. When the eggs hatch the larvae are carried passively downstream. It is not clear whether goby spawning is seasonal, or occurs all through the year. It is possible that spawning seasonality varies between species. Larval fish return to the estuary during the dry season and this indicates that spawning and downstream migration takes place early in the wet season. Thus, it is likely that hatching and downstream movement occurs during floods and freshes with the high flows ensuring rapid and safe transport to the sea. If so, the dam may be spilling and larval fish will pass over the spillway.

Although there are very few studies of larval survival through turbines, it is well known that the length of fish is the primary determinant of survival (e.g., Larinier and Travade 2002) and with larval fish potential mortality caused by striking the turbine blades or wicket gates will be low. Morris et al. (1985) describe quantitative data on entrainment mortalities that were gathered at the Ludington Hydro Plant on Lake Michigan, which has a head of 110m. Survival tests on 9 species of larval fishes indicated that passage through the Ludington turbines decreased survival rates by an average of 15%. Large smelt larvae (15-42 mm) experienced much greater mortality than did smaller (<15 mm) smelt larvae. Some larvae were apparently robust and seemed to survive turbine passage (i.e., ninespine stickleback, lake whitefish, turbot larvae). Goby larvae are small (<10mm) and there is unlikely to be significant mortality through the turbines.

Although the gobies in the Solomon Islands are generally considered diadromous, large numbers of 10 mm gobies were observed in the shallow low velocity margins of the river between the dam and power house sites on 11-15 July 2016. It is unlikely that fish of this size have the swimming ability to make the 25 km journey from the sea and this suggests that these fish are rearing in the river rather than the sea. Shallow low velocity margins are the type of rearing habitat used by non-diadromous bullies in New Zealand.

Adult eels migrate to the sea at the beginning of the wet season. They are likely to migrate on the first fresh so that the deeper swift flowing water facilitates their passage to the sea, similar to the migration of New Zealand eels. The mortality of adult eels through turbines is significant, and there does not seem to be any easy way of screening or diverting adult eels. However, if they are migrating during a flood, a proportion of the migrating population may be carried over the spillway rather than through the turbines. Consideration should be given to increasing the normal operating level to near full supply level, during the first month of the wet season, to facilitate the downstream movement of adult eels over the spillway during floods. The loss of generation resulting from increasing spill would be partially offset by the increased generation from the extra head on the turbines. Consideration could be given to the possibility of 15-25 mm screens in front of the intake structure to prevent the ingress of large eels.

H.1.1 The TRHDP: a Barrier to the Downstream Migration of Silver Eels and Amphidromous Larvae

As mentioned above, all native fish species in the Tina River are migratory species with a life cycle that shifts between the sea and the river.

All species that utilise the Tina River enter into the river mouth as juveniles and undertake upstream migration to colonize the whole watershed and mature to adults.

The downstream migration follows two patterns:

- For catadromous species (eels *Anguilla marmorata, A. megastoma and A. reinhardti*), the adults at a certain stage of their cycles (silver eels) return to the sea to spawn in deep marine areas, after which they die.
- For amphidromous species (Syciinidae and other Gobbidae, Eleotridae, Paleomonidae), spawning occurs in in the river. After hatching, the larvae are passively flushed down to the sea within a few days of hatching, where they grow for a period of several weeks/months before migrating back upstream.

Unlike salmonidss, these species do not follow a homing behavior. Juveniles can colonize any river, not only their natal stream.

Assuming that an efficient fish trap and haul system is emplaced for the Project (see Appendix A) allowing upstream migration of juvenile eels and target amphidromous species (Syciinids, other Gobiids, prawns), thereby ensuring that fish grow to adulthood upstream of the dam, the ecological continuity for these species would be fully achieved if silver eels and gobidae/prawn larvae are able to successfully migration back to the sea.

In the absence of appropriate mitigation measures, the TRHDP facilities will potentially impair the downstream migration. A proportion of fish will be entrained into the power intake tunnel and passed through the turbines. The passage through the turbines is likely to cause mortalities due to pressure fluctuation, turbulence and cavitation (affecting both silver-eels and larvae) plus physical damage when struck by the runners blades. However, Francis turbines, which are less damaging than Pelton turbines, have been proposed by Entura (March 2014).

H.1.2 Facilitating Downstream Migration of Silver Eels and Amphidromous Larvae

To move achieve full ecological continuity for target species by balancing upstream and downstream migrations, different mitigation measures can be considered for protecting outward migrating fish. This includes physical barriers (i.e., fish screens), behavioral barriers (i.e., light, acoustic, electric or hydrodynamic fields) and fish-friendly turbines. These are presented in the following sections with a discussion on their suitability for the Tina River context.

H.1.2.1 Fish Screens in the context of reservoir spills

Mature eels, also referred to as silver eels, may reach more than 1m in length and 10kg in weight for the most common species *A. marmorata.* Other species may grow to be larger.

One solution considered to prevent eels from being entrained into the power intake and thereby passed through the turbines, is to install fish screens on the power intakes. The screens should have a mesh size or inter-bar spacing of a 2cm to 5cm. In this scenario, attention would need to be paid to: (i) slecting a sufficiently wide mesh to prevent fish from being stuck against the screen; (ii) a bypass outlet to allow fish to swim away from the screen covered power intake, and (iii) an automatic cleaning system to keep the screens free from fouling.

The efficacy and impact of this option has been considered in relation to the fact of reservoir spills occurring regularly in the context of river freshes, which silver eel migration has been observed to occur timed to coincide with.

During such events of silver eel migration, the reservoir level at a level to spill water over the spillway, thereby providing a route for eels to migrate downstream, and reduce the need for screens.

It is considered preferable to permit this spill option to be relied on for the downstream migration of the eel species.

H.1.2.2 Behavioral Barriers

These systems are based on the response of fish to visual, auditory, electrical or hydrodynamic stimuli. Many systems have been experimented with, incliuding light screens, bubble screens, and other methods. However, these systems are usually specific to a particular fish species or taxa.

Prawn larvae are known to be attracted by light (phototaxis). Fievet *et al.* (2000), inspired from works in Japan, implemented a pilot system on a dam in the French West indies, which consisted of streetlights on the bank opposite to the power intake structure to entice the larvae to the downstream fish pass. The results appear promising, though they vary widely in relation to natural light (moonlight / sunlight), turbidity, and waves on the reservoir. However, the most attractive wave-length may differ according to prawn species. Unfortunately, phototaxis has not been highlighted for Goobidae larvae, and light has a repellent effect on eels.

Therefore, implementing behavioral screens would need to be preceded by technical studies on the targeted species to estimate the most effective system.

H.1.2.3 “Fish Friendly” Turbines

As mentioned above, fish passing through hydraulic turbines are subject to various forms of stress and physical damage that is likely to cause high mortality.

A new type of turbine (Alden) conceived as “fish-friendly” has undergone pilot stage testing in North America and Europe. This system has a lower rotation speed than other types of turbines, thereby reducing the risk of mortality from physical contact shocks or overpressure.

However, fish friendly turbines are at an early stage of field application and have been mainly tested on salmonids. Their effects on eels and fish / prawn larvae are unknown. Futhermore, fully installed equipment price is roughly 35% to 40% higher than with conventional Francis turbines.

H.1.2.4 Conclusions Regarding Downstream Fish Barrier Systems

Even if several solutions exist to prevent mortality during the downstream migration, the only method recommended is reliance on the high frequency of uncontrolled reservoir spills to provide regular down migration opportunities to the eel species.

Notwithstanding that measures aimed at reducing mortality to eels and fish larvae in the turbines may not be readily achievable with current technologies, considering the absence of homing behavior in native fish species, the Tina River watershed will be continuously stocked by upstream migration of juveniles that have spent part of their life cycle in other coastal rivers in the Solomon Islands.

Appendix I

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Appendix J

Free, Prior and Informed Consent

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Appendix J

Free, Prior and Informed Consent

There is no single internationally agreed definition of FPIC and “no single, nor a one-size fits all mechanism for its implementation” (UN Collaborative Program on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries, 2013). International development agencies define FPIC as follow:

- “Free” - implies the absence of coercion, intimidation or manipulation (including bribery or rewards).
- “Prior” - implies that sufficient time is provided to indigenous communities and stakeholders during consultations and decision-making processes. This allows community members and stakeholders to receive adequate information, come together, discuss the proposal, and make decisions prior to providing any formal response (e.g., consent).
- “Informed” - implies that the affected communities and stakeholders have access to relevant information on the project to engage in consultations and decision-making processes. Providing ‘access’ to information implies that the information is:
  - in a form and language that is suitable for the particular communities and stakeholders;
  - accurate;
  - delivered in a culturally appropriate and inclusive way; and
  - made available to every member of the community.

- “Consultation” refers to an inclusive and fair process of interaction, engagement, and dialogue between various stakeholders with respect to a proposed development or activity. The intention is to achieve a clear shared understanding of the proposal, the issues and concerns of all parties, and of any future actions and decisions. It does not imply common agreement or consensus as an outcome.
- “Consent”, in the context of IFC PS, refers to a “broad agreement” within and between the affected communities and stakeholders that the proposed project or activity can proceed, as determined through local customary decision-making practice. It does not imply universal agreement amongst stakeholders or all members of a community.

Appendix K

Analysis of Opportunities to Improve Conservation of the Upper Tina River Catchment

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Appendix K

ANALYSIS OF OPPORTUNITIES TO IMPROVE CONSERVATION OF THE UPPER TINA RIVER CATCHMENT

K.1 Protection of the Upper Tina River Catchment

The upper catchment area is defined as the area upstream of the proposed TRHDP dam. It covers an area of 125km2, and represents 83% of the total Tina/Ngalimbiu catchment area. The Tina River upper catchment is characterized by mountainous terrain, with peaks ranging from 800masl to 2300masl.

Approximately 60% of the catchment is higher than 800masl. The Tina River headwaters (270masl), are comprised of the junction of two main rivers: Vohara River (1) and Mbeambea River (2) and a minor tributary: Njarimbisu River (3). Becho River (4), a tributary of the Vohara is located further upstream.

Protection of the Upper Tina River Catchment would create one of the largest, if not the largest, terrestrial protected area in Solomon Islands. Protection of the area would provide conservation support to a key portion of the highlands of Guadalcanal identified as a Key Biodiversity Area by the IUCN and Bird Life International.

The highest reaches of the Tina catchment back onto the highest parts of Solomon Islands, and the most extensive cloud forests in the country. Unlike the directly impacted area of the project, which is heavily affected by logging and human encroachment, these parts of the catchment are relatively intact and are thought to harbour significant unique biological and ecological diversity.

K.2 Protection Avenues

There are two potential avenues to conserve the upper catchment. The first is to create a formal Protected Area, changing the existing rights of customary landowning groups to consent to commercial activities on the land. As the catchment is owned by customary landowners these groups rather than SIG or the Project Company have powers to consent to a formal PA under the *Protected Areas Act*. A formal PA would serve as a biodiversity and customary land use reserve and could start upstream from the dam, including the reservoir and the entire upper Tina River catchment, which covers 125km^2.

The second is to use the Project as an opportunity to increase awareness and supervision and to improve the enforcement of existing laws for the protection of the upper catchment. This latter option could be used in conjunction with informal customary protection. The two options are not exclusive and there is benefit to pursuing the latter while the former is explored.

A third option, creating a formal protected area under the *National Parks Act* without the consent of landowners, is not considered feasible. The Act provides inadequate safeguards for customary land users and owners and while not repealed has been effectively replaced by the *Protected Areas Act*. The Act has been used only once in 1973 to designate a registered area of land as a National Park (the largely degraded and unmanaged Queen Elizabeth National Park). The Act is not in current usage. Any restrictions on the use of customary land without the consent and participation of owners is anticipated to lead to a backlash against protection efforts.

K.1.1 Previous Activities

In October 2015, an international expedition, known as 'Islands in the Sky', was conducted by the University of the South Pacific (USP) and the American Museum of Natural History (AMNH), to explore the biodiversity of the upper catchment. This region, recognised as a Key Biodiversity Area (KBA) has received very little scientific attention. Expedition access to the key locales within the upland regions was made possible through the reliance on the existing relationships established between the TRHDP and landowning tribes, particularly the Uluna-Sutahuri tribe which has a guardianship status with the highest regions of the catchment. The expedition was conducted with the funding of Critical Ecosystem Partnership Fund (CEPF) and involved collaborations with the Solomon Islands National University (SINU) as well as other academic and conservation organisations.

The social pathway for the planning and implementation of the expedition was aligned with the behaviours and expectations that TRHDP has developed amongst indigenous peoples of the area, providing a stable association between tribal members and the members of the expedition.

K.1.2 ESMP Measures for Upper Catchment Protection

The Project is expected to have no direct impact on the terrestrial upper catchment. Initially indirect risks of increased access facilitated by the road to the dam site were considered. However, a new logging road on the right bank of the Tina River constructed in 2015/2016 provides unrestricted vehicular access to the same elevation. Unlike the logging road, the project road will be gated above Mengakiki (the end point of the existing usable road) and will have restricted vehicular access from Mengakiki onwards. 24 hours security guards will monitor access. This section of road is to remain a private road, owned by the TCLC and leased to the SPC during the BOOT period. As recorded in the social baseline assessments, part of the catchment is currently used in traditional hunting and fishing expeditions undertaken on foot by local communities. This use will continue to be permitted. Under no circumstances will SPC provide commercial logging operations access to the private road. In these circumstances, the TRHDP is anticipated to have negligible impacts on upper catchment access.

Notwithstanding this, the ESMP proposes a number of key measures to protect the upper catchment:

- SPC and PO to regularly monitor forest coverage in the upper catchment through satellite or aircraft imagery, and to monitor and report any logging trucks or logging operations operating in the Tina or Toni catchments. Reporting should be made to the WB, Ministry of Environment, Climate Change, Disaster Management and Meteorology, and Ministry of Forests and Research. SPC and PO to coordinate with Ministry of Forests and Research to enforce existing law preventing commercial logging above 400 metres; and

- SIG to provide assistance, information and seed funding to an NGO to conduct community consultations and studies contributing to the potential establishment of a protected area.

K.1.3 Activity Restriction

The key element in declaring the upper Tina River catchment as a PA is to establish a prohibition on commercial logging and mining activities, and ban infrastructure development, including road construction into the area. Traditional activities would be recognised such as small-scale logging by local communities, fishing and hunting.

Activity restrictions would need to be approved by customary landowners and the SIG since timber, prospect and mining licenses are approved by landowners and granted by the SIG. .

Sustainable funding schemes are key to the ongoing protection of the catchment. There will be pressure to monetarise the area and to receive royalties from logging or mining enterprises. The key to combatting this will be to provide opportunities for income streams and paid employment. Without the support of customary landowning groups, PA designation would be meaningless.

K.1.4 Staged Proposal

If protected, the Upper Tina Catchment would become the largest terrestrial protected area in the country. Examples of other, technically «informal», protected areas include the Arnavon Islands, Choisseul, supported by The Nature Conservency, Tetepare Island, Western Proviince, managed by the Tetepare Descendents Association and supported by Solomon Islands Community Conservation Partnership (SICCP), and Kolombangara, managed by the Kolombangara Island Biodiversity Conservation Association (KIBCA).

Each of these sites involved several years of development and continue to receive ongoing external support. A successful protected area will need significant funding and long term commitment to establish and implement.

The support of customary landowners, SIG and donors will be key to the successful protection of the upper catchment. A potential staged process is contemplated, as set out in the table below.

	Activitiy	Actor
Stage 1	Monitoring and reporting of upper catchment forest coverage and logging activities	SIG and SPC
	Engagement with Ministry of Forests and Resoures to support their prevention of illegal commerical logging above 400 metres	PO/SIG
	Restricting use of the Project's access road above Mengakiki Village	SPC and HEC
Stage 2	Engagement of partner NGO to faciliate studies and consultations towards protected areas status	NGO/PO

Protected Area Feasibility		
	Supporting and facilitating NGO activities, including providing data and support to work with landowning groups	PO
	Consultation with landowning groups to seek in principle support for protection and proceed with preliminary studies	NGO
	Mapping and forestry studies undertaken with support of landowning groups. Studies to include potential opportunities for sustainable financing. Options will include a mix of eco-tourism, supporting scientific expeditions and voluntary carbon trading.	NGO
	Consultation and sharing of study findings with landowners and communities Consultations with SIG, including Minstry of Forests and Resources, Ministry of Environment, Climate Change and Disaster Management and Ministry of Mines, Energy and Rural Electrification	NGO
Stage 3 Establishment of an « informal » protected area through donor funded project with support of landowners and SIG	Agreement of customary landowners to prevent commercial logging and mining.	Donor/NGO with PO support where funding available
	Public signing of an MOU or equivalent with SIG and landowners Agreement marked by public declarations, cultural ceremony and media	Donor/NGO
	Option for SIG to provide 'legal' support to the informal protection of the area through designation of the area as a 'reserved area' under section 4 of the Mines and Minerals Act, prohibiting mining activities. It is not proposed to designate the area as a forest reserve under the FRTU Act due to compensation payment requirements and wide exemptions.	Donor/NGO

Stage 4 Formal Protection under the Protected Areas Act	Completion of all steps to create a formal protected area. This includes : - Establishment of a management committee - Consultation, agreement and support of customary landowning groups - Preparation of management plans - Mapping of area - Support of neighbouring customary landowning groups (as protection includes a buffer zone) - Preparation of a budget - Submission of formal application for approval Full summary of steps is available in the Protected Areas Toolkit prepared by the Landowners' Advocacy and Legal Support Unit.	Donor/NGO with PO support where funding available

K.3 Challenges

Like all projects in Guadalcanal, one challenge ithat arises is customary land ownership and the need to identify land owners and boundaries to approve the protected area and to share in any financial benefits. The upper catchment is owned by a number of Malango Tribes . Boundaries and ownership have not been mapped, and as a pristine environment, the ownership of land has not been the subject of previous court cases for logging or acquisition.

This challenge is reduced in an informal protected area as opposed to a formal area where the support of all potential landowning groups can be obtained without the need to articulate land boundaries. A number of groups can sign an MOU for protection. For this to work, benefits would need to be provided by way of employment opportunities and activities rather than as cash payments to be divided between groups Where possible, it is recommended that any formal protected area also avoid identifying landownership boundaries and adopt a principle of inclusion of groups where disputes arise. Again, the extent to which this is possible will depend on the form of benefits and their distribution.

As PAs remain under customary ownership, the role of the SIG is to declare the area a PA and to enforce a strict prohibition on issuing resource exploration and exploitation licenses, granting logging licences or allowing infrastructure development. Working with SIG to agree to designate a PA will be a lengthy process, since it has already issued prospecting licences in the upper Tina River catchment. These existing licences need to be reviewed to determine their expiration dates (and lawful extensions) and discussions held with MMERE towards agreeing that no further licences will be issued as the PA is formalised.. The support of customary landowners will be the key to SIG's support.

The PA project will require the cooperation of villages and customary landowners before any protection is possible. NGOs and consultant firms could be involved in training and capacity building of both communities and government officials and development of community awareness and community participation. The concept of carbon trading might not be fully understood by communities. If carbon credits are pursued, training sessions will need to be provided to all beneficiary communities.

Long term protection will be dependent on sustainable financing opportunities. Securing these on Guadalcanal is a significant challenge. Experience of other protected areas in SI suggests that a mix of financing should be pursued. This may include small scale eco-tourism (assisted by the area's proximity to Honiara), paid support of scientific expeditions in the form of guides and logistics, NGO funded activities including rangers, and potential sales in the voluntary carbon trading market.

By prohibiting logging activities, landowners could potentially use the area to generate income through a voluntary carbon trading scheme. Benefits of "forest carbon rights" on customary land would be owned by customary landowners, which could represent a small financial benefit to local communities. UNDP is currently supporting the preparation of a REDD+ program in Solomon Islands to establish a monitoring and reporting mechanism at the national level. This mechanism when complete will assist to establish the forest monitoring and legal frameworks required to attract a voluntary trading scheme. However, carbon trading opportunities in Solomon Islands are still many years away, as the ongoing SI REDD+ project continues to prepare frameworks and monitoring.

One issue raised by the SPC/GIZ Regional REDD+ Project in the Solomon Islands (2012), is that "there are currently no suitable mechanisms for customary land owners to join together as a legally recognized entity, to hold and manage forest carbon rights and to distribute benefits in an open and transparent way". This issue has been overcome in other components of the TRHDP, in particular the design of co-operative societies for the open and transparent sharing of the land purchase price and royalty benefits within each Core Land Tribe. The lessons learned from that exercise can contribute to the benefit sharing mechanisms for any protected area.

To summarize, there are currently three major challenges associated with designating the upper Tina River catchment as a PA. These include:

- Identifying customary landownership and boundaries, if this step cannot be avoided
- Providing sustainable benefits to achieve and maintain customary landowner support in competition with pressure and payments from logging or mining companies. Any income from carbon trading is likely to be small, and while UNDP's REDD+ preparation project is ongoing, may be some years away.
- Establishing and enforcing a prohibition on mining and logging when there are already existing prospecting licences in the Tina River catchment and significant political pressure asserted on Ministry of Forestry and Reseach by foreign logging companies.

K.4 Process for Formal Protection

The Ministry of Environment, Conservation and Meteorology is responsible for the protection and conservation of biodiversity and designation of the PA network in the Solomon Islands.

As mentioned in the Environmental Baseline, the *Protected Areas Act 2010* presents the process to designate a protected area. For an area to become a PA, a community or organization should prepare:

- An application to the Director of Environment for the site to be declared as a PA. The application will need to include a PA management plan and scientific studies to show that the area is of significance to biological diversity, and to the community in terms of natural resources. The application will also need to include an estimated budget for the PA and evidence of agreement by all customary landowners, a map showing the boundaries and size of the site.
- The Director, upon receiving the application, will review it and make recommendations to the Minister, if the application is deemed to have merit and should declared a PA. The basic requirements for an application and for considerations by the Minister include:
  - Conservation objectives of the PA identified in accordance with sound conservation practices;
  - Boundaries of the area accurately identified, or otherwise demarcated and surveyed;
  - Consent and approval obtained from persons having rights or interests in the area; and
  - Appropriate conservation, protection or management plan developed for the area to ensure that the conservation objectives of the PA would be achieved.

K.6 Conclusion Regarding Upper Tina River Protected Area

Establishing the upper Tina River catchment PA will require significant funding and a dedicated project team with expert assistance.

Neither SIG nor the SPC have the power to create a protected area without the consent and support of customary landowners. As a large area covering 125 km^2, protection will require the consent of a large number of landowning groups with disparate ideas about the value of conservation, and for many, a history of sometimes lucrative involvement in logging and mining. A dedicated and well resourced project team will be required to conduct the consultations and negotiations necessary to make the protected area a reality.

Expert assistance will also be required for studies and mapping, and preparation of a management plan. Funding for a project team and expert assistance will need to be obtained from international environmental NGOs or donor agencies such as the Green Climate Fund, Conservation International or the World Bank.

Once established, the protected area will need to leverage sustainable benefits to landowners to maintain landowner support, which in turn is crucial to maintaining SIG support. Sourcing and managing benefits will be a key component of the project team's work.

Based on this analysis, the declaration of a PA for the upper Tina River catchment should adopt a staged approach, the later stages of which will depend on the outcomes of Stage 2 feasibility assessments.

In the absence of a formal protected area, the role of TRHDP will be crucial to shining a spotlight on activities in the upper catchment. The Project provides an opportunity for the SPC to monitor and report on any deforestation activities. This will include reporting any illegal logging activities above the 400 metre contour, which covers the vast majority of the upper catchment area. The PO is well placed to secure SIG support to enforce existing laws and shut down illegal operations. Satellite monitoring of forestation through the SPC and SIG will provide essential data both to support future donor funding proposals as well as to provide baseline data for any carbon trading application.

Appendix L

Ian Jowett Report on Environmental Flow Requirements and Fish Passage Mitigation Measures

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Jowett Consulting Limited

Tina River Hydropower Development – environmental flow requirements and fish passage mitigation measures

Client Report: IJ1601

July 2016

Tina River Hydropower Development - environmental flow requirements and fish passage mitigation measures

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Contents

Executive Summary

The Tina River drains in a north-westerly direction from some of the highest peaks (2000+ m) on the island of Guadalcanal. It was selected as a potential site for an hydroelectric project because it has a relatively high flow and is close to Honiara.

This report assesses the effects of the proposed hydro-electric operation on the aquatic physical environment, including environmental flow requirements, potential effects on fish, fish passage requirements, hydro-peaking, morphological changes resulting from reduced sediment load, and possible mitigation measures.

Hydroelectric project description

The project comprises a 55 m high dam located at an elevation of approximately 123 m amsl, and roughly 30 river km from the sea, a 3.3 km tunnel to a powerhouse and tailrace at elevation 73 m amsl. The reservoir formed by the dam will extend upstream approximately 2.6 km and will have a surface area of about 0.28 km^2 at an elevation of 175 m amsl. The operating range of the reservoir formed by the dam will be 5 m but the reservoir will normally be held about 3 m below the full reservoir level to increase utilisation by storing water during floods and freshes and reducing the number of spill events.

Initially, the powerhouse will have 3 turbine/generator units, each with a capacity of 5MW, allowing a maximum discharge of about 18 m^3/s, and a minimum discharge of about 2.4 m^3/s.

An environmental flow will be maintained between the dam and power house tailrace. The river distance between the dam and tailrace is 5.4 km.

Hydrology and power station operation

A water level recorder was operated on the Tina River upstream of the dam between 16 June 2010 and 03 April 2014. The mean and median river flow at the dam site derived from this record is 14.85 m^3/s and 11.87 m^3/s, respectively. Entura derived 30 years of synthetic flows from rainfall record and estimated the long-term mean and median flows to be 13.1 m^3/s and 10.78 m^3/s, respectively. The maximum generating flow of 18 m^3/s was exceeded 22% of the time in the short-term record, and 18% of the time in the long-term record.

Power station operation was simulated using both the shorter recorded flow record and the longer synthetic flow record. These simulations showed spill flows would occur on average every 5.5 weeks and would usually be of 4-6 days duration. The mean spill flow for the short and long term flow record was 2.3 m^3/s and 1.3 m^3/s, respectively, and resulted in generation utilisation of 82% and 89%, respectively. Using the short flow record, the estimated energy generated at the power house and at a generator on the environmental flow outlet was 86 GWh/a for a 1 m^3/s environmental flow. Without a generator on the environmental flow, the estimated energy output was 82.2 GWh/a. Using the 30 year synthetic flow record, the estimated energy was 83 GWh/a or 79.2 GWh/a without any generation from the environmental flow. Transmission losses to Lungga are about 1.2 GWh/a.

Fish community and habitat preferences

The fish community in the Tina River is diverse and comprises about 20 species of goby, two eel species, two kuhlia species and two species of grunters. All species are reported to be diadromous in that they must have access to the sea to complete their life cycles (ESIA). All species, except for kuhlia and grunters, are excellent aquatic climbers and are able to negotiate rapids and waterfalls. All species occur in other Solomon Island rivers, and most are found in the wider area of the western Pacific. The gobies spawn in their adult locations and when the larvae emerge they are carried to the sea by floods during the wet season. The larvae rear in the sea and return to rivers as juveniles that then migrate upstream. Adult eels migrate downstream during wet season floods to spawn in the ocean. The adults die after spawning and the juvenile eels return to freshwater and migrate upstream. Adult kuhlia and grunters migrate to the Tina River estuary to spawn and, after spawning, the adults return upstream. Their young rear for a while in the estuary or coastal waters before migrating upstream.

Although the gobies in the Solomon Islands are generally considered diadromous, numerous juvenile gobies 10 mm in length were observed in the shallow low velocity areas of the river between the dam and power house sites on 11-15 July 2016. The number and size of these juvenile fish suggests that these fish are rearing in the river rather than the sea because it is unlikely that fish of this size have the swimming ability to make the 25 km journey from the sea.

As part of this study, measurements of fish numbers, water depth, velocity, and substrate composition were made at 70 locations across transects in the Toni and Tina rivers in a variety of habitat types (riffle, run and pool). A total of 18 species were either caught or observed on 11 March 2016 by electro-fishing and on 13-14 July 2016 by snorkel observation. Eight of these species were relatively common (present in more than 3 sampling locations).

These fish observations showed that coarse substrates with minimal sand movement were the preferred habitat of most fish species. In general, most species were found in shallow water (0.2-0.3 m) with moderate velocities (0.45-0.65 m/s) and coarse substrate. Eels and the two *Sicyopterus* species were found in the swiftest water and kuhlia were found in the lowest water velocities. Shallow water (<0.3 m) with a velocity of up to 0.7 m/s and boulder/cobble substrate contained the greatest density of fish and the greatest number of species.

Fish density and diversity was higher in the Toni River than in the Tina River, with an average of 60.4±81.7 fish/12m^2 in the Toni River compared to 6.7±17.1 fish/12m^2 in the Tina River.

Habitat suitability and generalised additive models (Jowett & Davey 2007) were developed for the eight most common species (*Stiphodon semoni, Stiphodon pelewensis*, *Stiphodon rutilaureus, Belobranchus sp., Anguilla marmorata, Sicyopterus cyanocephalus*, *Sicyopterus lagocephalu*s, *Kuhlia marginata*), as well as models for overall fish density and species richness.

Instream habitat

The Tina River gradually increases in gradient from its confluence with the Toni River to the head of the proposed reservoir. The average gradient between the Tina/Toni confluence and the power house site is 5.3 m/km, increasing to 9.3 m/km between the power house and dam. The morphology reflects the change in gradient with the substrate size and frequency of swift water habitat

increasing with gradient. The river is characterised by runs and riffle, with relatively few rapids/torrents and pools.

Surveys of the river were carried out on 6-9 March 2016 and 11-15 July 2013. During the first survey, the proportion of the different habitat types was measured and cross-sections were identified in each of the habitat types. A large flood that occurred on the second day of the survey and removed more than half of the temporary staff gauges that had been installed. This meant that only 3 cross-sections were surveyed in March, one pool, one run and one riffle. Water levels were measured at flows of 8.7 m^3/s and 19.7 m^3/s and these were used to develop rating curves at each cross-section. The second survey (11-12 July 2013) comprised cross-sections in 2 pools, 5 runs, 5 riffles and 2 rapids; a total of 14 cross-sections. The flow was 9.91 m^3/s on the 11 July and 9.66 m^3/s on the 12 July. Water level and flow measurements were taken on 15 July and 25 July for rating calibration when the flows were 8.28 m^3/s and 5.39 m^3/s, respectively.

These surveys showed that the river between the dam and powerhouse comprised 46% run, 36% riffle, 13% pool and 5% rapid habitats. The average water surface width at a flow of 9 m^3/s was 23.6 m and the average depth and velocity were 0.58 m and 0.66 m/s, respectively.

Variability of flows

The river downstream of the dam will require some flow variability, particularly floods and freshes to flush algal accumulations. Because the maximum capacity of the powerhouse and the amount of storage in the reservoir are not large, there will be frequent periods of spill between the dam and tailrace. Simulation of the hydro operation indicated that floods or freshes would occur on average every 6 weeks and their average duration would be between 4-6 days. This frequency is probably sufficient to prevent prolific periphyton (algae attached to substrate) accumulation in this low nutrient river. Therefore, it should not be necessary to provide for flushing flows or any other seasonal pulses to stimulate spawning, migration or other biotic activities.

Large scale hydro-peaking can severely affect fish and benthic invertebrates. In the Tina River during the dry season, it is intended to generate at full discharge during the day and reduce to zero power station discharge during the night leaving only the environmental flow in the river. This means that the flows could fluctuate between 18 m^3/s and the environmental flow on an almost daily basis. Flows of 18 m^3/s or more presently occur for about 20% of the time. Fluctuating flows from 1 m^3/s to 18 m^3/s would inconvenience local inhabitants but would not prevent them from crossing the river on foot.

The maximum flow from the generators is relatively low compared to the magnitude of floods and freshes during the wet season, so that it is unlikely that fish habitat and fish populations will be affected by hydro-peaking. However, depending on the mobility of the species, there is the possibility of fish stranding.

Sediment

Entura (2014) estimated that it would be about 65 years before it became necessary to flush deposited sediment from around the power station intake. Thus, the dam will trap all bed load sediment (sand and coarser material) and a proportion of suspended sediment, and reduce the amount of bed load in the river downstream of the dam.

At present, a large amount of sediment is transported through the steep, relatively narrow section of river between the dam and powerhouse sites. The movement of sediment during floods and in the deeper swifter areas of the river at normal flows reduces algal growth, benthic invertebrate production and fish habitat. The creation of a dam will prevent much of this sediment movement and will gradually coarsen the substrate. This will improve the fish habitat considerably, as the habitat observations showed a clear preference for coarse substrate and avoidance of deep swift water where sand was being transported along the river bed.

The reduction in sand supply will tend to deepen pools and improve habitat for the pool dwelling species kuhlia and grunters. Any beneficial effect of sediment removed by the reservoir will gradually reduce with distance downstream, as sediment is entrained for the sands and gravels on existing river banks and introduced from tributaries.

Observations downstream of New Zealand hydro dams on gravel bed rivers (Waitaki, Clutha) indicate that the river bed will not degrade (erode) to any noticeable degree because the surface will be armoured by cobbles and larger gravels once the surface fines are removed.

Water temperature and quality

Because there is little diurnal and seasonal temperature variation and little wind mixing, tropical reservoirs often become stratified (Barrow 1988). Shallow lakes with high inflow are least at risk of stratification. The low residence time (7 days), relatively narrow sinuous reservoir, combined with floods that can occur at any time of year, suggest that stratification is unlikely.

During the rainy season, spot temperatures measured in the Tina River were 24.5°C at the Tina Village. Water temperatures in the Toni River were higher at 28.4-29.4°C. Water temperatures were also measured in the Toni River and in the Tina River between the Toni River confluence and approximately 1.5 km below the dam site over the period 11-15 July 2016. The daily maximum water temperature was 26°C at all sites over the 5 days with a diurnal variation of about 3°C. The lack of any downstream increase in temperature and the similarity of the water temperatures in the Toni and Tina rivers suggests that during July the water temperature was in equilibrium with the physical and climatic conditions and therefore a change in flow would have minimal effect on daily mean water temperature.

A reduction in flow generally does not change the daily mean water temperature significantly, but it does increase the daily maximum and decrease the daily minimum temperature. However, during the wet season at least, water velocities are high and river water temperatures may be below the equilibrium temperature, so that a reduction in flow would increase the daily maximum water temperature and may increase the daily average water temperature in the river between the dam and powerhouse. With a flow of 1 m^3/s in the river between the dam and powerhouse, water temperatures are likely to be similar to those in the Toni River. This will not affect fish and benthic invertebrates as the aquatic community in the Toni River is similar to, if not better than, that in the Tina River.

The formation of a lake or reservoir is unlikely to have any effect on seasonal water temperatures because there is little variation in the annual air temperature in the Solomon Islands.

Environmental flow requirements

The environmental flow requirements were determined by modelling ten habitat suitability criteria (8 species -*Stiphodon semoni, Stiphodon pelewensis*, *Stiphodon rutilaureus, Belobranchus sp., Anguilla marmorata,* two *Sicyopterus* species, *Kuhlia marginata*, and two fish community measures fish density and species richness) for flows of up to 11 m^3/s. The analysis of habitat variation with flow suggested that a flow of 2-4 m^3/s would provide maximum habitat for most of the common species, fish density and species richness. However for the species that live in very swift water (*Sicyopterus cyanocephalus* and *S. lagocephalus*), habitat suitability is greatest at flows greater than 10 m^3/s.

The standard of environmental protection provided by an environmental flow can be assessed by comparing the amount of habitat (m^2/m of river length) at the environmental flow with the amount of habitat at median flow. A flow of 1 m^3/s would provide more habitat than is available at median flow for *Stiphodon semoni*, *Belobranchus* sp., *Stiphodon pelewensis* and *Kuhlia marginata* and a similar amount for *Stiphodon rutilaureus*. Fish density and species richness would both be greater with a flow of 1m^3/s than with the median flow of 11.1 m^3/s. The estimated fish density at an environmental flow of 1 m^3/s is approximately 50 fish per 12 m^2. This is slightly less than the average of 60.4 fish/12m^2 observed in the Toni River and considerably higher than the 6.7 fish/12m^2 observed in the Tina River. Similarly, the estimated number of species per quadrat with an environmental flow of 1 m^3/s was 2.1 compared to the observation of 2.61 and 1.17 in the Toni and Tina rivers, respectively.

The selection of an environmental flow depends on the balance between environmental effects and loss of generation and the relative values placed on the environment and generation. Provision of a 1 m^3/s environmental flow between the dam and powerhouse should maintain or improve fish and benthic invertebrate densities and total numbers for most species. An environmental flow of 1 m^3/s would maintain the riffle habitats that appear to be used by most fish species, although there would be a reduction in habitat for the *Sicyopterus* species, which can live in very swift water. Pools will also be maintained for kuhlia and grunters. Moreover, trapping of sediment in the dam and subsequent coarsening of substrate in the river below the dam will improve habitat for all aquatic species and overall productivity and this improvement with an environmental flow of 1 m^3/s should result in fish densities that are similar to that in the Tina and Toni rivers at present.

A possible increase in water temperature will not affect fish populations, as the predicted increase is small and the same fish community is present in the Toni River where water temperatures are similar or slightly higher than in the Tina River. There is little likelihood of any change in biotic interactions, such as predation, although the lower flow will make it easier for humans to spear fish.

The fish and invertebrate community in the Toni River is an example of the fish community that would probably develop between the dam and tailrace with an environmental flow of 1 m^3/s. The flow in the Toni River is approximately one fifth of that in the Tina River, yet the average fish density in the Toni River was almost 10 times higher than that in the Tina River. Fish diversity was also higher in the Toni River. This is probably because the Toni River provides a more stable aquatic environment than the Tina River, where the velocities were higher and amount of sand movement greater.

Fish passage

The suggested environmental flow will not be an impediment to fish passage between the power house and dam. The fish in the river are either swimming species or climbing species. It does not appear to be feasible to provide passage facilities for the swimming species (kuhlia and grunters), because such facilities would be prohibitively expensive and the success of any design would be uncertain. However, it is relatively easy to provide upstream passage for the gobies and eels by installing a trap and haul system. This would comprise a simple ramp into a trap. The fish in this trap would be transferred into the reservoir at intervals of 3-7 days. The advantages of a trap and haul system are that it is simple and inexpensive, it can be operated by local people and it would provide a record of fish migrations. If kuhlia and/or grunters accumulate at the powerhouse or base of the dam, it will be possible to net them and transfer them to other locations.

Downstream passage for adult eels could be facilitated by spilling water at the start of the wet season when adult eels are observed congregating at the dam face. In addition, it would be possible to operate the reservoir at a slightly higher level, to increase the probability of spill early in the wet season.

Mitigation measures

The environmental flow is one mitigation measure, and probably the most important, as this will maintain the aquatic habitat and fish populations.

Provision of fish passage is another measure that will sustain fish communities in the upper river. Sudden increases in water level can be dangerous to people in the river bed and it might be advisable to ramp up generation from minimum to maximum load over a period of 1 to 1.5 hours to give people sufficient warning of increasing flows. Sudden reductions in water level can strand fish. Therefore, it is recommended that an adaptive management approach be taken to determining whether ramping flows are needed to mitigate potential fish stranding. This would involve carrying out studies during initial operation to determine whether fish are stranded on sudden reductions in flow. If necessary, the rate of flow reduction (i.e., ramping rate) could then be reduced to see if that prevents stranding.

Part of the river upstream of the dam will change from a river to a lake. Lakes are rare on Guadalcanal, so this provides the potential for improved access, and recreational activities.

1 Introduction

The Tina River was selected as a possible river for hydropower development because it is close to Honiara and, because it drains from the highest region of Guadalcanal, is a relatively large river with a substantial flow.

The Tina River Hydropower development has been studied in some detail since 2006, and various options for dam sites and dam heights have been investigated. The preferred option is known as phase 3 option 7c, and is described by Entura (2014).

A study of the aquatic ecology of the Tina River catchment (Environmental and Social Impact Assessment ESIA) has been carried out. This comprised a review of existing information on fish species in the catchment, a fisheries field survey in the dry season from 20 July to 06 August 2013, plus discussions with fisherman and other river users regarding their observations of fish. A second fish and water quality survey was carried out in the wet season (February 2014), which included the sampling sites used in the 2013 dry season survey, as well as measurements and observations obtained at the dam site (option 7c).

These fish surveys provide good information on the fish species and their distribution within the Tina River catchment, as well as a description of the physical environment at sampling sites. However, the ESIA report acknowledged that there is limited knowledge about habitat use, life history, time of migration, and the ability or willingness of fish species to pass potential barriers, such as waterfalls and rapids. Consequently, Measurements were made of fish numbers, water depth and velocity, and substrate in the Toni and Tina rivers and these data were used to derive habitat suitability models for common species.

The potential effects of the Tina River hydropower development on fish are discussed in Annex 1 of the ESIA and in the engineering report by Entura (2014). Both reports considered that further work should be carried out to determine ecological effects, environmental requirements and possible mitigation measures.

An instream habitat survey of the Tina River was carried out to develop an instream habitat model that predicts how physical habitat in the river between the dam and powerhouse locations varies with flow. This model, in conjunction with habitat suitability models, was used to determine the effects of flow changes on fish habitat in the Tina River.

This report uses the results of the instream habitat modelling plus information in the ESIA and Entura report, to assess potential impacts in three areas: downstream of the powerhouse tailrace, between the tailrace and the dam, and upstream of the dam. In particular, the study addresses:

- the issues of environmental flow requirements between the dam and tailrace, as well as downstream of the tailrace;
- the potential effects of hydro-peaking on fish;
- the effect of reduced sediment load downstream of the dam on river morphology; and
- the potential effects of the dam on fish distribution and possible fish passage options.

Although the report considers changes to river morphology, changes in water temperature, and effects on algal accumulation, the focus is on fish because maintenance of the fish community at an acceptable level is considered an appropriate management goal for an environmental flow.

2 Methods of determining environmental flow requirements

Long-term solutions to river flow management need to take a holistic view of the river system, including geology, fluvial morphology, sediment transport, riparian conditions, biological habitat and interactions, and water quality, both in a temporal and spatial sense.

The instream flow incremental methodology (IFIM; Bovee 1982) is an example of an interdisciplinary framework that can be used in a holistic way to determine an appropriate flow regime by considering the effects of flow changes on instream values, river morphology, physical habitat, water temperature, water quality, and sediment processes (Fig. 1). Its use requires a high degree of knowledge about seasonal and life-stage requirements of species and inter-relationships of the various instream values or uses.

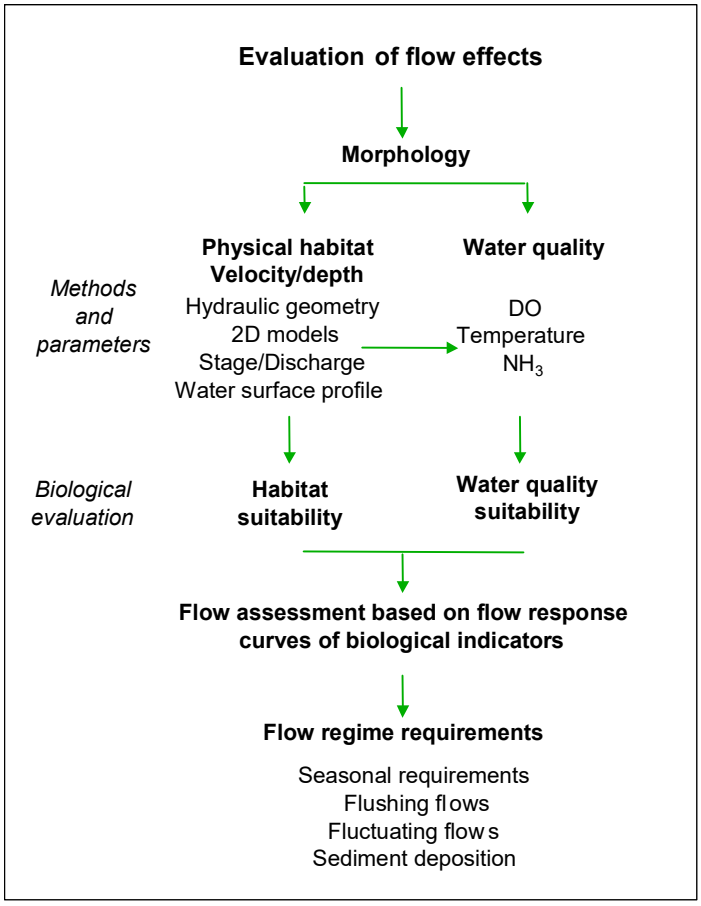


Figure 1: A framework for the consideration of flow requirements.

Other flow assessment frameworks are more closely aligned with the "natural flow paradigm", a concept that emphasises the need to partially or fully maintain or restore the range of natural intra- and interannual variation of hydrologic regimes in order to protect native biodiversity and the

evolutionary potential of aquatic, riparian and wetland ecosystems (Poff et al. 1997). The range of variability approach (RVA) and the associated indicators of hydrologic alteration (IHA) allow an appropriate range of variation, usually one standard deviation, in a set of 32 hydrologic parameters derived from the 'natural' flow record (Richter et al. 1997). The implicit assumption in this method is that the natural flow regime has intrinsic values or important ecological functions that will be maintained by retaining the key elements of the natural flow regime. Arthington et al. (1992) described a holistic method that considers not only the magnitude of low flows, but also the timing, duration and frequency of high flows. This concept was extended to the building block methodology (BBM), which "is essentially a prescriptive approach, designed to construct a flow regime for maintaining a river in a predetermined condition" (King et al. 2000). It is based on the concept that some flows within the complete hydrological regime are more important than others for the maintenance of the river ecosystem, and that these flows can be identified and described in terms of their magnitude, duration, timing, and frequency.

A holistic consideration of every aspect of flow and sediment regime, river and riparian morphology, and their associations with the life cycles of the aquatic biota requires a degree of knowledge about individual rivers that is rarely available. The aim of the minimum flow is to retain adequate water depths and velocities in the stream or river for the maintenance of the critical values. Most flow assessments and habitat suitability criteria consider physical habitat at a meso- to macro-habitat level rather than microhabitat. In this way, suitable average depths and velocities can be maintained in the main habitats, with a degree of habitat diversity that is generated by the morphology of the river, and is largely independent of flow. The geomorphological and flow-related ecological processes that are associated with low to median flows are generally taken into consideration in instream flow methods. However, fish passage or seasonal flow requirements may need to be investigated in situations where fish passage may be an issue or where the species has distinct seasonal habitat requirements. Consideration should also be given to downstream effects. The effect of an abstraction is usually greatest immediately below the abstraction site, but diminishes as the river flow is supplemented by contributions from tributaries and the proportional change in flow reduces.

Instream flow methods can be classified into two basic types; historic flow and hydraulic-habitat methods. Historic flow methods are coarse and largely arbitrary. An ecological justification can be argued for the mean annual low flow (MALF) and retention of the natural flow regime, and the concept of a low flow habitat bottleneck for large brown trout has been partly justified by research (e.g., Jowett 1992), but setting flows at lower levels (e.g., the 5 year 7 day low flow — $Q_{7,5}$) is rather arbitrary. Hydraulic-habitat methods have a direct link to habitat use by aquatic species. They predict how physical habitat (as defined by various habitat suitability models) varies with flow, and the shapes of these curves provide the information that is used to assess flow requirements. Habitat based methods allow more flexibility than historic flow methods, offering the possibility of allocating more flow to out-of-stream uses while still maintaining instream habitat at levels acceptable to other stakeholders (i.e., the method provides the necessary information for instream flow analysis and negotiation).

The ecological goal of habitat methods is to provide or retain a suitable physical environment for aquatic organisms that live in the river. Habitat methods tailor the flow assessment to the resource needs and can potentially result in improved allocation of resources. The consequences of loss of

habitat are well known; the environmental bottom line is that if there is no suitable habitat for a species it will cease to exist. It is essential to consider all aspects such as food, shelter, and living space (Orth 1987; Jowett 1995) and appropriate habitat suitability curves are the key to the successful application of habitat based methods.

The procedure in an instream habitat analysis is to select appropriate habitat suitability curves or criteria (e.g., Fig. 2), and then to model the effects of a range of flows on the selected habitat variables in relation to these criteria. The habitat suitability index (HSI) at each point was calculated as a joint function of depth, velocity and substrate type using the method shown in Figure 2. The area of suitable physical habitat, or weighted usable area (WUA), was calculated by multiplying the area represented by each point by its joint habitat suitability. Using the example in Figure 2, a given point in the river (representing an area of reasonably uniform depth and velocity) where the depth is 0.1 m, depth suitability is only 65% optimal, according to knowledge of the depth requirements of the fish. Similarly, the velocity recorded at the point is 0.25 m/s, which is optimal (suitability weighting of 1), and the substrate is fine gravel (sub-optimal, with a weighting of 0.4) and cobbles (optimal with a weighting of 1). Multiplying these weighting factors together we get a joint habitat suitability weighting of 0.455 for that point in the river for the selected fish species. If the depth had been 0.2 m and there had been only cobbles, then that point in the river would have been optimal (i.e., 1 for depth $\times$ 1 for velocity $\times$ 1 for substrate = 1). This exercise was repeated within the habitat assessment model for the depth/velocity/substrate types in every grid square across the river, and the area covered by each square was multiplied by the point suitability. These areas, which have been weighted by their respective point suitability values, were then summed to give a measure of total area of suitable physical habitat for the given species at the given flow. This process was then repeated for a series of other flows with the depths, velocities, and habitat suitability being modelled for the new flows as described above. The total area of suitable physical habitat was then plotted as a function of flow to show how the area of suitable physical habitat for a given species changes with flow. Variations in the amount of suitable habitat with flow are then used to assess the effect of different flows for target organisms. Flows can then be set so that they achieve a particular management goal, such as an objective in a regional plan.

The flow related habitat metrics used to quantify instream habitat are weighted useable area (WUA m^2/m) and the average habitat suitability index (HSI) (Bovee 1982; Stalnaker et al. 1995). HSI is numerically equivalent to WUA divided by the wetted river width.

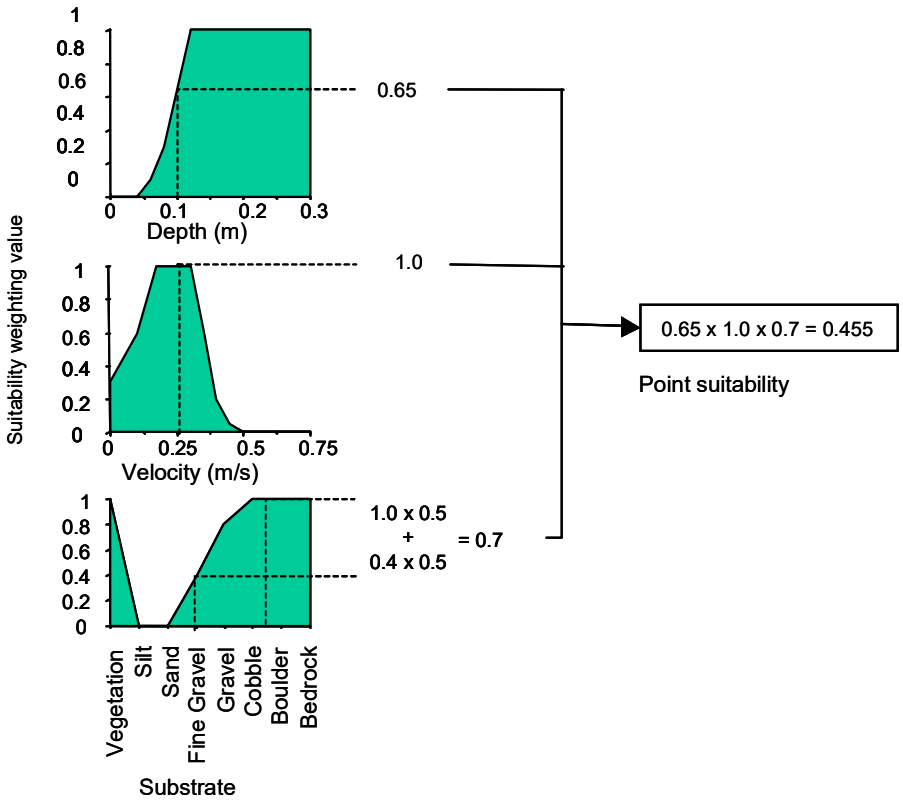


Figure 2: Calculation of habitat suitability for a fish species at a point with a depth of 0.1 m, velocity of 0.25 m/s, and substrate comprising 50% fine gravel and 50% cobble. The individual suitability weighting values for depth (0.65), velocity (1.0), and substrate (0.7) are multiplied together to give a combined point suitability of 0.455.

Various approaches to setting levels of protection provided by a minimum flow have been used, from maintaining a maximum amount of habitat, a percentage of habitat at median flow, or using a breakpoint (or "inflection point") on the habitat/flow relationship (Jowett 1997). While there is no percentage or absolute value associated with a breakpoint, it is a point of diminishing return, where proportionately more habitat is lost with decreasing the flow than is gained by increasing the flow.

Habitat methods can also incorporate flow regime requirements, in terms of both seasonal variation and flow fluctuations. Flow fluctuations are an important component of the habitat of most naturally flowing streams. Such fluctuations remove excess accumulations of silt and accumulated organic matter (e.g., from algal mats) and rejuvenate stream habitats. Extended periods without a flow disturbance usually result in a shift in benthic community composition, such as a reduction in diversity and an increase in biomass of a few species.

3 Tina River

The Ngalimbui River is a large river draining in a northerly direction from some of the highest peaks (2000+ m) on the island of Guadalcanal. The river has two main tributaries, the Tina and Toni rivers. The Tina River catchment is more than three times larger than the Toni River. The catchment area of the Tina River is about 150 km^2 compared to 45 km^2 for the Toni River. The Tina River contains a diverse fish community and is unaffected by human development in its upper reaches. The gradient of the river increases with distance upstream (Table 1). Downstream of the Tina/Toni confluence the gradient is 2.3 m/km. This increases to about 5 m/km between the Tina/Toni confluence and the powerhouse site. Upstream of this the gradient continues to increase and is an average of about 9.3 m/km through the reach between the dam and powerhouse, and is steep (19 m/km) between the dam and the head of the proposed reservoir.

Table 1: Distance, elevation and gradient of key sections of the Tina River.

Location	Distance from sea (km)	Elevation (m amsl)	Gradient (m/km)
Estuary	0	0	0.0
Tina/Toni confluence	19	43	2.3
Powerhouse site	24.7	73	5.2
Dam site	30.1	123	9.3
Proposed reservoir reach	32.7	172	18.8

The changes in gradient with distance upstream are reflected in the substrate and morphology. In the lower reaches downstream of the Tina/Toni confluence, the river is relatively wide and the substrate is dominated by sand and gravel. The bars and braiding are evidence of bedload movement during floods. From the Tina/Toni confluence to approximately 1 km upstream of Tina Village the river gradient is low, and the river unconfined with a substrate comprised of cobble, gravel and sand. The aquatic habitat comprises mainly wide runs and riffles. Upstream of this, the river becomes steeper and more confined and boulders are present, as well as cobbles, gravel and sand. The runs and riffles are generally narrower, with occasional rapids and places where the river splits into two channels. There are also pools which form where the river flows against a bedrock bank and changes direction. Upstream of the powerhouse site, the river becomes even more confined and steeper (50 m in 5.4 km).

On 6 March 2016, habitat types were identified and their lengths estimated between Tina Village and a point about 1.5 km downstream of the dam site. The flow on that day was measured at 8.7 m^3/s. The habitat types were classified into pools, runs, riffles and rapids according to their surface characteristics. The water surface in pools was smooth and the water was relatively deep (>1.5 m). At high flows (>8 m^3/s) the water velocity in the pools was noticeable (Fig. 3). The water surface of runs was usually wavy and broken by boulders (Fig. 4). Riffles were shallower than runs and contained more broken water (Fig. 5) and rapids were steep torrents over boulders (Fig. 6).

Figure 3: Pool formed against cliff

Figure 4: Run

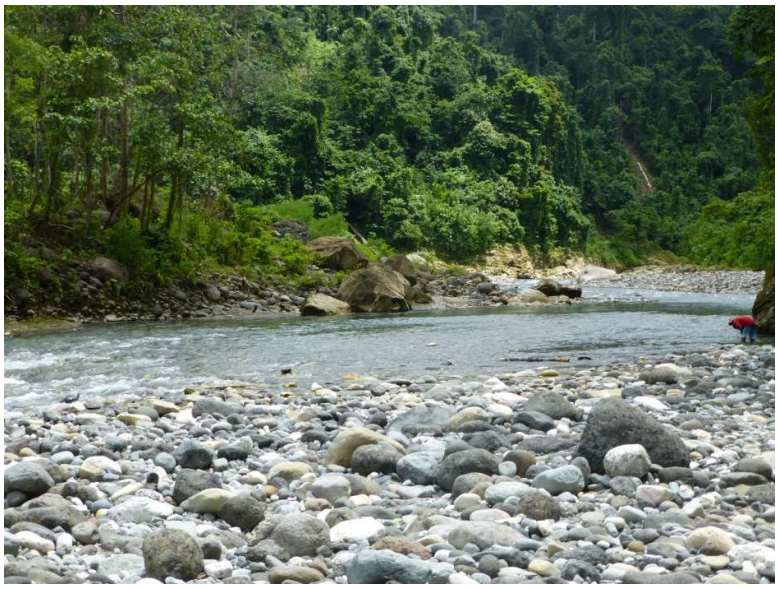


Figure 5: Run transitioning into riffle

Figure 6: Rapid and riffle habitat

Overall, the swift water habitat types were more frequent upstream of the powerhouse site than downstream of it, but the average length of each habitat type tended to be shorter because the river was more constrained by its steep banks (Table 2).

Table 2: Percentage of habitat types between Tina Village, powerhouse site and dam site on 6 March 2016.

Habitat type	1 km upstream of Tina Village to powerhouse site	Upstream of powerhouse to 1.5 km downstream of dam site
Rapid	5%	5%
Riffle	31%	36%
Run	55%	46%
Pool	9%	13%

3.1 Hydrology

A flow measurement and rainfall station was established at the commencement of the Phase 1 study in the upper Tina River catchment to provide flow data for the river. The flow station was operational from 15 June 2010 to 3 April 2014, providing approximately 4 years of river flow data. The water level recorder was located about 7 km upstream of the dam site and recorded flow data were multiplied by the ratio of the catchment areas (125/115) to provide a flow record at the dam site (Entura 2015a). The derivation of the river flows used in this report is described in detail by Entura (2015a).

Table 3: Flow statistics for Tina River at Dam site (for period 16 June 2010-3 April 2014) derived from daily mean flows.

Mean flow	14.85 m^3/s
Mean annual flow (for complete years only)	15.87 m^3/s
Median flow	11.87 m^3/s
Coefficient of Variation	0.89
Fre3 (frequency of flows > 3 x median per year)	6.3
MALF (mean annual 1-day low flow for complete years)	4.83 m^3/s
MALF (mean annual 7-day low flow for complete years)	5.27 m^3/s

The recorded (2010-2014) median flow of the Tina River at the dam site (Option 7c) was approximately 11.9 m^3/s (Table 3) with higher mean and median flows during the wet season (October-May) than the dry season (Figure 7). The annual minimum daily flow varied from 2.9 m^3/s in 2010 to 5.8 m^3/s in 2012, and can occur between June and September.

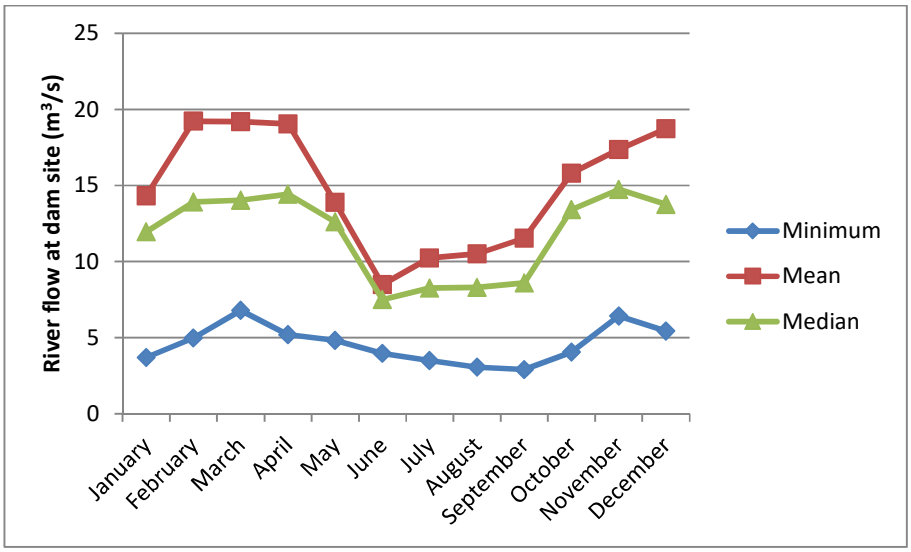


Figure 7: Monthly average flows in the Tina River at dam site (2010-2014)

To estimate the long-term flow statistics, Entura (2015a) simulated 30 years of rainfall and flow data from rainfall data recorded at Henderson Field, and showed that the statistical characteristics of the simulated rainfall series were similar to those of the rainfall recorded in the Tina River catchment (Chupukarma). Entura fitted a hydrological model to the 4 years of flow and rainfall data, and used this model to produce 30 years of simulated flow record. This showed that the period 2010-2014 was probably a period of slightly higher than normal flows (Table 4). The median flow was 10.78 m^3/s compared to 11.87 m^3/s for the short-term flow record. A flow of 18 m^3/s was exceeded for 18% of the time with the long-term record, and for 22% of the time for the short-term record (Fig. 8).

Flows at the dam site were obtained by scaling the recorded flows by the proportion of the catchment area at the dam site (125 km^2) by the catchment area at the recorder site (115 km^2). With the strong south to north rainfall gradients that probably exists, there is a risk that this scaling might slightly over-estimate flows at the dam site.

Table 4: Simulated flow statistics for Tina River at Dam site (January 1975-24 December 2003)

Mean flow	13.10 m^3/s
Mean annual flow (for complete years only)	12.91 m^3/s
Median flow	10.78 m^3/s
Coefficient of Variation	0.69
Fre3 (frequency of flows > 3 x median per year)	4.83
MALF (mean annual 1-day low flow for complete years)	4.56 m^3/s
MALF (mean annual 7-day low flow for complete years)	5.09 m^3/s

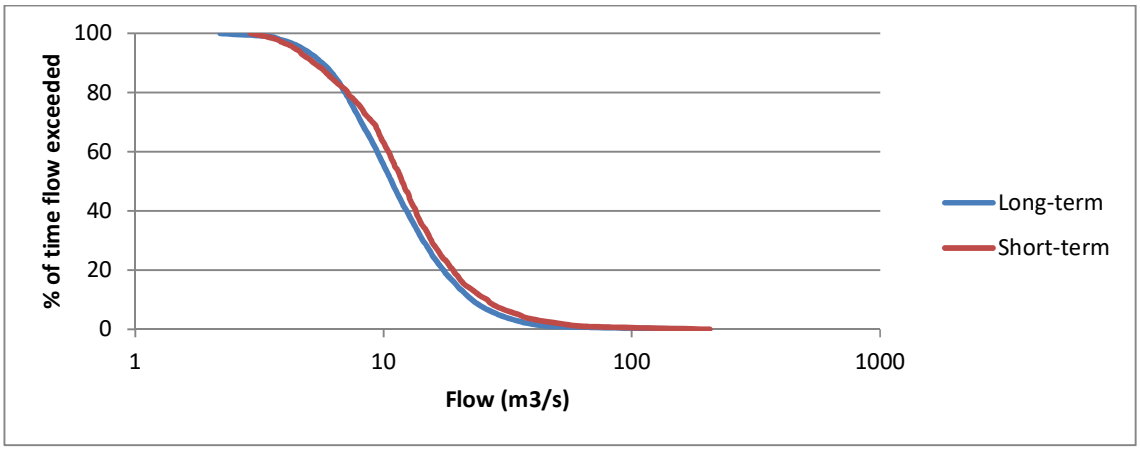


Figure 8: Flow duration curves for long-term synthetic flows in the Tina River at dam site (2010-2014) and short-term recorded flows (16 June 2010 to 3 April 2014).

4 Description of power scheme

The preferred option, known as Phase 3 - Option 7c, is described by Entura (2014). The proposed dam is located approximately 30 km upstream of the mouth of the river and about 11.7 km upstream of the Toni River confluence. The development comprises an approximately 55 m high dam with a 3.3 km headrace tunnel leading to a powerhouse and tailrace from which the water is discharged back into the Tina River.

The operating range of the reservoir formed by the dam will be 5 m. However, the reservoir will normally be held about 3 m below full stage to increase utilisation by storing water during floods and freshes. Initially, the power house will have three generator/turbine units, each with a capacity of 5MW, allowing a maximum discharge of about 18 m^3/s and a minimum discharge of about 2.4 m^3/s. Provision will be made for a fourth unit, should it be required in the future.

At the dam site the river elevation is approximately 123 m amsl and the catchment area is about 123 km^2. At the tailrace location the elevation is about 73 m amsl, and the catchment area is about 133 km^2. The river distance between the dam and tailrace is 5.4 km.

4.1 Power station operation

The power station will be operated to maximise power generation, so that during periods of high flow the station will be at full generation for much of the time. However, during low flows in the dry season, the river flow will be considerably less than the maximum generating capacity. During these periods, the station will operate on a daily/weekly cycle, generally following the load demand with maximum generation up to 18 m^3/s on weekdays during working hours, then shutting down during the night, as shown in Fig. 9. From an environmental perspective, it would be preferable for the night generation to reduce to minimum machine discharge (2.4 m^3/s) rather than zero flow. This will reduce the magnitude of fluctuations in flows, and better meet environmental flow requirements in the Tina River between the tailrace and Toni River confluence.

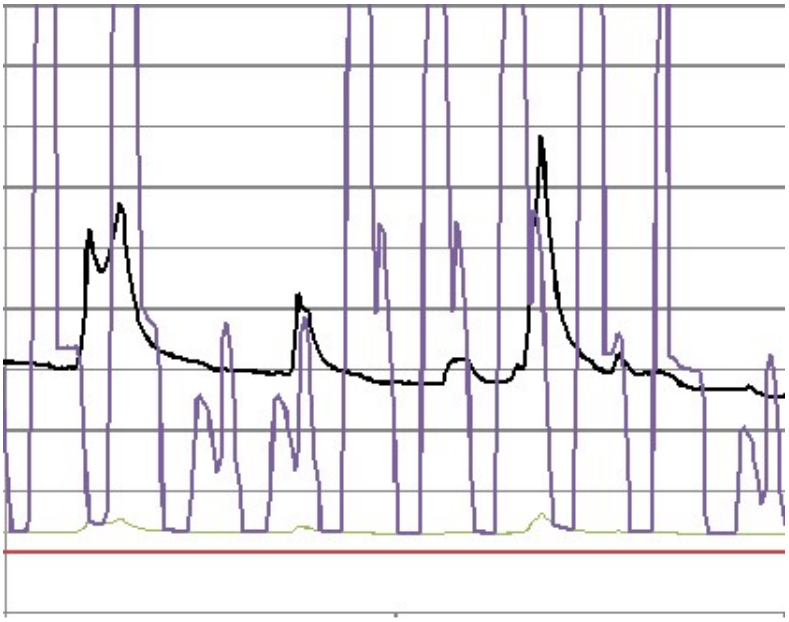


Figure 9: Likely operation of power station during low flows showing inflow in black and power station discharge in blue (Entura 2014)

4.1.1 Operation modelling

Power station operation was simulated for the 3.3 years of hourly flow data (15 June 2010 to 21 September 2013) that were available. The simulation assumed that generation was maximised with a maximum generation rate of 18 m^3/s, and that the minimum generation was 2.4 m^3/s. The environmental flow downstream of the dam was assumed to be 1 m^3/s. The normal operating level was assumed to be 172 m amsl, with the spillway invert at 175 m amsl. This provides 3 m of water storage during floods and freshes to reduce the incidence of spill events. The reservoir area is relatively small and was assumed to be 0.284 km^2. The ogee spillway width was taken as 45 m, with a discharge formula of 2.03*45*(Reservoir level of 175 m amsl)^1.5, calculated assuming the spill capacity at 185.9 m amsl is 3300 m^3/s (Entura 2014).

The simulation of power station operation showed that spill flows could occur in any month (Fig. 10). The mean inflow over the simulation period was 14.8 m^3/s and mean flow of the river between the dam and the powerhouse would be about 3.5 m^3/s, comprising 1 m^3/s environmental flow and 2.5 m^3/s of spill (Table 5). Tributary flows, between the dam and powerhouse, would increase the mean environmental flow by up to 8%, but this would mainly be during, and just after, storms. Flows in the river would be 1 m^3/s for about 88% of the time. The average reservoir level would be about 172.8 m amsl, and the average flow through the powerhouse would be approximately 11.3 m^3/s, giving utilisation of about 82% of the available water, excluding the environmental flow.

For the period simulated assuming a 1 m^3/s environmental flow, it is estimated that the annual energy generation from the powerhouse and environmental flow generator could be about 82.2 GWh/a and 3.8 GWh/a, respectively, for a total of 86 GWh/a. When reduced for transmission losses of about 1.2 GWh/a, the annual output is close to Entura's estimate of 84.7 GWh/a (Table 11.14

Entura 2014). If the environmental flow were increased to 3 m^3/s, the annual energy generation from the powerhouse and environmental flow generator could be about 71.5 GWh/a and 11.3 GWh/a, respectively, or a decrease of about 3.7%. For the environmental flow generator at the dam, it was assumed a tailrace level of 123 m amsl and a generation efficiency of 88%. At the powerhouse, it was assumed a tailrace level of 73 m amsl, an efficiency of 89%, and total hydraulic losses of $0.02179*Q^2$ (Entura 2014).

The median and mean flows for the period 15 June 2010 to 21 September 2013 were 11.1 m^3/s and 14.8 m^3/s, respectively (Table 5), compared to the estimated long-term median and mean flows of 10.78 m^3/s and 13.1 m^3/s, respectively (Entura 2015a).

To check the long-term energy generation, generation for the 30 years of synthetic daily flows was simulated on an hourly time step. The use of daily data for the simulation was checked by converting the short-term record for the period 15 June 2010 to 21 September 2013 to daily means, and then using these daily means to simulate operation. This showed that simulation with hourly and daily data produced similar results. The mean inflow over the 30-year simulation period was 13.1 m^3/s, and mean flow of the river between the dam and the powerhouse was about 2.3 m^3/s, comprising 1 m^3/s environmental flow and 1.3 m^3/s of spill. The average reservoir level was approximately 172.55 m amsl, and the average flow through the powerhouse was about 10.8 m^3/s, providing utilisation of about 89% of the available water, excluding the environmental flow. The average generation was reduced by 3.5% from 86 Gwh/a for the 2011 to 2013 period, to 83.0 Gwh/a for the synthetic 30-year record. This is a slightly less than the reduction of 5% calculated by Entura (Table 3.9, Entura 2015b).

According to Entura (2014), in the early years of operation (2018), average Honiara power demand will range from 8.2MW to 15.8MW. However, in 2035, average power demand is expected to range from 15.4MW to 29.7MW. For the purposes of the present analysis, it was assumed that generation was maximised, i.e., by 2035 there will likely always be demand for the power generated .

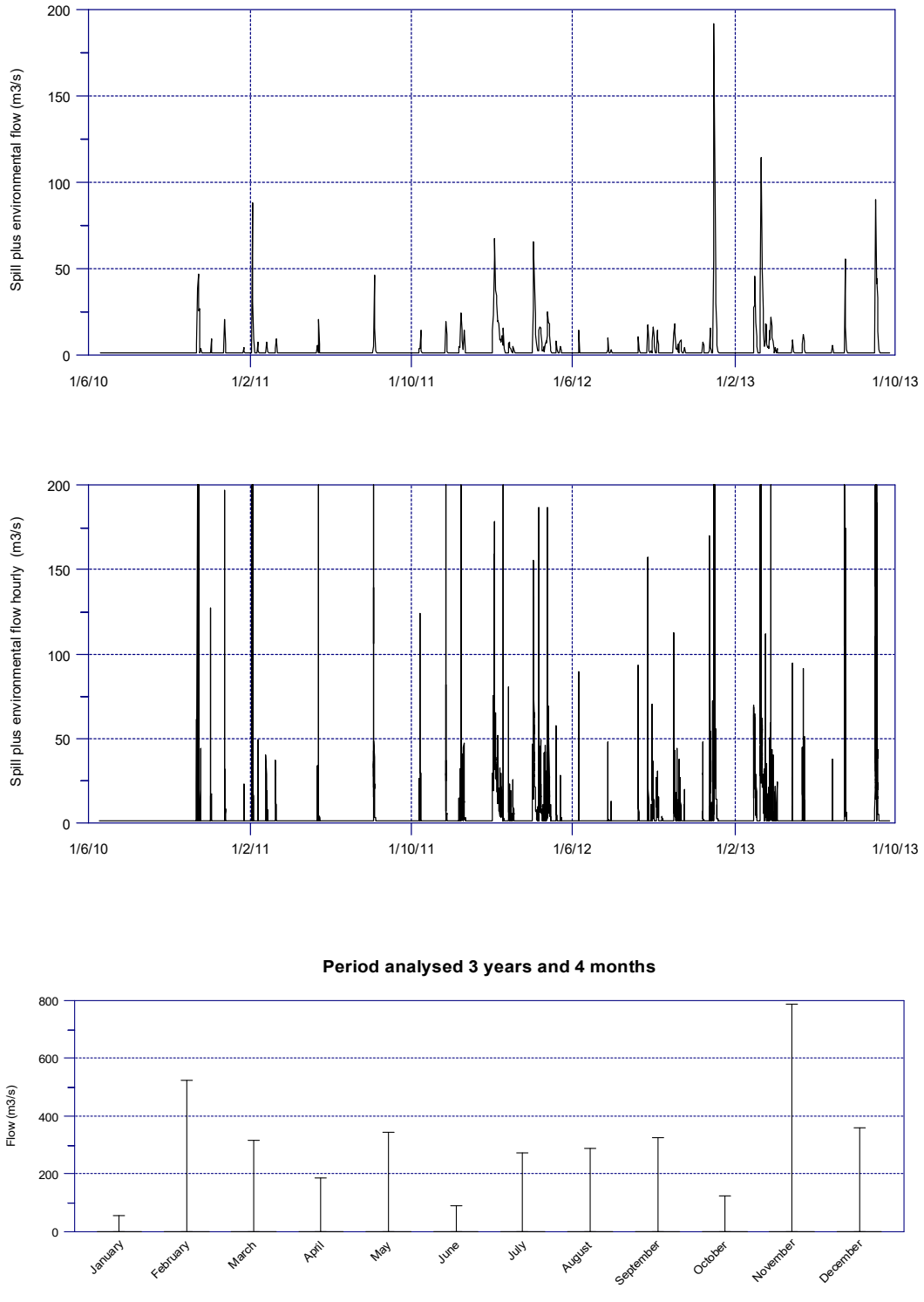


Figure 10: Simulated daily mean spill flows (upper), hourly flows (middle) and monthly maximum hourly spill flows (lower).

Table 5: Simulated flow statistics for the period (15 June 2010 to 21 September 2013 for the river between dam and powerhouse

	Environmental flow	**Natural flow**
Mean flow	3.5	14.8
Median flow	1.0	11.1
Coefficient of Variation	4.6	1.2
MALF (mean annual 1-day low flow for complete years)	1.0	4.2
MALF (mean annual 7-day low flow for complete years)	1.0	4.3

4.1.2 Occurrence of floods and freshes (spill events) in the residual river

Hydroelectric operation was simulated using hourly data, and daily means were calculated from the hourly flows. Spill events, that would flush the channel and remove any fine sediment deposits and algal accumulations (Table 6), would occur relatively frequently, with 9.5 events per year (every 5.5 weeks on average). These would be of relatively short duration (4 to 6 days), but 5% of the spill events could last for longer than 23 days. A spill event of 6 days means that there will be spill on 6 successive days, but without necessarily spilling continuously for 6 days. An examination of hourly spill showed that a spill event of 6 days could be made up of a number of spills that were shorter duration than a day. This happens when flows are high, the reservoir is at full control level, and afternoon thunderstorms requiring spill releases cease early the next day, as shown in Fig. 11.

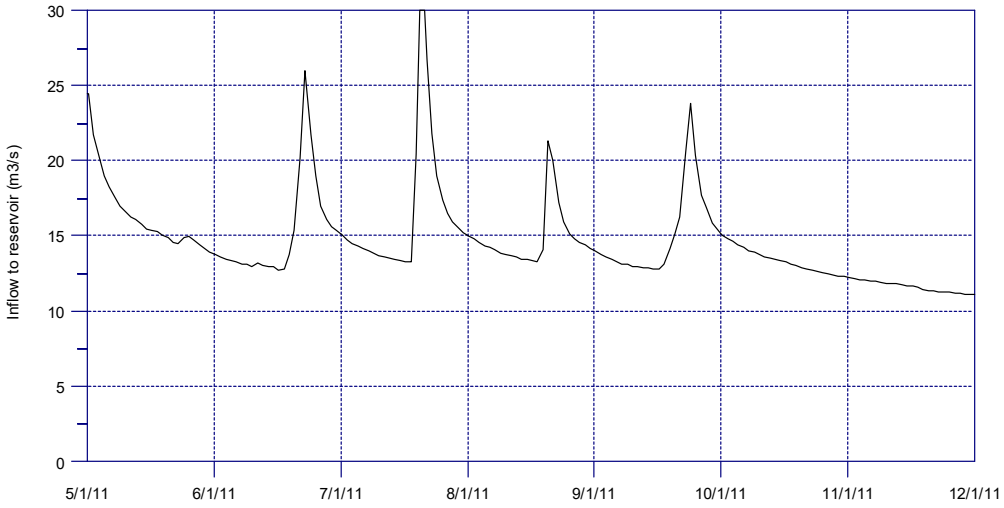


Figure 11: Example of inflow sequence that triggers short duration spill events over a number of days.

Table 6: Frequency and duration of spill events in the residual river

Number of days that the flow > 1 m^3/s per year	58
Average number of contiguous events per year	9.5
Mean duration	6.1
Maximum duration	30
Duration equalled or exceeded by 5% of events	23.4
Duration equalled or exceeded by 25% of events	6.0
Median duration	4.0
Duration equalled or exceeded by 75% of events	3.0
Duration equalled or exceeded by 95% of events	1.4

5 Fish species in the Tina River

5.1 Diversity

The fish fauna of the Solomon Islands is diverse, with the total number of species potentially numbering as high as 100. Polhemus, et al (2008), report a total of 43 species from 31 sites in the Solomon Islands and Jenkins & Boseto (2007) report 60 species from 15 sites in lakes and rivers of Tetepare Island. Surveys of the Tina River (ESIA) report 76 fish species. However, many of these species are predominantly marine species that are found in the estuaries. No fish species are believed to be endemic to the Tina River, although it is possible that some gobies are endemic to the Solomon Islands (ESIA). Tilapia have been found in still water of the Lower Toni River (Robson Hevalao 14 July 2016) and it is likely that they would be in similar habitats in the lower Tina River. It is unlikely that tilapia or gambusia would be found in the swift flood-prone water of the upper Tina River catchment.

5.2 Distribution and species richness

The distribution of fish species observed during ESIA surveys in the Tina River catchment (Table 7) is described in the ESIA report. A total of 44 species were identified in the middle reaches (site 7c, Koropa, Sengue) and 32 species were identified upstream of the dam site (recorder site, plus 2 sites further upstream). The 44 species identified were 1 species of eel, 38 species of goby, 2 mullet species, 2 kuhlia species, 1 grunter and 1 pipefish. All of these species are reported to be migratory and require access to the sea to complete their life cycles.

Of the species observed in the middle and upper reaches of the Tina River catchment, 4 species were found in the upper catchment that did not occur in the middle catchment, and 16 species were found in the middle catchment that did not occur in the upper catchment. This suggests that some of the species in the middle catchment do not migrate to the upper part of the catchment.

Fish observations were also made in the Ngalimbui River downstream its confluence with the Toni River. The average number of species found in the Ngalimbui River (10) was less than in the Tina River (19). This difference was statistically significant in the wet season (Kruskal-Wallis, P=0.02, N=11) but not in the dry season (Kruskal-Wallis, P=0.28, N=10). The finer and less stable substrate of

the Ngalimbui River is probably the reason for the reduced species richness. However, fish were sampled using nets and snorkelling observation in the wet season, and only snorkelling observation in the dry season.

The ecological value of the Tina catchment is high because of its species richness, area and unmodified nature. However, the catchment is not unique and studies (Boseto 2016) have been carried out that show that the Tina River is similar to nearby catchments in terms of fish species composition. The river provides some food for the local people who spear the larger fish species (>70 mm) and catch the freshwater shrimps.

The amount of sediment transported, particularly sand, is an important ecological characteristic of the Tina River. Where the river is relatively narrow, such as between the dam and powerhouse sites, the river is steep and flow is concentrated in a relatively narrow cross-section. This results in considerable substrate mobility during floods and some movement of sand along the bed of the river at most flows. From a biological point of view, this creates an inhospitable environment in the deeper swifter areas of the river where there is virtually no algal growth or benthic invertebrate production and few fish.

Table 7: Distribution of fish species observed in Tina River. This table is from the ESIA and is subject to review by D. Boseto.

Species		**Reach in which species was observed**		
Scientific name	Common name	Both upper and middle	Upper alone	Middle alone
Anguilla marmorata	Eel	X		
Allamogurna sp.	Goby			X
Belobranchus spp.	Goby			X
Butis amboinensis	Goby	X		
Ophieleleotris hoedti	Goby			X
Ophieleotris sp.1	Goby	X		
Ophieleotris sp. 2	Goby	X		
Bunaka gyrinoides (Eleotris gyrinoides)	Goby			X
Awaous guamensis	Goby	X		
Awaous melanocephalus	Goby	X		
Awaou ocellaris	Goby	X		
Awaous sp.	Goby		X	
Bathygobius andrei	Goby	X		
Glossogobius celebius	Goby			X
Lentipes multiradiatus	Goby	X		
Lentipes sp.1(Solomonensis)	Goby	X		
Lentipes sp. 2(Solomonensis)	Goby	X		
Redigobius bikolanus	Goby	X		
Schismatogobius ampluvinculus	Goby			X

Species		Reach in which species was observed		
Scientific name	Common name	Both upper and middle	Upper alone	Middle alone
Schismatogobius roxasi	Goby			X
Sicyopterus lagocephalus[*]	Goby	X		
Sicyopterus longifilis	Goby		X	
Sicyopterus ouwensi	Goby	X		
Sicyopterus sp.	Goby			X
Sicyopus discordipinnis	Goby	X		
Sicyopus mystax	Goby			X
Sicyopus sp.1	Goby	X		
Sicyopus sp.2	Goby			X
Sicyopus zosterophorum	Goby	X		
Stenogobius hoesei	Goby			X
Stiphodon pelewensis[**]	Goby	X		
Stiphodon autopurpureus	Goby	X		
Stiphodon birdsong	Goby	X		
Stiphodon multisquamus	Goby	X		
Stiphodon ornatus	Goby	X		
Stiphodon rutilaureus	Goby			X
Stiphodon semoni	Goby	X		
Stiphodon sp.1	Goby		X	
Stiphodon sp.2	Goby			X
Rhyacichthys aspro	Loach goby	X		
Kuhlia marginata	Spotted flagtail	X		
Kuhlia rupestris	Jungle perch	X		
Liza vaigiensis	Mullet			X
Chelon macrolepis	Mullet			X
Microphis sp.	pipe fish			X
Mesopristes argenteus	Silver grunter		X	
Mesopristes cancellatus	Grunter	X		
Total number of species		**27**	**4**	**16**

[*] probably includes *Sicyopterus cyanocephalus*
[**] previously called *Stiphodon atratus*

5.3 Migration

Species of gobies probably spawn on stable substrate in the habitats they occupy as adults. When the larvae hatch, they are carried downstream to the sea or estuary, where they rear for 2-3 months,

before returning as juveniles to freshwater, in the dry season. The return of these juvenile fish supports a subsistence and commercial fishery. The juveniles swim upstream, sometimes in shoals, using low velocity areas, such as river margins, due to their poor swimming ability. The life cycle of gobies and the fishery for juveniles is similar to that of juvenile galaxiids (whitebait) in New Zealand (McDowall 1990).

None of the fish species whose larvae rear in the sea (e.g., eels and gobies) are believed to return to their natal habitats. The goby larvae rear in near shore environments and are attracted by freshwater plumes when they move into freshwater as juveniles. However, numerous small (10 mm) gobies were observed in the margins of the Tina River between the dam and powerhouse sites in July 2016. The distance upstream and the number and size of these fish suggest the possibility that not all species of gobies require access to the sea to complete their life cycles. Unreported otolith studies also suggest that not all larvae of Sicydiinae gobies reared in the sea (Boseto 2016).

Eels, kuhlia and possibly grunters migrate downstream as adults to spawn and the juveniles migrate upstream to the adult habitats. Eels migrate downstream in late November, at the start of the wet season, spawn in the ocean, and die after spawning. Adult eels probably migrate to a spawning location in the Pacific Ocean. The larvae (Leptocephali) feed in the ocean until they develop into glass eels (juveniles), at which time they move into freshwater. Juvenile eels begin their upstream migration at the start of the dry season in May and, because they are excellent climbers, are able to migrate to high elevation reaches. Conversely, kuhlia are a swimming species with no climbing ability, but have been found up to 300 m above sea level. They can spawn several times, migrating downstream to the estuary at the start of the wet season (December). The extent and timing of the return of post-spawning adults is unknown. After rearing in the estuary or near-coast, juvenile kuhlia migrate upstream in the dry season (April/May).

Mullet are essentially a marine swimming species that rarely travel upstream past passage barriers such as rapids. Grunters and pipefish are swimming species that probably spawn in the estuary. Little is known about the timing of their migrations but the grunters negotiate rapids to high elevation reaches.

Most of the species found upstream of the dam site (option 7c) will have good climbing abilities. The kuhlia and grunters (Mesopristes) are probably the only swimming species that are found upstream of the dam site.

5.4 Habitat use

There is little published information about the types of habitat used by Tina River fish species. No specific information is available on the water depths, velocities and substrates in which they are found. Gobies are usually found in riffles, where coarse substrate (boulders, cobbles and large gravels) provide both shelter from the current, and a food resource. Pools provide habitat for large eels, grunters and kuhlia. Measurements of fish species and number, water velocity and depth and substrate composition in small areas (2-4 m^2) were made on 11 March 2016 and 13-14 July 2016 to determine habitat suitability for common fish species in the Tina River.

Very little is known about the factors controlling fish populations in the Solomon Islands. As in New Zealand, most Solomon Island fish species will have evolved to cope with the conditions they experience. Eels and most gobies are capable climbers and can penetrate to the headwaters of most

rivers. The diadromous life history protects their early life stages from the vagaries of the riverine environment, such as strong and variable currents caused by floods and freshes. The overwhelming influence of diadromy suggests that total fish numbers and diversity in a given reach will depend on access to the sea, with instream habitat controlling the density of fish within a given reach.

6 Method for determining environmental flow requirements

6.1 Habitat modelling

Modelling of instream habitat availability for selected species, over a range of flows, is a valuable tool when assessing potential effects of flow changes and making decisions about environmental flow requirements. This method is one of the most commonly used methods of assessing flow requirements (Tharme 2003). The background to methods used here is discussed in Jowett et al. (2008).

Habitat modelling entails measuring water depths and velocities, as well as substrate composition, across a number of stream cross-sections at a given flow (referred to as the survey flow). Points on the banks, above water level, along the cross-sections are also surveyed to allow model predictions to be made at flows higher than the survey flow. Calibration data for fitting rating curves are obtained from additional measurements of water level at each cross-section, relative to flow, on subsequent visits. The stage (water level) with no flow in the river (stage of zero flow) is also estimated at each cross-section to help fit rating curves. These data allow calibration of a hydraulic (instream habitat) model to predict how depths, velocities and the substrate types covered by the stream will vary with discharge in the surveyed reach.

The habitat suitability at each point in the reach is calculated from modelled depth, velocity and substrate from habitat suitability curves[1] (HSC). Habitat suitability weighted by the area represented by each point is summed over the reach to give area weighted suitability (AWS previously known as WUA weighted usable area) with units of m^2/m. The average habitat suitability of a given reach is the AWS divided by the wetted area of the river and is a dimensionless number between 0 (totally unsuitable and 1 (ideal). Habitat modelling is undertaken over a range of flows to predict how habitat availability (AWS) and average habitat suitability will change with flow.

6.1.1 Habitat mapping

The first step in the process is to carry out habitat mapping along the length of the reach between the dam and tailrace locations. The habitat types are assessed in the field after traversing the affected reach. The habitats would typically be classified as riffle, run, pool, and rapid. The length and location of each habitat type is recorded. The habitat mapping between Tina Village and the dam site was carried out on 6 March 2016 and is presented in Table 2.

6.1.2 Cross-section selection

The number of cross-sections required depends on the morphological variability within the river, with homogenous stretches of river requiring fewer cross-sections than stretches that are highly varied morphologically. Studies have shown that relatively few cross-sections can reproduce the

[1] HSC describe the suitability of different depths, velocities and substrate sizes for given species of interest.

results from a survey in which a large number of cross-sections were sampled (see Jowett et al. 2008 for details).

The total number of cross-sections needed to generate a robust result should be proportional to the complexity of the habitat hydraulics, with 6 to 10 sampled for simple reaches and 18 to 20 for diverse reaches.

Each cross-section is given a percentage weighting based on the proportion of the habitat type in the reach that it represents. The underlying assumption is that the cross-sections measured provide a reasonable representation of the habitat throughout the reach. Reach results can be extended to longer sections of river, if the flows, river gradient and morphology do not change significantly.

Surveys of the river were carried out on 6-9 March 2016 and 11-15 July 2013. During the first survey, the proportion of the different habitat types was measured and cross-sections were identified in each of the habitat types. A large flood that occurred on the second day of the survey and removed more than half of the temporary staff gauges that had been installed. This meant that only 3 cross-sections could be surveyed. One cross-section was a wide riffle at the proposed powerhouse location and the other two were in a pool and run further upstream. Water levels were measured at flows of 8.7 m^3/s and 19.7 m^3/s and these were used to develop rating curves at each cross-section. The cross-section at the powerhouse site was selected to evaluate the effect of flow on water level between the powerhouse and Tina Village where the valley is wider than between the dam and powerhouse. Because the powerhouse cross-section was unrepresentative of the habitat between the dam and powerhouse it was excluded from the habitat analyses.

The second survey (11-12 July 2013) comprised cross-sections in 2 pools, 5 runs, 5 riffles and 2 rapids; a total of 14 cross-sections. The flow was 9.91 m^3/s on the 11 July and 9.66 m^3/s on the 12 July. Water level and flow measurements were taken on 15 July and 25 July for rating calibration when the flows were 8.28 m^3/s and 5.39 m^3/s, respectively.

6.2 Habitat suitability

It is the quality of the habitat that is provided by the flow that is important to density of stream biota, rather than the magnitude of the flow, per se. In many streams, flows less than the naturally occurring low flow are able to provide good quality habitat and sustain stream ecosystems. The magnitude of this flow will vary with the requirements of the species and with the morphology of the stream.

Water velocity is probably the most important characteristic of a stream. Without it, the stream becomes a lake or pond. In New Zealand gravel bed rivers, an average velocity of at least 0.2-0.3 m/s tends to provide for most stream life. Velocities lower than this are unsuitable habitat for a number of fish species and stream insects, and allow deposition of sand and finer materials which is also unsuitable habitat. In large rivers, water depth of more than 0.4 m provides habitat for swimming species, but benthic fish are often found in shallower water. Gobies feed either on algae or small invertebrates associated with algae growing on the stable cobbles and boulders.

The flow at which limiting conditions of depth and velocity occurs varies with stream morphology. Generally, minimum flow increases with stream size, because stream width increases with stream

size. However, the relationship is not linear. In general, small streams require a higher proportion of the natural stream flow to maintain minimum habitat than do large rivers.

6.2.1 Method for determining habitat suitability

Fish densities were sampled across transect across transects in the Toni River in a variety of habitat types (riffle, run and pool) on 11 March 2016. Thirteen quadrats of between 2 m^2 and 6 m^2 were sampled by electro-fishing using an EFM300 (NIWA Instrument Systems, Christchurch, New Zealand) electro-fishing equipment. Flooding and turbidity prevented sampling in the Tina River. The quadrats were situated at regular intervals across each transect, with a distance of at least 1 metre between quadrats to avoid fish disturbance. The quadrats were selected so that there was minimal variation in water depth, velocity and substrate composition within the quadrat. Electro-fishing was conducted using a downstream stop net and a dip net to catch any fish that missed the stop net. Captured fish were placed in a bucket for subsequent identification and recording. The species of fish, and estimated length of fish caught were recorded after which the fish were released at their capture point.

A further 57 quadrats were sampled by snorkelling on the 13-14 July 2016; 23 in the Toni River and 33 in the Tina River. A total of 18 species were either caught or observed and 8 of these species were relatively common (present in more than 3 quadrats).

After fish sampling, measurements were made of water depth and velocity (at 0.4 times depth above the bed) in each quadrat. The percentage of five substrate size categories (bedrock, boulder, cobble, gravel, and fines) was estimated visually. Potential cover, such as banks with overhanging vegetation or large logs, was also noted and sampled.

The average depth and velocity was calculated in each quadrat from the measurements taken within the quadrat. For substrate, substrate index (s) was calculated from the visual percentage estimates using the formula (Jowett & Richardson, 1990)

s =0.08*bedrock + 0.07*boulder + 0.06*cobble + 0.05*gravel + 0.04*fine gravel + 0.03*sand.

The most suitable habitat was determined by the density of fish. For example, if the highest average density of fish occurred in riffles, and the lowest density in pools, riffles would be the most suitable habitat and pools the least. A similar procedure was followed to determine habitat suitability for depth, velocity and substrate. The methods used for determining habitat suitability are described in Jowett & Davey (2007) and Jowett & Richardson (2008).

Some size-related habitat selection was observed with smaller fish found in lower velocity water than the larger individuals of the same species. A preference for margins and avoidance of the swift deep water in the thalweg of the Tina River was noted. The margins usually provide a more stable environment than the centre of the river where the high velocities carry sand that either embeds or covers the larger substrate.

This sampling showed that coarse substrates with minimal sand movement were the preferred habitat of most fish species. Based on the snorkelling observations, the average fish density where the substrate index was less than 5 (i.e. gravel) was 7.3±16.5 fish/12 m^2 compared to an average of 34.7±65.7 fish/12m^2 when the substrate index was 5 or higher (Mann-Whitney non-parametric test,

P=0.066). No fish were found in association with log or bank cover, although fish were found against a bedrock bank in a pool.

Fish density and diversity was higher in the Toni River than in the Tina River (Mann-Whitney non-parametric test, P<0.001), with an average of 60.4±81.7 fish/12m^2 in the Toni River compared to 6.7±17.1 fish/12m^2 in the Tina River and an average number of species per quadrat of 2.61±1.44 in the Toni River compared to 1.17±1.09 in the Tina River. There were no significant differences between rivers in sampling depth or substrate composition (Mann-Whitney non-parametric test, *P*>0.1) but sampling velocities were higher in the Tina River than in the Toni River (Mann-Whitney non-parametric test, *P*=0.001).

Habitat suitability and generalised additive models (Jowett & Davey 2007) were developed for the eight most common species (*Stiphodon semoni, Stiphodon pelewensis*, *Stiphodon rutilaureus, Belobranchus sp., Anguilla marmorata, Sicyopterus cyanocephalus*, *Sicyopterus lagocephalus*[2], *Kuhlia marginata*), as well as models for overall fish density and species richness (Fig. 12).

In general, most species (Table 8) were found in shallow water (0.2-0.3 m) with moderate velocities (0.45-0.65 m/s) and coarse substrate. Eels and the two *Sicyopterus* species were found in the swiftest water and Kuhlia were found in the lowest water velocities (Table 8). The two *Sicyopterus* species have a sucker or disc on their underside that allows them to attach to large substrate in high velocities. Shallow water (<0.3 m), a velocity of up to 0.7 m/s, and boulder/cobble substrate contained the greatest density of fish and the greatest number of species (Fig. 12).

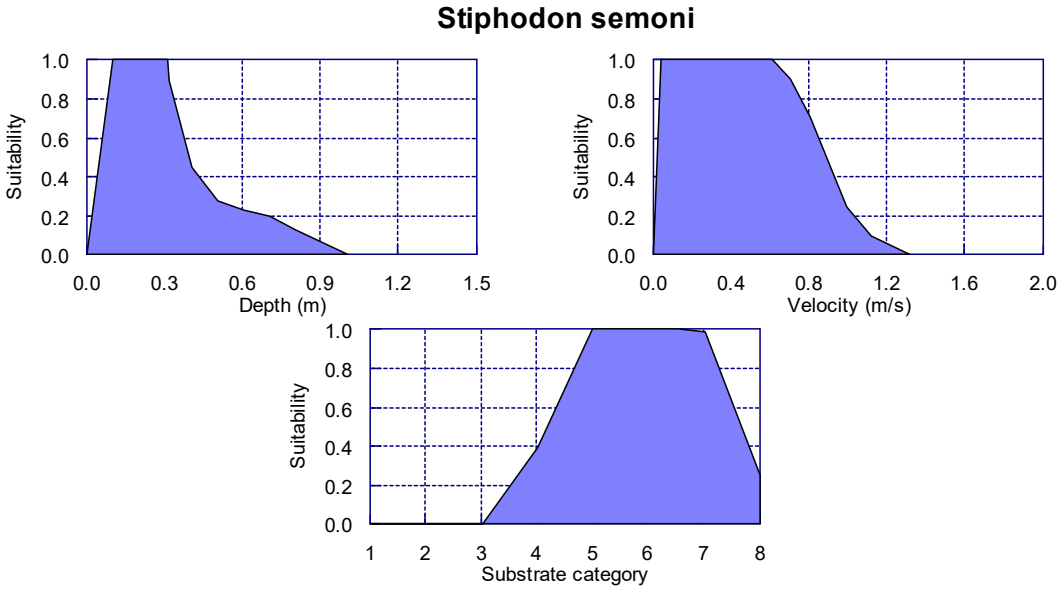
Table 8: Depths and velocities used by fish species in the Tina and Toni Rivers

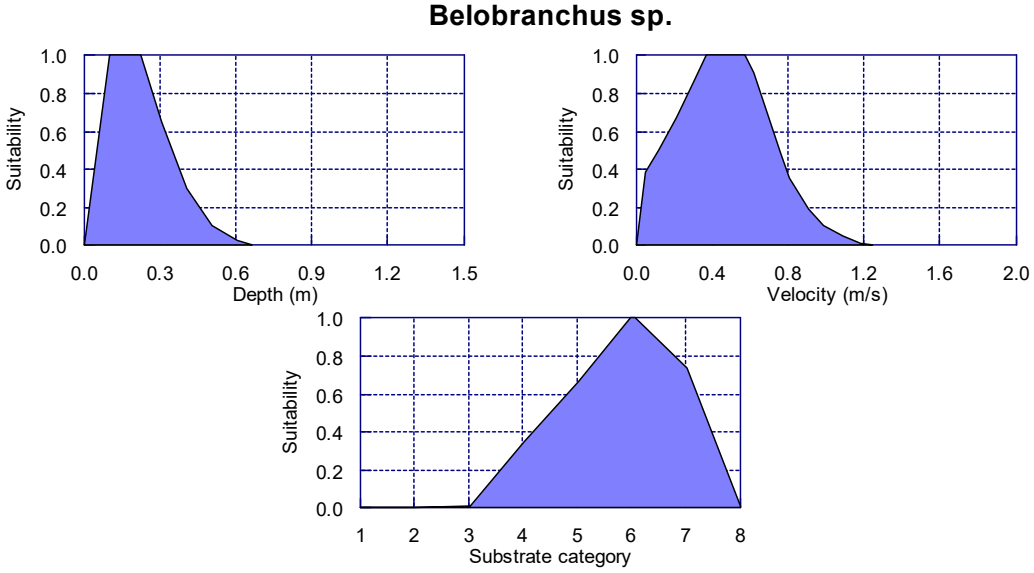
Species	**N**	**Depth ± s.d. (m)**	**Velocity ± s.d. (m/s)**
Quadrats sampled	70	0.35 ±0.18	0.64 ±0.33
Stiphodon semoni	2408	0.2 ±0.11	0.46 ±0.25
Stiphodon pelewensi	1002	0.18 ±0.1	0.5 ±0.25
Stiphodon rutilaureus	345	0.24 ±0.11	0.55 ±0.26
Belobranchus sp.	48	0.21 ±0.08	0.49 ±0.16
Sicyopterus cyanocephalus	50	0.4 ±0.26	0.85 ±0.21
Sicyopterus lagocephalus	74	0.29 ±0.19	0.72 ±0.3
Anguilla marmorata	15	0.34 ±0.2	0.93 ±0.56
Kuhlia marginata	71	0.39 ±0.12	0.38 ±0.15

The preferred habitat of the goby species *Sicyopterus stimpsoni* in Hawaii (Fig. 13) was similar to the preferred habitat of the Solomon species *Stiphodon semoni, S. pelewensis, S. rutilaureus* and *Belobranchus* sp., in that they preferred shallow water, low to moderate velocities and coarse substrate. However, the other Guam and Hawaii species (*S. elegans* and *Awaous stamineus*) seemed to prefer lower velocities than the Solomon *Stiphodon* species and the Solomon *Sicyopterus* species

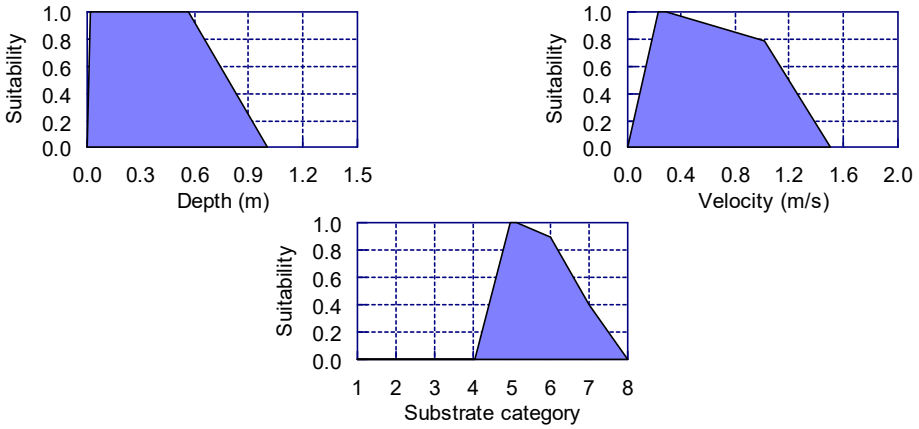
[2] These species are similar in morphology and habitat use

were found in higher velocity water than indicated by the suitability curves for the Hawaian *Sicyopterus stimpsoni*.

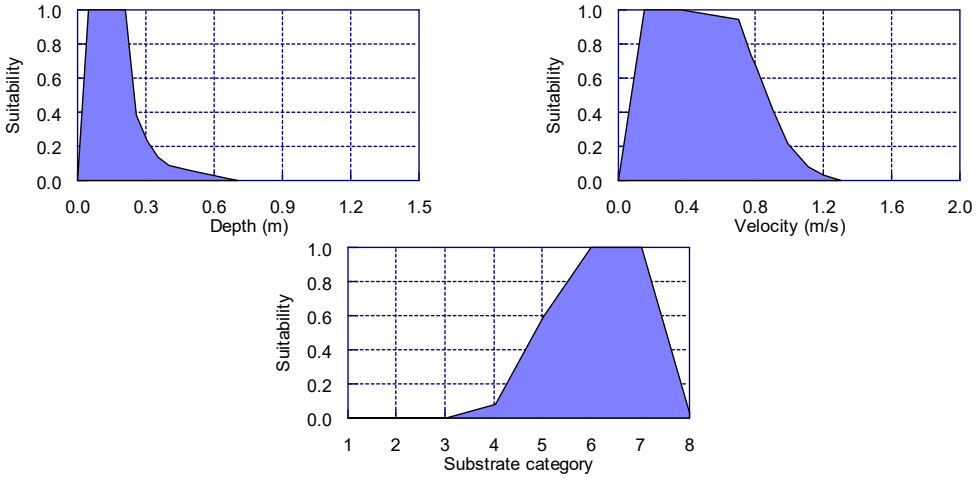




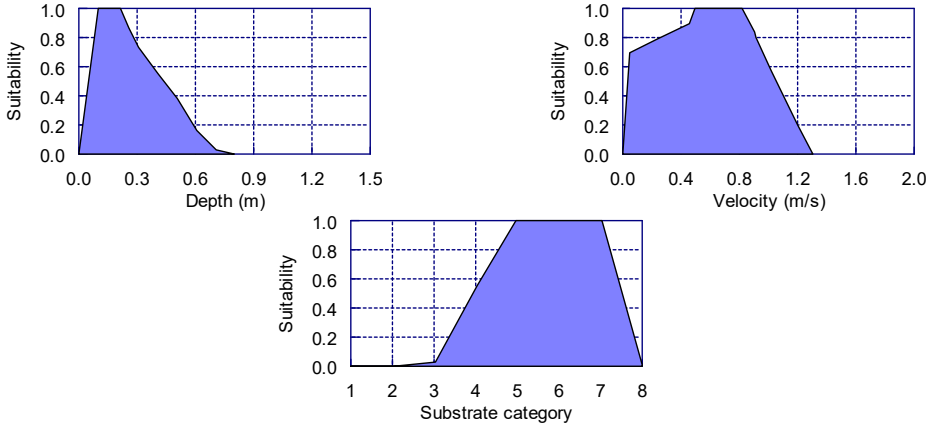
Anguilla marmorata (<150mm)



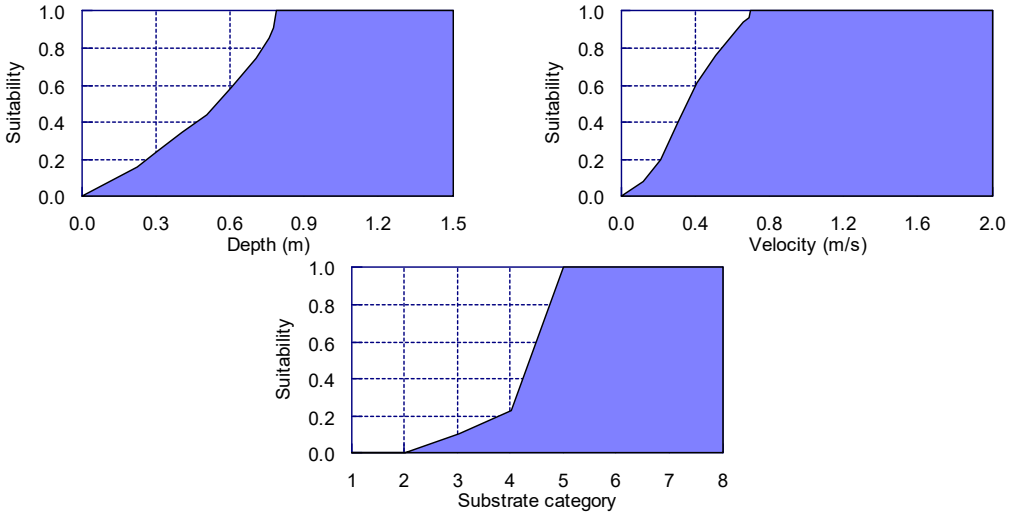
Stiphodon pelewensis



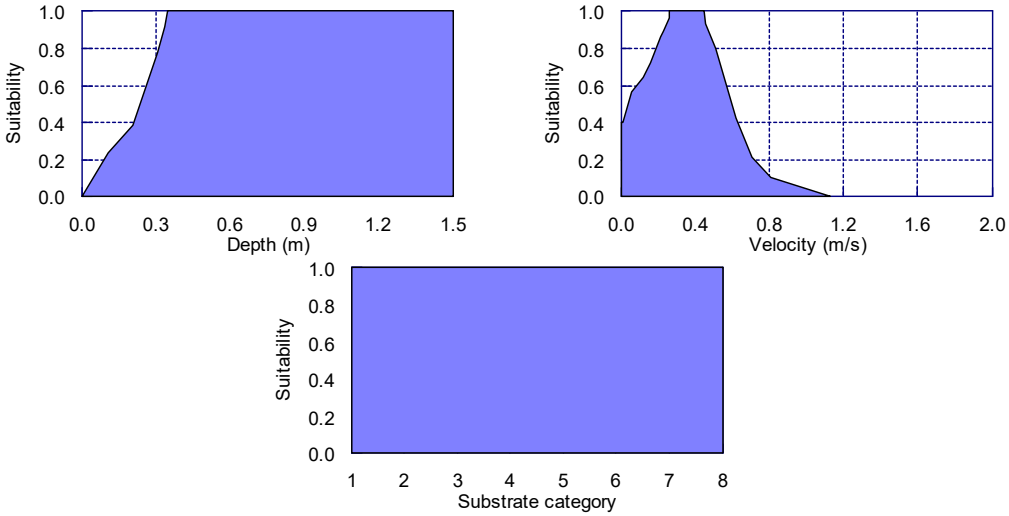
Stiphodon rutilaureus



Sicyopterus sp.



Kuhlia marginata



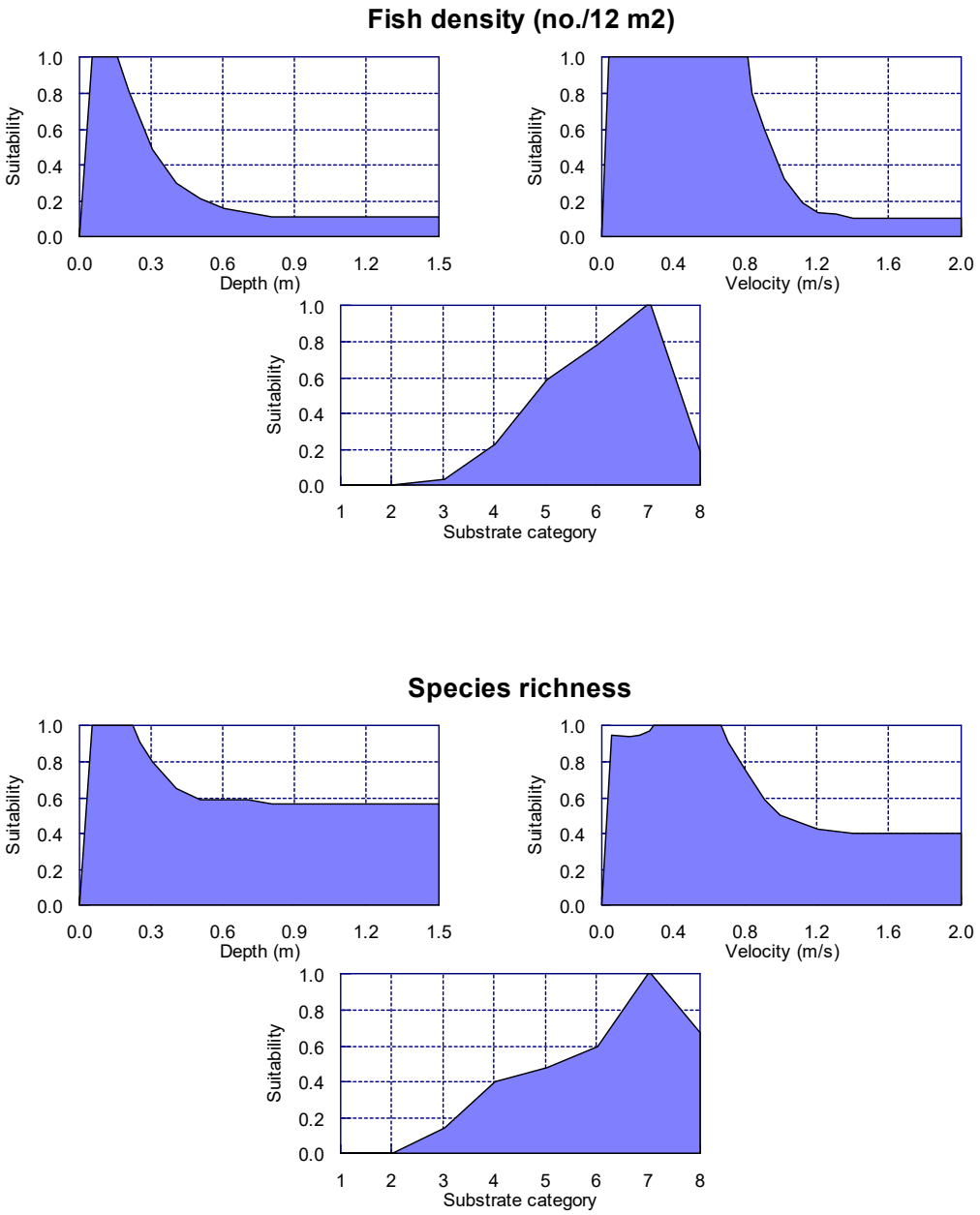


Figure 12: Habitat suitability curves for *Stiphodon semoni, Stiphodon pelewensis*, *Stiphodon rutilaureus, Belobranchus sp., Anguilla marmorata,* two *Sicyopterus* species, *Kuhlia marginata*, fish density and species richness. The substrate categories are 1= vegetation, 2=mud/silt, 3=sand, 4=fine gravel, 5=gravel, 6=cobble, 7=boulder, 8=bedrock.

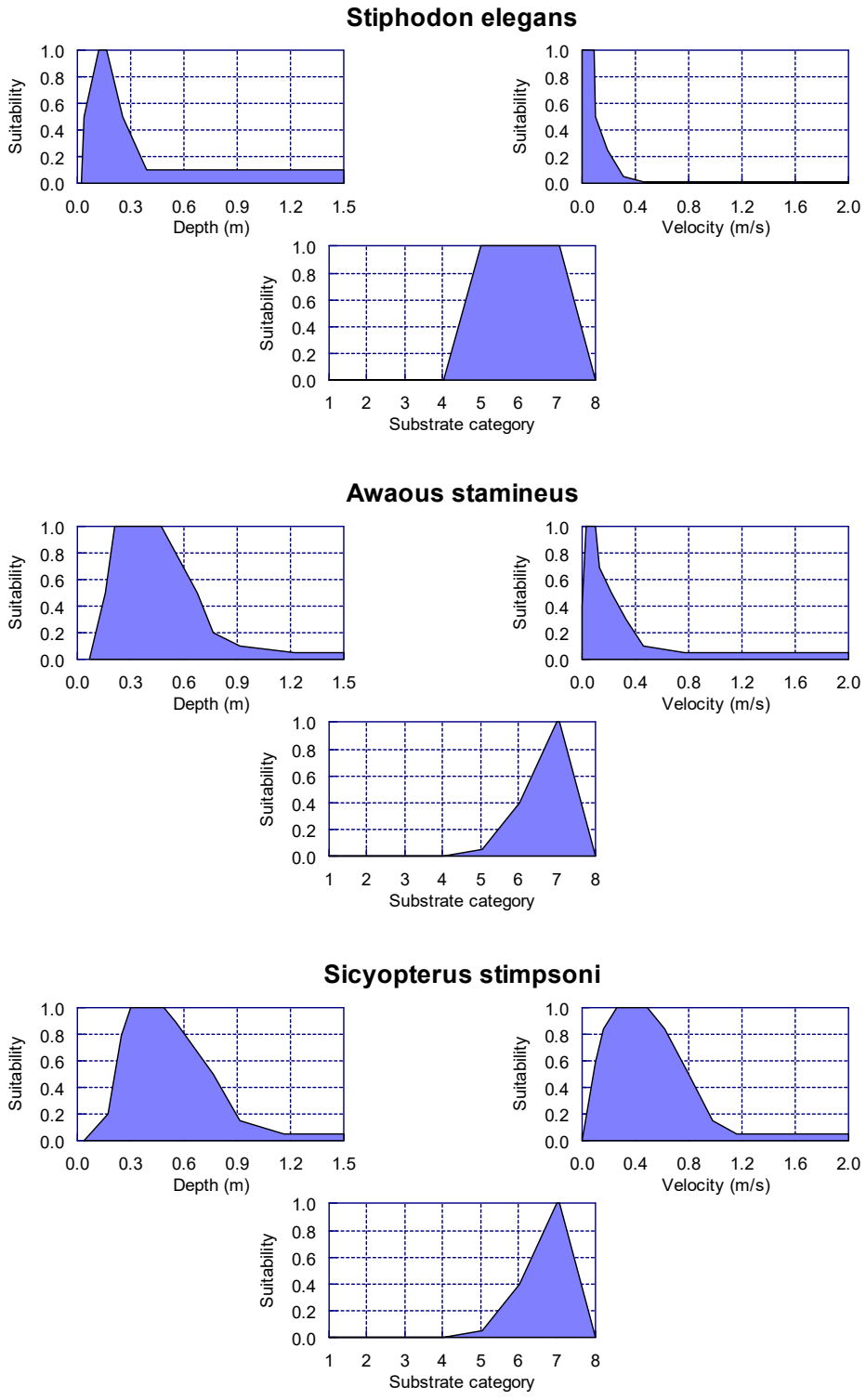


Figure 13: Habitat suitability curves for goby species from Guam and Hawaii from Thomas R Payne & associates. The substrate categories are 1= vegetation, 2=mud/silt, 3=sand, 4=fine gravel, 5=gravel, 6=cobble, 7=boulder, 8=bedrock.

7 Assessment of effects on aquatic ecology

7.1 Reduced flows

The potential effects of hydroelectric dam developments are mostly related to the change in flows. Where there are large flow reductions, an environmental flow will usually be provided to prevent or mitigate potential detrimental effects of low or zero flow.

For the Tina River Hydropower Development Project, environmental flows will be required for the river reach between the dam and tailrace and downstream of the tailrace. The magnitude of the environmental flow will be the flow that provides an adequate amount of suitable habitat for the fish species in the river, as determined from an instream habitat survey and information of habitat use by the various fish species. The necessary information on habitat use is gathered from a field survey to determine the relative densities of fish in the various habitats, depths and velocities present in the Tina River, in the vicinity of the tailrace. The instream habitat analysis uses an hydraulic model based on cross-sections surveyed in each of the habitat types, and habitat suitability models for the various species, as well as fish density and species richness. The model predicts how habitat suitability for the various species varies with flow.

A reduction in flow from the median flow of 11.1 m^3/s to an environmental flow of 1 m^3/s reduces the water surface width by 27%, the average depth by 41%, and the average velocity by 68% (Table 9).

Table 9: Predicted variation of water surface width, average depth and width weighted average velocity with flow in the Tina River between the dam and powerhouse.

Flow (m^3/s)	Width (m)	Depth (m)	Velocity (m/s)
1	18.0	0.36	0.23
2	20.1	0.40	0.29
3	21.0	0.44	0.35
4	21.4	0.47	0.42
5	21.8	0.50	0.47
6	22.3	0.53	0.52
7	22.7	0.55	0.57
8	23.1	0.57	0.61
9	23.5	0.58	0.65
10	23.9	0.60	0.69
11	24.6	0.60	0.72

The analysis of habitat variation with flow suggested that a flow of 2-4 m^3/s would provide maximum habitat for most of the common species, fish density and species richness (Fig. 14). However for the species that live in very swift water (*Sicyopterus cyanocephalus* and *S. lagocephalus*), habitat suitability is greatest at flows greater than 10 m^3/s.

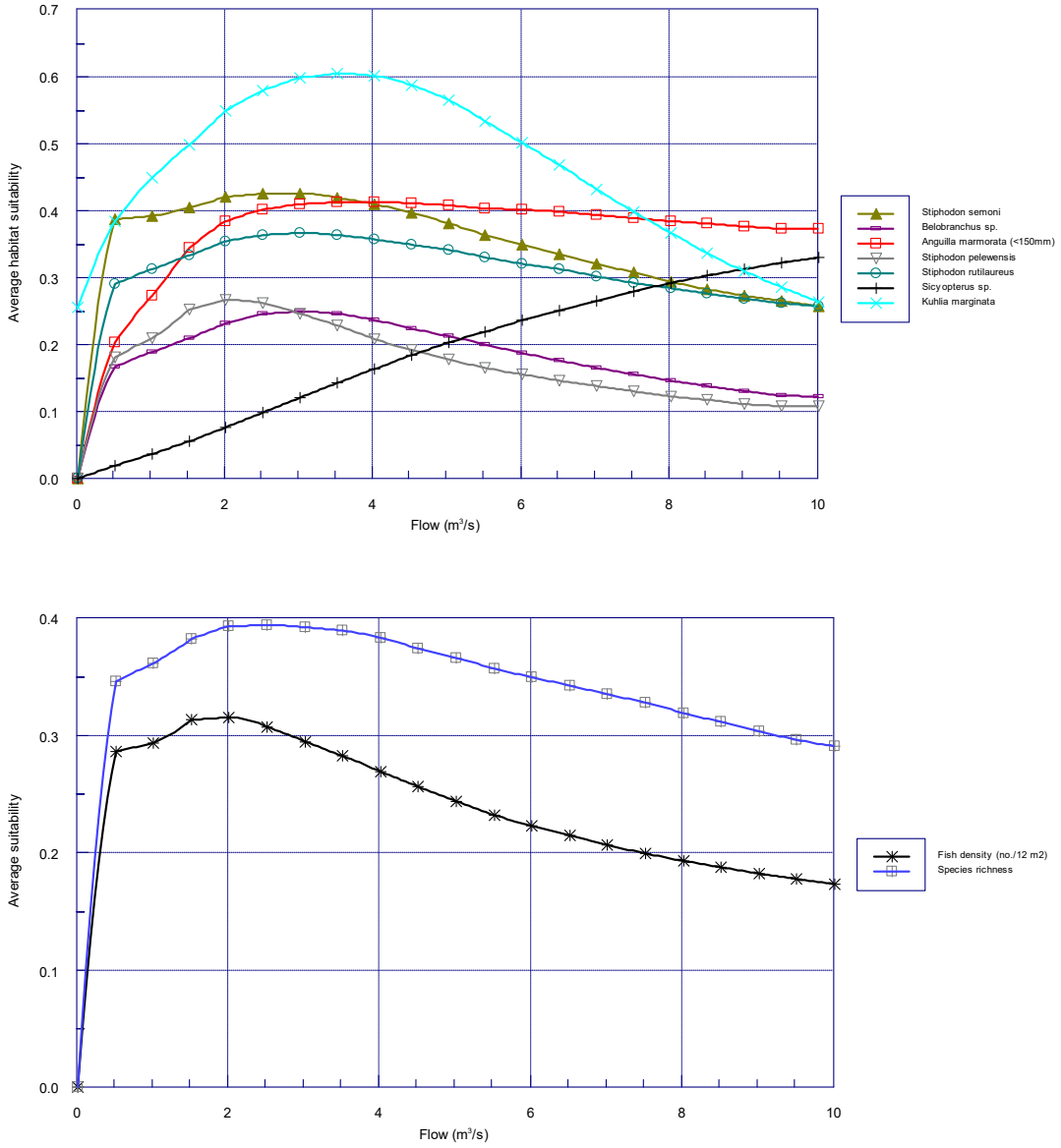


Figure 14: Variation in average habitat suitability with flow for the 8 common fish species (upper) and for fish density and diversity (lower) in the reach between the dam and powerhouse.

The standard of environmental protection provided by an environmental flow can be assessed by comparing the amount of habitat (m^2/m of river length) at the environmental flow with the amount of habitat at median flow.

A flow of 1 m^3/s would provide more habitat than is available at median flow for *Stiphodon semoni*, *Belobranchus* sp., *Stiphodon pelewensis* and *Kuhlia marginata* and a similar amount for *Stiphodon rutilaureus* (Fig. 15). Fish density and species richness are likely to be greater with a flow of 1m^3/s than with the median flow of 11.1 m^3/s. The estimated fish density at an environmental flow of 1 m^3/s is approximately 50 fish per 12 m^2. This is slightly less than the average of 60.4 fish/12m^2

observed in the Toni River and considerably higher than the 6.7 fish/12m^2 observed in the Tina River. Similarly, the estimated number of species per quadrat with an environmental flow of 1 m^3/s was 2.1 compared to the observation of 2.61 and 1.17 in the Toni and Tina rivers, respectively.

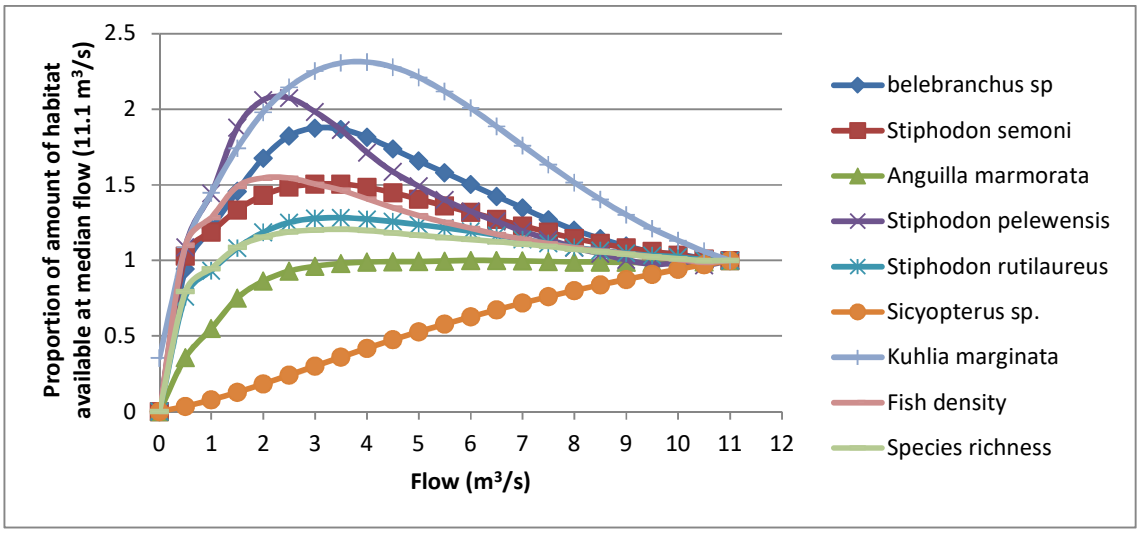


Figure 15: Relationship between flow and the proportion of the amount of habitat available at the median flow of 11.1 m^3/s.

At present, a large amount of sediment is transported through the steep, relatively narrow section of river between the dam and powerhouse sites. The movement of sediment during floods and in the deeper swifter areas of the river at normal flows reduces algal growth, benthic invertebrate production and fish habitat. The creation of a dam will prevent much of this sediment movement and will gradually coarsen the substrate. This will improve the fish habitat considerably, as the habitat observations showed a clear preference for coarse substrate and avoidance of deep swift water where sand was being transported along the river bed.

The selection of an environmental flow depends on the balance between environmental effects and loss of generation, and the relative values placed on the environment and generation. Based on the available data, the amount of habitat provided by a 1 m^3/s environmental flow is similar to the amount of habitat at a median flow of 11.1 m^3/s for most of the common fish species. Predicted overall fish density should be higher than at present and should be similar to that in the Toni River. A 1 m^3/s flow would provide for fish passage and would maintain pool habitat for the pool dwelling species and good riffle habitat for the riffle dwelling species that comprise the majority of fish in the river. In addition, there would be an improvement in habitat quality resulting from a reduction in the amount of fine gravel and sand in the river channel.

The gradient of the Tina River between the tailrace and its confluence with the Toni River is less than the gradient between the dam and tailrace. Environmental flow requirements tend to increase as the gradient decreases, so that the flow requirement downstream of the tailrace will probably be higher than the flow requirement upstream of the tailrace.

As suggested by Entura (2014), the loss of generation resulting from an environmental flow can be partially offset by installing a generator on the environmental flow discharge point at the dam.

Entura (2015b) estimated that with a 1 m^3/s environmental flow, potential long-term generation (powerhouse plus generator on environmental flow, less transmission losses) would be about 80.6 Gwh/a with 3 turbine/generator units compared to this report's estimate of 81.8 GWh/a (i.e., 83 Gwh/a less 1.2 Gwh/a transmission loss)

7.2 Variability of flows

The river between the dam and powerhouse requires some flow variability, particularly for floods and freshes. The maximum capacity of the powerhouse and the amount of storage in the reservoir are not large compared to the flow in the river, and the size of floods and freshes. Thus, it is likely that there will be frequent periods of spill between the dam and tailrace. Simulation of the hydro operation indicated that floods or freshes would occur on average every 6 weeks, and their average duration would be between 4 to 6 days. This frequency is probably sufficient to prevent prolific periphyton (algae attached to substrate) accumulation in this low nutrient river. Therefore, it should not be necessary to provide for flushing flows, or any other seasonal pulses, to stimulate spawning, migration or other biotic activities.

7.3 Hydro-peaking

Large scale hydro-peaking can severely affect fish and benthic invertebrates. During the dry season, the intention is to generate electricity at full discharge during the day and reduce to zero power station discharge during the night, leaving only the environmental flow in the river. This means that the flows could fluctuate between 18 m^3/s and the environmental flow on an almost daily basis .The maximum flow from the generators is relatively low compared to the magnitude of floods and freshes during the wet season, so that it is unlikely that fish habitat will be affected by hydro-peaking. However, depending on the mobility of the species, there is the possibility of fish stranding and a reduction in benthic invertebrate and periphyton abundance. It is unlikely that a reduction in benthic invertebrate abundance will substantially affect gobies. This is because the fish are small and benthic invertebrate abundance is probably in excess of their trophic requirements. A reduction in periphyton is also unlikely to affect fish, because there is no evidence of a reduction in species richness during the wet season when there are frequent floods and freshes that reduce periphyton and benthic invertebrate abundance.

Local people make considerable use of the river, and sudden increases in water level can endanger people if they are caught in the river bed. Usually, a rate of rise of 0.3 m per hour is considered safe. Safe rates of change in flow were calculated from data collected at a wide riffle at the powerhouse tailrace site during the instream habitat survey. Water levels at this cross-section were measured at flows of 8.7 m^3/s and 19.7 m^3/s and a rating curve (relationship between water level and discharge) was developed. This indicated that a flow change from minimum generation (2.4 m^3/s) to maximum generation (18 m^3/s) will increase the water level by about 0.38 m. This is likely to be conservative since much of the river downstream of the tailrace is less confined than at the powerhouse tailrace location. Thus, it might be advisable to ramp up generation from minimum to maximum load over a period of 1 to 1.5 hours.

As well as endangering people in the river bed, sudden reductions in water level can strand fish. Therefore, it is recommended that an adaptive management approach be taken to determining whether ramping flows are needed to mitigate potential fish stranding. This would involve carrying out studies during initial operation to determine whether fish are stranded on sudden reductions in

flow. If necessary, the rate at which flow is reduced (i.e., flow ramping) could then be decreased to see if that prevents stranding.

7.4 Sediment

The reservoir volume up to the invert of the sediment scour outlet (155m) is 2344x10^3 m^3, and 6900x10^3 m^3 up to Full Supply Level (175 m). Entura (2014) estimated that the annual suspended sediment load would be about 500 t/km^2/year, which would deposit about 45000 m^3/year of sediment in the reservoir. They estimate that it would take approximately 65 years before it became necessary to flush deposited sediment from around the power station intake. Thus, the dam will trap all bed load sediment (sand and coarser material) and a proportion of suspended sediment, and reduce the amount of bed load in the river downstream of the dam. This will result in a coarsening of the substrate within the river downstream of the dam, as reduced sediment input, combined with high flows that wash the sand and fine gravel component from the substrate, will leave coarser gravels and cobbles. An increase in the amount of coarse substrate will improve habitat for eels, gobies and benthic invertebrates that live around and under coarse substrates. In addition, the reduction in sand supply would tend to deepen pools and improve habitat for the pool dwelling species like kuhlia and grunters. Any effect of sediment removed by the reservoir will gradually reduce with distance downstream, as sediment is entrained for the sands and gravels on existing river banks and introduced from tributaries.

Observations downstream of New Zealand hydro dams on gravel bed rivers (Waitaki, Clutha) indicate that the riverbed will not degrade (erode) to any noticeable degree because the surface will be armoured by cobbles and larger gravels once the surface fines are removed.

7.5 Water quality

Because there is little diurnal and seasonal temperature variation and little wind mixing, tropical reservoirs often become stratified (Barrow 1988) and there is a risk that dissolved oxygen concentration is reduced in the lower layers (hypolimnion). Shallow lakes with high inflow are least at risk of stratification.

The residence time of the proposed reservoir when full is approximately 7 days at median flow of 11.1 m^3/s and the average flow depth is approximately 10 m (Entura 2014). The shallow depth and short residence time suggests that stratification is extremely unlikely. Relationships between temperature differential thermal (stratification) and residence time (Jorgenson et al. 2005) that show virtually no thermal stratification with a residence time of 7 days, and thus it is very unlikely that there will be any stratification and development of a hypolimnion with a low dissolved oxygen concentration.

The discharge of surface water from the reservoir through the spillway, tailrace and environmental flow outlet is unlikely to cause any measurable change in dissolved oxygen.

7.5.1 Water temperature

As water flows down a river, it is heated by solar radiation and cooled by evaporation until a thermal equilibrium is reached. If the amount of shade and radiation or ambient air temperatures changes, the water temperature adjusts towards thermal equilibrium. Usually, this will mean that water temperature will increase in a downstream direction.

In the Tina River during the rainy season, measured spot temperatures increased from 24.5°C at the Tina Village to 32.0°C at the Ngalimbiu River Bridge. The Toni River flows into the Tina River just downstream of Tina Village. Water temperatures in the Toni River were 28.4 to 29.4°C so that the Ngalimbiu River water temperature downstream of the Tina/Toni confluence was 26.4 to 27.2°C.

Water temperatures were also measured in the Toni River and in the Tina River between the Toni River confluence and approximately 1.5 km below the dam site over the period 11-15 July 2016. There was no rain over the period 11-15 July 2016. The daily maximum water temperature was 26°C at all sites over the 5 days. The daily minimum temperature was 23°C indicating diurnal variation of about 3°C. The lack of any downstream increase in temperature and the similarity of the water temperatures in the Toni and Tina rivers suggest that the water temperature was in equilibrium and therefore a change in flow would have minimal effect on daily mean water temperature.

The formation of a reservoir will generally alter the seasonal thermal characteristics of the river immediately downstream of the outlet. Since the thermal capacity of a reservoir is greater than that of a river, the reservoir tends to store heat resulting in smaller daily temperature fluctuations, lower summer temperatures, and higher winter temperatures. However, there is little variation in the annual air temperature in the Solomon Islands, so seasonal variation in water temperature is unlikely. Measurements in other lakes suggest that the reservoir water temperature is likely to be less than 28 °C (pers. comm., Robson Hevalao).

A reduction in flow generally does not change the daily mean water temperature significantly, but it does increase the daily maximum and decrease the daily minimum temperature. However, during the wet season at least, water velocities are high and river water temperatures may be below the equilibrium temperature, so that a reduction in flow would certainly increase the daily maximum water temperature and may increase the daily average water temperature in the river between the dam and powerhouse. With a flow of 1 m^3/s in the river between the dam and powerhouse, water temperatures are likely to be similar to those in the Toni River. The fish community in the Toni River is similar to, or better than, that in the Tina River. Thus, an increase in water temperature in the Tina River is unlikely to have any effect on the fish community in the Tina River.

7.6 Fish passage

The dam will create a barrier to the passage of migratory fish species to the catchment upstream of the dam. It is possible to provide fish passage past the dam for most species. The options include a natural stream fish pass (if there is sufficient space), or a trap and haul system. These systems are used in New Zealand for a variety of climbing species and in UK, France, and the US for eels (Paterson & Boubee 2010, Solomon & Beach 2004). Fish pass systems developed in Europe and North America for salmonids and similar species are expensive and will not necessarily suit the Tina River species. The 5 m operating range of the reservoir would necessitate a complicated system of hydraulic structures at the upstream end of a conventional fish pass to maintain a constant flow under the range of reservoir levels.

7.6.1 Upstream passage

Because of their climbing ability, it is relatively easy to provide effective upstream passage for gobies and eels using either a natural stream channel[3] pass, or trap and haul system. It is likely that a trap and haul system will be the least costly and most practical option for fish passage. A simplified diagram of the trap is shown in Fig. 16. Fish from the trap can and should be released in or upstream of the reservoir at a location that will avoid the possibility of fish being entrained by spillway or power station flows. The ramp allows migratory fish to climb to the trap, where they remain until transferred to an upstream location.

One advantage of a trap and haul system is that fish caught in the trap can be identified and counted before they are transferred to areas upstream of the dam. Thus, a trap system will provide very useful monitoring data on the state of the goby and eel populations which is very difficult, if not impossible to obtain by other means.

Neither a trap and haul system, or natural fish pass, is likely to provide passage for kuhlia and grunters, both of which are a swimming species. Kuhlia appear to be reluctant to use fish passes (Lewis & Hogan 1987). However, if kuhlia and/or grunters accumulate at either the powerhouse tailrace or the base of the dam, it will be possible to net them and transfer them to a more suitable environment such as the Toni River or upstream Tina River. The former would be more preferable because some mortality would occur when the adult fish migrate from the upper Tina River to the estuary area to spawn.

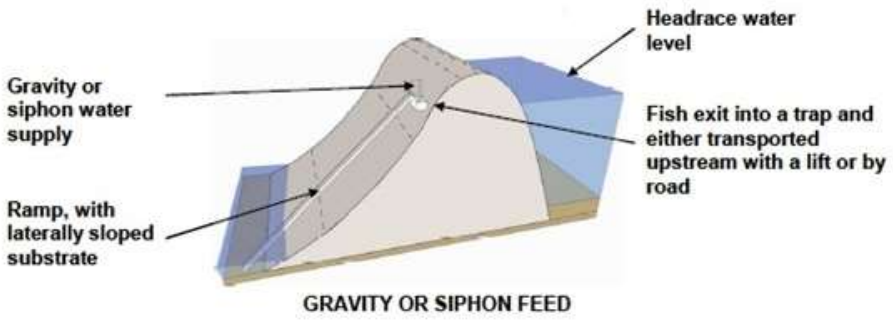


Figure 16: Principle of trap and transfer system

[3] A gravel/cobble channel similar to a riffle which would zig-zag up the dam face or abutments with resting pools at the changes of direction.

Figure 17: Example of trap installation at dam.

Figure 17 shows the trap system with ramp leading to a holding tank and piped water supply installed at Waitaki Dam, New Zealand. The ramp can be lined with bristles, gravel or a drainage product called Miradrain or Cordrain (Patterson & Boubee 2010). The optimum slope is about 15 degrees.

While bristles appear to best for eels, gravel or drainage products suit both gobies and eels. New Zealand traps have been used to collect eels, galaxiids, redfin bully (*Gobiomorphus huttoni*) and to a lesser degree torrentfish (*Cheimarrichthys fosteri*). The ramp should also have a transverse slope to provide deep water on one side and shallow water on the other to provide a choice of velocities and depths for the fish that move up the ramp. The climbing abilities and modes of locomotion of these New Zealand species are the same as those used by crawling and climbing species in the Solomon Islands, as described in the ESIA.

7.6.2 Downstream passage

Gobies spawn on substrate in the area in which they live. When the eggs hatch the larvae are carried passively downstream. It is not clear whether goby spawning is seasonal, or occurs all through the year. It is possible that spawning seasonality varies between species. Larval fish return to the estuary during the dry season and this indicates that spawning and downstream migration takes place early in the wet season. Thus, it is likely that hatching and downstream movement occurs during floods and freshes with the high flows ensuring rapid and safe transport to the sea. If so, the dam may be spilling and larval fish will pass over the spillway. Although there are very few studies of larval survival through turbines, it is well known that the length of fish is the primary determinant of survival (e.g., Larinier and Travade 2002) and with larval fish potential mortality caused by striking the turbine blades or wicket gates will be low. Morris et al. (1985) describe quantitative data on entrainment mortalities that were gathered at the Ludington Hydro Plant on Lake Michigan, which has a head of 110m. Survival tests on 9 species of larval fishes indicated that passage through the Ludington turbines decreased survival rates by an average of 15%. Large smelt larvae (15-42 mm) experienced much greater mortality than did smaller (<15 mm) smelt larvae. Some larvae were

apparently robust and seemed to survive turbine passage (i.e., ninespine stickleback, lake whitefish, turbot larvae). Goby larvae are small (<10mm) and there is unlikely o be significant mortality through the turbines.

Although the gobies in the Solomon Islands are generally considered diadromous, large numbers of 10 mm gobies were observed in the shallow low velocity margins of the river between the dam and power house sites on 11-15 July 2016. It is unlikely that fish of this size have the swimming ability to make the 25 km journey from the sea and this suggests that these fish are rearing in the river rather than the sea. Shallow low velocity margins are the type of rearing habitat used by non-diadromous bullies in New Zealand.

Adult eels migrate to the sea at the beginning of the wet season. They are likely to migrate on the first fresh so that the deeper swift flowing water facilitates their passage to the sea, similar to the migration of New Zealand eels. The mortality of adult eels through turbines is significant, and there does not seem to be any easy way of screening or diverting adult eels. However, if they are migrating during a flood, a proportion of the migrating population may be carried over the spillway rather than through the turbines. Consideration should be given to increasing the normal operating level to near full supply level, during the first month of the wet season, to facilitate the downstream movement of adult eels over the spillway during floods. The loss of generation resulting from increasing spill would be partially offset by the increased generation from the extra head on the turbines. Consideration could be given to the possibility of 15-25 mm screens in front of the intake structure to prevent the ingress of large eels.

8 Mitigation measures

Mitigation can take the form of reducing the detrimental effect to an acceptable level by modifying the operation of the proposed scheme. The following sections describe possible options for this form of mitigation. Mitigation can also take the form of providing some facility or service that is valued by the local community and substitutes for the loss caused by the construction of the power scheme.

8.1 Uniqueness of upper Tina catchment fish community

The upper Tina catchment is a valuable fish resource because the high elevation catchment is unmodified and has high water quality and minimal disturbance. Although the fishes found in the upper catchment are reportedly diadromous species that require access to the sea to complete their life cycles, there is a high possibility that some are non-diadromous and will establish self-sustaining populations upstream of the dam. There are also other similar catchments with unmodified high elevation catchments nearby and the fish communities in these appear to be the same as those in the Tina River catchment (Boseto 2016).

The river between the dam and powerhouse will experience reduced flows. Likewise, the river downstream of the tailrace will experience reduced flows during non-generation hours when the reservoir is being filled. Fish communities and densities present in rivers smaller than the Tina River are likely to be indicative of the aquatic community that would be present in the environmental flow between the dam and tailrace. The fish community in the Toni River is an example of the fish community that would probably develop between the dam and tailrace. The average fish density and diversity in the Toni River was significantly higher than that in the Tina River, probably because

the Toni River provides a more stable aquatic environment than the Tina River, where the velocities were higher and amount of sand movement greater.

8.2 Change from riverine to lacustrine (lake) habitat

The creation of the reservoir will replace about 2.6 km of riverine habitat with a reservoir (Entura 2014). The average width of the reservoir would be about 118 m at a FSL of 175 m amsl. There are very few lakes on Guadalcanal, so it is not known what riverine fish species will take up residence in the newly formed lake with its lacustrine environment. Non-native fish species could be introduced into the lake, but generally this is not considered desirable because of potential effects on native species.

8.3 Environmental flow

Provision of a 1 m^3/s environmental flow between the dam and powerhouse will maintain or improve fish and benthic invertebrate densities and total numbers for most species. An environmental flow of 1 m^3/s would maintain the riffle habitats that appear to be used by most fish species, although there would be a reduction in habitat for the *Sicyopterus* species, which can live in very swift water. Pools will also be maintained for kuhlia and grunters. However, trapping of sediment in the dam and subsequent coarsening of substrate in the river below the dam will improve habitat for all aquatic species and overall productivity and this improvement with an environmental flow of 1 m^3/s should result in fish densities that are similar to that in the Tina and Toni rivers at present.

8.4 Fish passage and species diversity

A suitable trap and haul system will maintain the diadromous species in the streams and river upstream of the dam. Downstream passage for adult eels could be facilitated by spilling water at the start of the wet season when adult eels are observed congregating at the dam face. In addition, it would be possible to operate the reservoir at a slightly higher level early in the wet season to increase the probability of spill. In addition, there is a high possibility that one or more of the goby species are non-diadromous and therefore live their entire lives in freshwater and do not require passage to the sea .

A trap and haul system would not provide for swimming species (kuhlia and grunters). Therefore, the provision of passage for these species is probably impractical, as described earlier. However, if these species accumulate at the powerhouse or base of the dam, it will be possible to net them and transfer them to other locations.

Kuhlia and grunters are widespread. *Kuhlia rupestris* is widely distributed from the western Indian Ocean, north to Japan (Ryukyu Islands), south to Queensland, Australia and east to the Federated States of Micronesia (the Caroline Islands), Fiji and Samoa. *Kuhlia marginata* is widespread throughout the Indo-Pacific, from Japan to Australia and east to the Federated States of Micronesia (Caroline Islands).

The Indo-Pacific species *Mesopristes argenteus* is fairly widespread from Indonesia and the Philippines, north to Japan (the Ryukyu Islands), south to Australia (Queensland) and east to Melanesia (Papua New Guinea, Vanuatu and Solomon Islands). The distribution of *Mesopristes cancellatus* is slightly more restricted than *M. argenteus* but is still fairly widespread from Indonesia

and the Philippines to East Timor), Papua New Guinea, north to Taiwan and into Melanesia (Vanuatu and the Solomon Islands).

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Appendix M

Fauna Report

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Appendix M

Fauna Report

Edgar Pollard

Table of contents

1. FAUNA CHARACTERISATION

In each sampling station a general habitat description is carried out. The polygons and points of habitat areas and important species areas will be drawn using Google Earth. Species tables will then be created with the following information for fauna, specifically amphibians, birds, mammals, and reptiles: species name (including scientific and common name), migration routes of wildlife in the project areas of impacts (if any), population trends of species (population declining increasing or stable), species status (CITES, IUCN, endemism), description of wildlife role for local populations (bush meat and cultural significance) as sources of livelihood and series of photographs to help describe each station and species (if possible). Potential species that were not observed will also be presented in order to have a complete overview of the area. This series of potential species can be gathered from other sources such as previous studies (see scoping reports, Gold Ridge reports, scientific journals or field guides).

1.1 METHOD FOR THE ON FIELD CHARACTERIZATION

Method for inventory descriptions will be described in this section: they include direct observations, species identification, species traces, netting and interviews, the date of field visit will be provided.

Methods used to identify terrestrial vertebrate inventories include visual and auditory encounter surveys (diurnal and nocturnal) consisting of 1) point and 2) plot counts primarily for birds, reptiles and amphibians and 3) mist nets primarily for birds and mammals. Informal interviews were also carried out with locals to determine important species presence. The field visits and sampling occurred on the dates 05/08/13 to 17/08/13.

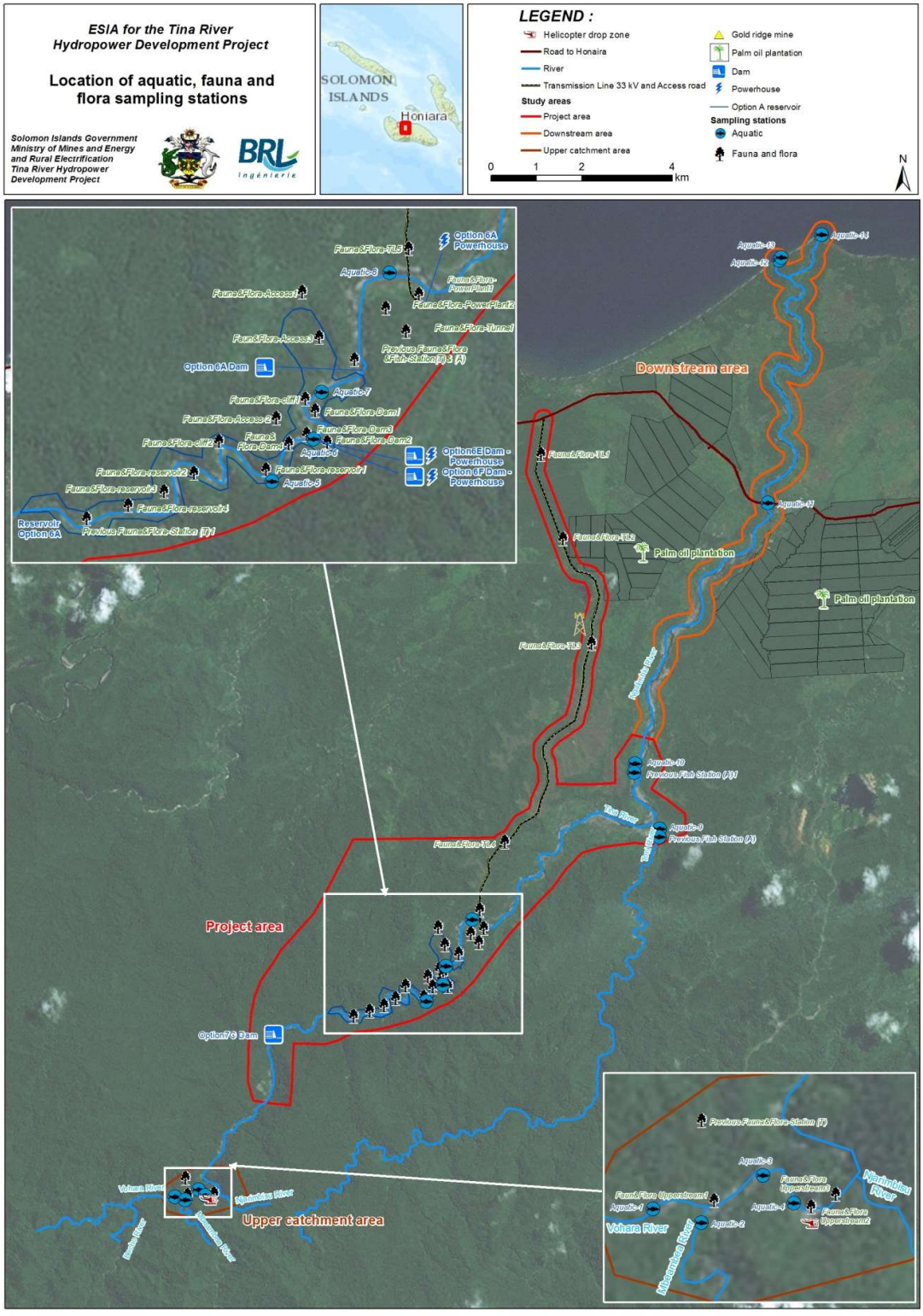
Point counts involved visual and auditory surveying from a set location (sampling station) for the duration of 20min. Visual aids in the form of binoculars were also used. All faunal species (amphibians, birds, mammals and reptiles) observed (seen or heard) during the sampling period were recorded.

Plot counts involved the movement (where possible) and visual and auditory surveying in and around a 10x10m plot to sample for fauna (amphibians, birds, mammals and reptiles). Visual aids in the form of binoculars were also used. All faunal species (amphibians, birds, mammals and reptiles) observed (seen or heard) during the sampling period were recorded.

Mist netting involved the placement of 8 mist nets (15m x 2m, 20mm mesh size) in sampling stations to capture and record birds and mammals. Nets were placed in forested areas and also in locations adjacent to waterways.

Informal interviews involved the discussion with locals of important fauna and associated uses of associated species, these informal interviews also resulted in the significant recording of local knowledge (LK).

1.2 SAMPLING STATIONS



1.2.1 Fauna Transmission Line (TL1, 2, 3, 4 & 5)

Transmission Line areas were mainly covered in grassland, garden, oil palm plantation, remnant forest and fallow brush land habitats. TL1 is located between oil palm plantation and fallow bush dominated by paper mulberry trees. TL2 is located between oil palm plantations and grassland inter-mixed with gardens. TL3 is located in grassland and TL4 is located between grassland, gardens and remnant forest dominated by Canarium nut trees. TL5 is located in remnant forest. Conditions during the sampling of the TL sites were clear to cloudy and were deemed optimal for faunal sampling.

1.2.2 Fauna Access Road (Acc.1 & 2)

Access Road areas were mainly covered in forested habitats. Acc.1 is located on a hill slope surrounded by forest with evident signs of disturbance such as past timber extraction. Acc.2 is located on a ridge adjacent to a steep slope to the Tina river, it is surrounded by relatively undisturbed forest with the presence of large canopy trees. Conditions during the sampling of the Acc. sites were clear to cloudy and were deemed optimal for faunal sampling.

1.2.3 Fauna PowerPlant (PP1 & 2)

PowerPlant areas were mainly covered garden, fallow brush land habitats and disturbed forest. PP1 is located on a flat areas that is surrounded by gardens with crops of betelnut, banana and coconut, fallow brush land is also evident. PP2 is located on a small hill and is covered by forest with evidence of timber extraction and some relatively undisturbed areas. Conditions during the sampling of the TL sites were clear to cloudy and were deemed optimal for faunal sampling.

1.2.4 Fauna Reservoir (Res.1, 2, 3 & 4)

Reservoir areas were mainly covered in forest, though there were certain areas that were garden, and disturbed forest habitats. Res.1 is located on a flat area that is forested however there is evidence of disturbance through timber exploitation. Res.2 is located adjacent to a village area and is surrounded by gardens and remnant forest. Res.3 is located on a slope and covered by forest with evidence of disturbance through timber extraction and past garden use. Res.4 is located in forest with slight disturbance and evidence of timber extraction. Conditions during the sampling of the Res. sites were wet to cloudy and were deemed not optimal for faunal sampling as the conditions would limit the movement of species.

1.2.5 Fauna Dam (Dam1, 2, 3 & 4)

Dam areas were mainly covered in disturbed forest and gardens. Dam1 is located on a steep sloping area that is forested however there is evidence of disturbance through past timber exploitation. Dam2 is located in forested areas with disturbance due to current timber extraction. Dam3 is located on a slight slope and covered gardens and fallow brush land from past garden use. Dam4 is located in a very steep area that is forested with evidence of past timber extraction. Conditions during the sampling of the Dam sites were wet to cloudy and were deemed not optimal for faunal sampling as the conditions would limit the movement of species.

1.2.6 Fauna Tunnel (Tun.)

The Tunnel (Tun.) area was mainly covered in disturbed forest, with evidence of past and current timber extraction. Conditions during the sampling of the TL sites were clear to cloudy and were deemed optimal for faunal sampling.

1.2.7 Fauna Cliff (Clif.1 & 2)

Cliff areas were mainly covered in distinct cliff vegetation that lacked larger canopy trees but covered with smaller plants such as ferns and shrubs, both Clif.1 and Clif.2 areas displayed similar characteristics of very steep slope adjacent to the water. Conditions during the sampling of the Clif. sites were wet to cloudy and were deemed not optimal for faunal sampling as the conditions would limit the movement of species.

1.2.8 Fauna Upper Stream (Upp.1 2 &3)

Upper Stream areas were mainly covered in undisturbed forest, though most terrain was quiet steep. Upp.1 is located at a confluence of two major rivers, surrounding areas were forested however there is evidence past village settlement. Upp.2 is located adjacent to a cliff area and is surrounded undisturbed forest and the river. Upp.3 is located adjacent to a river gorge with small vegetation growing through cracks and small caves. Conditions during the sampling of the Upp. sites were wet to cloudy and were deemed not optimal for faunal sampling as the conditions would limit the movement of species.

1.2.9 Faunal inventories

1.2.9.1 Amphibians

A total of 9 amphibian species were observed from a total of 13 potential species from 4 families. This is 64 percent of all amphibians expected to be found along the Tina River study area. Table 1 (below) lists amphibian species by family including scientific and common nomenclature. The sampling stations that the species is present in are noted as well as the 'Potential Presence' of the species in the Tina River study area based on species observed in areas in close vicinity to the study site in literature (TRHDP ESIA Scoping Study (Sherwood 2012) = SS, Frogs of the SI (Pikacha *et al.* 2008) = PP, Gold Ridge Report (NL 1996) = GR and Local Knowledge = LK). Species migratory and endemic status (Guadalcanal = G, Solomon Islands = SI, Introduced = I) were also stated based on Pikacha *et al.* (2008). Each species Red List category (IUCN 2013) as a value of vulnerability is also specified (Least Concern = LC, Vulnerable = VU and Data Deficient = DD). Each species CITES category (UNEP-WCMC 2013) where possible, of protection is also stated, as well as the status of local protection based on the Wildlife and Protection Act (1998). The 'Population Trend' (where possible, Increasing =I & Stable =S) is based on the IUCN (2013) Red List and 'Local Uses' is based on information regarding the species from locals (Food =F). Each species dependence on the river based on literature (Pikacha *et al.* 2008) and in-field observations is also stated.

Table 1 Amphibian Species Inventory of Tina River

Species name	Common name	Station Presence	Potential Presence	Migratory	Endemic	IUCN Red List Category	CITES Appendix	1998 Act	Population Trend	Local Uses	River Dependent

***Bufonidae* TRUE TOADS**											
Bufo marinus	Cane Toad	TL1, Res.1, Res.2, Res.3, Res.4, Dam2, Upp.2	PP	-	I	LC	-		I	-	-
Ceratobatrachidae											
Batrachylodes vertebralis	Fauro Sticky-toed Frog	Res.2, Res.3, Res.4, Dam2, Dam3,	PP	-	SI	LC	-	II	S	-	-
Batrachylodes elegans	Elegant Sticky-toed Frog		SS	-	SI	LC	-		S	-	-
Ceratobatrachus guentheri	Solomon Islands Eyelash Frog	Res.3, Dam2,	PP, GR	-	SI	LC	-	II	S	-	-
Discodeles guppyi	Giant Webbed Frog		PP, SS, GR, LK	-		LC	-		S	F	X
Discodeles malakuna	Malakuna Webbed Frog	Upp.2,	SS	-	SI	DD	-		S	-	-
Platymantis guppyi	Solomon Islands Giant Treefrog	Upp.2	SS, GR, PP	-	SI	LC	-		S	-	-
Platymantis solomonis	Solomon Wrinkled Ground Frog		SS, PP	-	SI	LC	-	I	S	-	-
Platymantis weberi	Weber's Wrinkled Ground Frog	Res.2, Dam2,	SS, PP	-	SI	LC	-		S	-	-
***Hylidae* TREEFROGS**											
Litoria lutea	Solomon Island's Treefrog		SS	-	SI	VU	-		S	-	-
Litoria thesaurensis	Treasury Island Treefrog	Res.2,	PP	-	SI	LC	-		S	-	-
Litoria sp.		Res.3	SS, GR	-	-	-	-		S	-	-
***Ranidae* TRUE FROGS**											
Hylarana kreffti	San Cristobal Treefrog	Upp.2	GR, PP	-	SI	LC	-		S	-	X

(Potential Species, TRHDP ESIA Scoping Study = SS, Frogs of the SI = PP, Gold Ridge Report = GR, Local Knowledge = LK), (Endemic, Guadalcanal = G, Solomon Islands = SI, Introduced = I), (IUCN Red List Category, Least Concern = LC, Vulnerable = VU & Data Deficient = DD), (1998 Act, Prohibited Species = I, Regulated Species = II), (Population Trend, Increasing =I & Stable =S), (Local Uses, Food =F), (X = Dependent on the river).

1.2.9.2 Birds

A total of 41 bird species were observed from a total of 67 potential species from 28 families. This is around 61 percent of all birds expected to be found along the Tina River study area. Table 2 (below) lists bird species by family including scientific and common nomenclature. The sampling stations that the species is present in are noted as well as the 'Potential Presence' of the species in the Tina River study area based on species observed in areas in close vicinity to the study site in literature (TRHDP ESIA Scoping Study (Sherwood 2012) = SS, Birds of Melanesia (Dutson 2011) = GD(Dutson 2011)(Dutson 2011), Guadalcanal Island Bird Checklist (Tarburton 2007) = MT, Gold Ridge Report (NL 1996) = GR and Local Knowledge = LK). Species migratory and endemic status (Guadalcanal = G, Solomon Islands = SI, Introduced = I) were also stated based on Dutson (2011). Each species Red List category (IUCN 2013) as a value of vulnerability is also specified (Least Concern = LC, Near Threatened = NT, Vulnerable = VU and Data Deficient = DD). Each species CITES category (UNEP-WCMC 2013) where possible, of protection is also stated, as well as the status of local protection based on the Wildlife and Protection Act (1998). The 'Population Trend' (where possible, Increasing =I, Decreasing =D & Stable =S) is based on the IUCN (2013) Red List and 'Local Uses' is based on information regarding the species from locals (Food =F and Cultural Importance =CI). Each species dependence on the river based on literature (Dutson 2011) and in-field observations is also stated.

Table 2 Bird Species Inventory of Tina River

Species name	Common name	Station Presence	Potential Presence	Migratory	Endemic	IUCN Red List Category	CITES Appendix	1998 Act	Population Trend	Local uses	River Dependent
***Ardeidae* HERONS**											
Nycticorax caledonicus mandibularis	Nankeen Night Heron	Res.2, Res. 3, Res.4, Clif.2	SS, GD, MT	-	-	LC	-		S	-	X
Egretta s. sacra	Pacific Reef Heron	TL3	GD	-	-	LC	-		S	-	-
***Phalacrocoracidae* CORMORANTS**											
Microcarbo m. melanoleucos	Little Pied Cormorant	Res.1, Res.2, Res.3, Res.4, Upp.1,	SS, GD	-	SI	LC	-		S	-	X
***Anatidae* DUCKS**											
Anas superciliosa	Pacific Black Duck		SS, MT, GD	-	-	LC	-		S	F	X
***Accipitridae* HAWKS and EAGLES**											

Haliastur indus flavirostris	Brahminy Kite	Res.3, Acc.2,	SS, MT, GD, GR	-	SI	LC	II		D	-	-
Aviceda subcristata proxima	Pacific Baza		MT, GD, LK	-	SI	LC	II		S	-	-
Accipiter novaehollandiae pulchellus	Variable Goshawk	Upp.1	MT, GD	-	G	LC	II		D	-	-
Accipiter meyerianus	Meyer's Goshawk	TL3	MT, GD, GR	-	-	LC	II	I	D	-	-
Haliaeetus sanfordi	Solomon Sea-Eagle	TL5, Upp.1,	MT, GD	-	SI	VU	II	I	D	-	-
***Megapodiidae* MEGAPODES**											
Megapodius eremita	Melanesian Scrub Fowl		SS, MT, GD, LK	-	-	LC	-		D	F	-
***Turnicidae* BUTTONQUAILS**											
Turnix maculosa salamonis	Red-backed Button-Quail		MT, GD	-	G	LC	-		D	F	-
***Rallidae* RAILS**											
Gallirallus philippensis christophori	Buff-banded Rail	TL3	MT, GD, LK	-	SI	LC	-		S	F	-
Nesoclopeus w. woodfordi	Woodford's Rail	TL1, TL3	MT, GD, LK	-	G	NT	-	I	D	F	-
Amaurornis moluccanus sp.	Pale-vented Bush-hen	Res.2,	MT, GD, LK	-	SI	LC	-		S	F	-
Porphyrio p. samoensis	Purple Swamphen	TL3,	GD, LK	-	-					F	
***Scolopacidae* SANDPIPERS and CURLEWS**											
Actitis hypoleucos	Common Sandpiper	Res.1, Res.3, Res.4	MT, GD, LK	X	-	LC	-		D	CI	X
***Columbidae* PIGEONS**											
Ptilinopus s. superbus	Superb Fruit-Dove		MT, GD, GR	-	-	LC	-		S	F	-

Ptilinopus solomonensis ocularis	Yellow-bibbed Fruit-Dove		MT, GD, GR	-	G	LC	-	I	S	F	-
Ptilinopus viridis lewisii	Claret-breasted Fruit-Dove		MT, GD, GR	-	-	LC	-		S	F	-
Ducula rubricera rufigila	Red-knobbed Imperial Pigeon	TL4, Acc.1, Acc.2, PP1, PP2, Res.2, Res.3, Dam2, Tun.,	SS, MT, GD, GR, LK	-	SI	NT	-		D	F	-
Ducula p. pistrinaria	Island Imperial Pigeon		MT, GD	-	-	LC	-		S	F	-
Gymnophaps solomonensis	Pale Mountain Pigeon		MT, GD	-	SI	LC	-		S	F	-
Macropygia mackinlayi arossi	Mackinlay's Cuckoo-Dove	Dam4, Upp.1, Upp.2	SS, MT, GD	-	-	LC	-		S	F	-
Reinwardtoena crassirostris	Crested Cuckoo-Dove	Tun.	SS, MT, GD	-	SI	NT	-		D	F	-
Chalcophaps stephani mortoni	Stephan's Dove		SS, MT, GD, GR	-	SI	LC	-		S	F	-
***Cacatuidae* COCKATOOS**											
Cacatua ducorpsi	Ducorp's Cockatoo	TL5, Acc.1, Upp.1, Upp.2	SS, MT, CD, GR	-	SI	LC	II	II	S	-	-
***Psittacidae* PARROTS**											
Chalcopsitta cardinalis	Cardinal Lory		SS, MT, GD, GR, LK	-	SI	LC	II	II	S	-	-
Trichoglossus haematodus massena	Coconut Lorikeet	TL4, Tun., Upp.1, Upp.2,	SS, MT, GD, LK	-	SI	LC	II	II	D	-	-
Lorius chlorocercus	Yellow-bibbed Lory	PP1, PP2, Res.1, Res.3, Dam2, Upp.2,	SS, MT, GD, GR, LK	-	SI	LC	II	II	S	-	-

Charmosyna margarethae	Duchess Lorikeet		MT, GD, GR	-	SI	NT	II	I	D	-	-
Micropsitta finschii aolae	Finsch's Pigmy Parrot	Tun.	MT, GD, GR, LK	-	SI	LC	II	I	S	-	-
Eclectus roratus solomonensis	Eclectus Parrot	Upp.2	SS, MT, GD, GR, LK	-	-	LC	II	II	D	-	-
Geoffroyus h. heteroclitus	Song Parrot		MT, GD, GR	-	-	LC	II	I	S	-	-
***Cuculidae* CUCKOOS**											
Cacomantis variolosus addendus	Brush Cuckoo		MT, GD, GR	-	SI	LC	-		S	-	-
Centropus m. milo	Buff-headed Coucal	TL3, TL4, TL5, Acc.1, PP1, Dam2,	SS, MT, GD, GR	-	SI	LC	-		S	-	-
***Strigidae* OWLS**											
Ninox jacquinoti granti	Guadalcanal Boobook		MT, GD, GR	-	G	LC	II		S	-	-
***Apodidae* SWIFTS**											
Aerodramus vanikorensis lugubris	Uniform Swiftlet	TL1, TL3, Dam2, Upp.2,	MT, GD	-	SI	LC	-		S	-	-
Collocalia esculenta becki	Glossy Swiftlet	Res.2, Res.3, Res.4, Dam2, Dam4, Clif.1, Clif.2, Upp.1, Upp.2,	SS, MT, GD, GR,	-	SI	LC	-		S	-	-
***Hemiprocnidae* TREESWIFTS**											
Hemiprocne mystacea woodfordiana	Moustached Tree-Swift		MT, GD, GR	-	SI	LC	-		S	-	-
***Coraciidae* ROLLERS**											
Eurystomus orientalis solomonensis	Dollar Bird		MT, CD, GR	-	SI	LC	-		D	-	-
***Bucerotidae* HORNBILLS**											

Aceros plicatus mendanae	Blyth's Hornbill	Res.1, Res.3, PP1, Dam2, Dam3, Dam4, Upp.1, Upp.2,	SS, MT, GD, GR, LK	-	SI	LC	II		D	-	-
***Alcedinidae* KINGFISHERS**											
Alcedo atthis salomomensis	Common (River) Kingfisher	Upp.2,	SS, MT, GD, GR	-	SI	LC	-		S	-	X
Ceyx lepidus nigromaxilla	Variable Dwarf Kingfisher	Res.3, Dam4,	MT, GD, GR	-	G	LC	-		D	-	X
Todirhamphus chloris alberti	Collared Kingfisher		MT, GD, GR	-	SI	LC	-		D	-	-
Todirhamphus leucopygius	Ultramarine Kingfisher		MT, GD, GR	-	SI	LC	-		S	-	-
***Hirundinidae* SWALLOWS**											
Hirundo tahitica subfusca	Pacific Swallow		SS, MT, GD	-	-	LC	-		I	-	-
***Campephagidae* CUCKOOSHRIKES and TRILLERS**											
Coracina lineata pusilla	Barred Cuckoo-shrike		MT, GD, GR	-	SI	LC	-		S	-	-
Coracina papuensis elegans	White-bellied Cuckoo-Shrike	TL4,	SS, MT, GD, GR	-	SI	LC	-		I	-	-
Coracina h. holopolia	Solomon Cuckoo-Shrike		MT, GD, GR	-	SI	NT	-		D	-	-
Coracina tenuirostris erythropygia	Common Cicadabird	Res.2	MT, GD, GR	-	SI	LC	-		S	-	-
***Rhipiduridae* FANTAILS**											
Rhipidura leucophrys melaleuca	Willie Wagtail	Res.3, Res.4, Dam4, Clif.1, Upp.1, Upp.2,	SS, MT, GD, GR	-	-	LC	-		I	-	-
Rhipidura c. cockerelli	Cockerell's Fantail		MT, GD, GR	-	G	NT	-		D	-	-

Rhipidura rufifrons rufofronta	Rufous Fantail		MT, GD, GR	-	G	LC	-		D	-	-
***Monarchidae* MONARCHS**											
Monarcha c. castaneiventris	Chestnut-bellied Monarch	Res.3, Dam4,	SS, MT, GD, GR, LK	-	SI	LC	-		D	-	-
Monarcha b. barbatus	Solomons Monarch	Res.3, Dam2,	MT, GD, GR, LK	-	SI	NT	-		D	-	-
Myiagra f. ferrocyanea	Steel-blue Flycatcher	Res.3, Upp.2,	MT, GD, GR	-	SI	LC	-		S	-	-
***Pachycephalidae* WHISTLERS**											
Pachycephala pectoralis cinnamomea	Golden Whistler	PP2, Res.2, Res.4, Dam2,	SS, MT, GD, GR, LK	-	G	LC	-		S	-	-
***Dicaeidae* FLOWERPECKERS**											
Dicaeum aeneum becki	Midget Flowerpecker	Acc.2, Res.1, Res.3, Res.4, Dam2, Clif.1, Clif2, Upp.2,	MT, GD, GR	-	G	LC	-		S	-	-
***Nectariniidae* SUNBIRDS**											
Nectarinia jugularis flavigastra	Olive-backed Sunbird	TL4, Upp.1,	SS, MT, GD	-	-	LC	-		S	-	-
***Meliphagidae* HONEYEATERS**											
Myzomela melanocephala	Black-headed Myzomela	Dam2, Dam4, Upp.2	MT, GD, GR	-	G	LC	-		D	-	-
***Sturnidae* STARLINGS**											
Aplornis cantoroides	Singing Starling		SS, MT, GD, GR	-	-	LC	-		S	-	-
Aplornis grandis macrura	Brown-winged Starling	Res.2, Res.3, Clif.2,	MT, GD, GR	-	G	LC	-		S	-	-
Aplornis metallicus nitida	Metallic Starling	Res.3, Dam2,	SS, MT, GD	-	-	LC	-		S	-	-

Aplornis brunneicapilla	White-eyed Starling		MT, GD, GR	-	SI	EN	-		D	-	-
Acridotheres tristis	Common Myna	TL3	MT, GD	-	I	LC	-		I	-	-
Mino kreffti sanfordi	Long-tailed Myna	TL4, TL5, Acc.1, PP2, Res.3,	SS, MT, GD, GR	-	SI	LC	-		S	-	-
***Corvidae* CROWS**											
Corvus woodfordi	White-billed Crow	Acc.2, PP1, Tun., Upp.2,	SS, MT, GD, GR, LK	-	SI	LC	-		S	-	-

(Potential Species, TRHDP ESIA Scoping Study = SS, Birds of Melanesia = GD, Guadalcanal Island Bird Checklist = MT, Gold Ridge Report = GR, Local Knowledge = LK), (Endemic, Guadalcanal = G, Solomon Islands = SI, Introduced = I), (IUCN Red List Category, Least Concern = LC, Near Threatened = NT, Vulnerable = VU, Endangered = EN & Data Deficient = DD), (CITES Appendix for international trade of species, II = may be authorized by the granting of an export permit), (1998 Act, Prohibited Species = I, Regulated Species = II), (Population Trend, Increasing =I, Decreasing =D & Stable =S), (Local Uses, Food =F & Cultural Importance = CI), (X = Dependent on the river).

1.2.9.3 Mammals

A total of 5 mammals were observed from a total of 14 potential species from 4 families. This is around 36 percent of all mammals expected to be found along the Tina River study area. Table 3 (below) lists mammal species by family including scientific and common nomenclature. The sampling stations that the species is present in are noted as well as the 'Potential Presence' of the species in the Tina River study area based on species observed in areas in close vicinity to the study site in literature (TRHDP ESIA Scoping Study (Sherwood 2012) = SS, Gold Ridge Report (NL 1996) = GR and Local Knowledge = LK). Species migratory and endemic status (Guadalcanal = G, Solomon Islands = SI, Introduced = I) were also stated based on IUCN (2013). Each species Red List category (IUCN 2013) as a value of vulnerability is also specified (Least Concern = LC, Near Threatened = NT, Endangered = EN, Critically Endangered = CR and Data Deficient = DD). Each species CITES category (UNEP-WCMC 2013) where possible, of protection is also stated, as well as the status of local protection based on the Wildlife and Protection Act (1998). The 'Population Trend' (where possible, Increasing =I, Decreasing =D & Stable =S) is based on the IUCN (2013) Red List and 'Local Uses' is based on information regarding the species from locals (Food =F). Each species dependence on the river based on in-field observations is also stated.

Table 3 Mammal Species Inventory of Tina River

Species name	Common name	Station Presence	Potential Presence	Migratory	Endemic	IUCN Red List Category	CITES Appendix	1998 Act	Population Trend	Local uses	River Dependent
***Pteropodidae* FRUIT BATS**											

Macroglossus minimus	Northern Common Blossom Bat		GR, SS	-	-	LC	-		S	F	-
Melonycteris fardoulisi	Fardoulis's Blossom Bat		GR	-	SI	LC	-		D	F	-
Nyctimene major	Island Tube-nosed Fruit Bat	Res.2, Res.3, Res.4	GR	-	-	LC	-		S	F	-
Pteropus rayneri	Solomon's Flying Fox	Res.3, Dam3,	SS, LK	-	SI	NT	II	I	D	F	-
Pteropus admiraltatum	Island Flying Fox		SS, LK	-	-	LC	II	I	D	F	-
Rousettus amplexicaudatus	Rousette Bat	Res.3, Res.4	GR	-	-	LC	-		S	F	-
***Hipposideridae* LEAF-NOSED BATS**											
Aselliscus tricuspidatus	Trident Leaf-nosed Bat		GR	-	-	LC	-		S	F	-
Hipposideros cervinus	Fawn Leaf-nosed Bat	Res.3		-	-	LC	-		S	F	-
Hipposideros diadema	Diadem Leaf-nosed Bat		GR	-	-	LC	-		S	F	-
***Muridae* RODENTS**											
Rattus exulans	Polynesian Rat		GR	-	I	LC	-		S	-	-
Rattus rattus	House Rat		GR	-	I	LC	-		S	-	-
Uromys rex	King Rat		SS, LK	-	G	EN	-	I	D	-	-
Uromys imperator	Emperor Rat		SS, LK	-	G	CR	-	I	D	-	-
***Suidae* PIGS**											
Sus scrofa	Wild Pig	PP2, Tun., Res.3	LK	-	-	LC	-		S	F	-
***Phalangeridae* NOCTURNAL MARSUPIALS**											
Phalanger orientalis	Northern Common Cuscus		LK	-	-	LC	-		S	F	-

(Potential Species, TRHDP ESIA Scoping Study = SS, Local Knowledge = LK, Gold Ridge Report = GR), (Endemic, Guadalcanal = G, Solomon Islands = SI, Introduced = I), (IUCN Red List Category, Least Concern = LC, Near Threatened = NT, Endangered = EN & Critically Endangered = CR), (CITES Appendix for international trade of species, II = may be authorized by the granting of an export permit), (1998 Act, Prohibited Species = I, Regulated Species = II), (Population Trend, Decreasing =D & Stable =S), (Local Uses, Food =F).

1.2.9.4 Reptiles

A total of 5 reptiles were observed from a total of 23 potential species from 5 families. This is around 22 percent of all reptiles expected to be found along the Tina River study area. Table 4 (below) lists reptile species by family including scientific and common nomenclature. The sampling stations that the species is present in are noted as well as the 'Potential Presence' of the species in the Tina River study area based on species observed in areas in close vicinity to the study site in literature (TRHDP ESIA Scoping Study (Sherwood 2012) = SS, Reptiles of the SI (McCoy 2006) = MM, Gold Ridge Report (NL 1996) = GR and Local Knowledge = LK). Species migratory and endemic status (Guadalcanal = G, Solomon Islands = SI, Introduced = I) were also stated based on McCoy (2006). Each species Red List category (IUCN 2013) as a value of vulnerability is also specified (Least Concern = LC, Near Threatened = NT and Data Deficient = DD). Each species CITES category (UNEP-WCMC 2013) where possible, of protection is also stated, as well as the status of local protection based on the Wildlife and Protection Act (1998). The 'Population Trend' (where possible, Increasing =I & Stable =S) is based on the IUCN (2013) Red List and 'Local Uses' is based on information regarding the species from locals (Food =F). Each species dependence on the river based on literature (McCoy 2006) and in-field observations is also stated.

Table 4 Reptile Species Inventory of Tina River

Species name	Common name	Station Presence	Potential Presence	Migratory	Endemic	IUCN Red List Category	CITES Appendix	1998 Act	Population Trend	Local uses	River Dependent
***Gekkonidae* GECKOS**											
Cyrtodactylus salomonensis	Solomons Bent-toed Gecko		MM, GR	-	SI	NT	-	II	S	-	-
Cyrtodactylus biordinis	Guadalcanal Bow-fingered Gecko		MM, LK	-	G	LC	-		S	-	-
Gehyra oceanica	Oceanic Gecko		MM,	-	-	LC	-		S	-	-
Gekko vittatus	Sago Gecko		MM	-	-	LC	-	II	S	-	-
Nactus multicarinatus	Solomons Slender-toed Gecko	Res.4, Dam2,	MM	-	-	LC	-		S	-	-
***Scincidae* SKINKS**											
Corucia zebrata	Prehensile-tailed Skink		MM, LK	-	SI	NT	II	II	D	F	-
Emoia cyanogaster	Greeen-Bellied Tree Skink		MM, SS	-	-	LC	-		S	-	-

Emoia cyanura	Brown-tailed Copper-striped Skink	TL4, Acc.1,	MM, SS, GR	-	-	LC	-	II	S	-	-
Emoia nigra	Pacific Black Skink	TL1, Acc.1, Upp.2, Dam1, Dam2,	MM, SS, GR, LK	-	-	LC	-		S	-	-
Emoia pseudocyanura	Solomons Blue-tailed Skink	TL5, Acc.1, PP1, PP2, Dam1, Upp.1, Upp.2,	MM, SS, GR	-	SI	LC	-		S	-	-
Eugongylus albofasciolatus	White-banded Giant Skink		MM	-	-	LC	-		S	-	-
Lipinia noctua	Moth Skink		MM	-	-	LC	-		S	-	-
Lamprolepsis smaragdina	Emerald Tree Skink		MM, SS	-	-	LC	-	II	S	-	-
Prasinohaema virens	Green-blooded Skink		MM, GR	-	-	LC	-	II	S	-	-
Sphenomorphus bignelli			MM	-	SI	LC	-		S	-	-
Sphenomorphus concinnatus	Elegant Forest Skink		MM, GR	-	SI	LC	-	II	S	-	-
Sphenomorphus solomonis			MM, GR	-	-	LC	-	II	S	-	-
Sphenomorphus cranei	Crane's Skink		MM, GR	-	SI	LC	-		S	-	-
Tribolonotus schmidti	Schmidt's Crocodile Skink		MM, GR	-	G	LC	-		S	-	-
***Boidae* BOAS**											
Candoia paulsoni	Solomons Ground Boa		MM, SS, GR, LK	-	-	LC	II		S	-	-
***Colubridae* COLUBRID SNAKES**											
Boiga irregularis	Brown Tree Snake		SS, GR	-	-	LC	-		S	-	-
Dendrelaphis salomonis	Solomons Tree Snake	TL5	MM, GR, LK	-	-	LC	-		S	-	-
***Elapidae* ELAPID SNAKES**											
Salomonis par	Solomons Red Krait		MM, SS, GR, LK	-	SI	LC	-		S	-	-

(Potential Species, TRHDP ESIA Scoping Study = SS, Reptiles of the Solomon Islands = MM, Gold Ridge Report = GR, Local Knowledge = LK), (Endemic, Guadalcanal = G, Solomon Islands = SI), (IUCN Red List Category, Least Concern = LC, Near Threatened = NT), (CITES Appendix for international trade of species, II = may be authorized by the granting of an export permit), (1998 Act, Prohibited Species = I, Regulated Species = II), (Population Trend, Decreasing =D & Stable =S), (Local Uses, Food =F).

1.3 IMPORTANT SPECIES DESCRIPTIONS

This section will describe species observed that are deemed ecologically important because of their migratory patterns, endemic status, threatened status and protected status and water dependence. Species that will be described include species that are migratory, are Guadalcanal island endemics, are IUCN red listed as Vulnerable, Endangered or Critically Endangered, are protected CITES species and have a dependence on the river water system.

Literature regarding specific life cycle, breeding and feeding habits of most fauna in the Solomon Islands is lacking. There is lack of human and financial resources to carry out research at a species specific level. Due to this lack of information there is therefore a limitation regarding in the impact that development activities may have on such species. Therefore care must always be taken to err on the side of caution when assumptions are being made.

1.3.1 Amphibians

Amphibians are sensitive animals and often seen as good indicators for forest health. This is due to their dependence on certain moisture regimes and sensitivity for pollutants as they are able to 'breathe' through their skin. Therefore amphibians require moist environments that are relatively pollutant free.

Discodeles guppyi **Giant Webbed Frog**

This frog is deemed ecologically important because of its dependence on the river system and is usually found along smaller rivers and streams (Pikacha *et al.* 2008). This is the largest frog in the Solomon Islands and locals report eating this species. This species belongs to the riparian habitat. Possible impacts of the hydro project on this species is the loss of habitat for breeding and feeding.

Litoria lutea **Solomon Island's Treefrog**

This frog is deemed ecologically important because of its vulnerability based on the IUCN Red List assessment (IUCN 2013). This is a rare forest frog in the Solomon Islands and little information about this species is available (Pikacha *et al.* 2008). This species belongs to the upland, forest habitats. Possible impacts of the hydro project on this species is minimal.

Hylarana kreffti **San Cristobal Treefrog**

This frog is deemed ecologically important because of its dependence on the river system and is an aquatic breeder that lays eggs in pools of water (Pikacha *et al.* 2008). This is the only Solomon Islands frog that has a tadpole stage as opposed to direct development evident in the Ceratobatrachidae frogs (See egg and tadpole pictures in appendix). This species belongs to the riparian habitats. Possible impacts of the project on this species is the loss of habitat for feeding, however the creation of a dam may increase micro-habitats for breeding.

1.3.2 Birds

There is a wide variety of birds that occupy different ecological niches in various habitats from grasslands to waterways to upland forests. Birds play an important ecological role in the dispersal of plant seeds, the control of insects and the pollination of plants amongst other things. Specialist birds that occupy very narrow niches (such as the common sandpiper) are very good indicators as their disappearance can easily signify a degraded habitats.

Nycticorax caledonicus mandibularis **Nankeen Night Heron**

This bird is deemed ecologically important because of its dependence on the river system for feeding (such as on little fish and shrimp) and the sub-species is also a Solomon Islands endemic (Dutson 2011). This heron is found close to water and especially along forested rivers such as the Tina and is found in riparian habitats (see picture of footprint in appendix). Loss of habitat for breeding and feeding for this species may occur, however the creation of a dam may increase micro-habitats for feeding.

Microcarbo m. melanoleucos **Little Pied Cormorant**

This bird is deemed ecologically important because of its dependence on the river system for feeding (such as on little fish and shrimp). It is found along large rivers and nests in large trees beside water (Dutson 2011). This cormorant is found in riparian habitats. Loss of habitat for breeding and feeding for this species may occur, however the creation of a dam may increase micro-habitats for feeding.

Anas superciliosa **Pacific Black Duck**

This bird is deemed ecologically important because of its dependence on the river system for feeding and breeding and is found along waterways such as rivers (Dutson 2011). This duck is also opportunistically hunted by locals as a food source. This species is found in riparian habitats. Loss of habitat for this species may occur, however the creation of a dam may increase micro-habitats for feeding.

Haliastur indus flavirostris **Brahminy Kite**

This bird is deemed ecologically important because of its CITES protection status (UNEP-WCMC 2013), this sub-species is also a Solomon Islands endemic (Dutson 2011). It is the commonest raptor in the Solomon's and if found throughout a wide range of habitats, it is found throughout the entire study area. This raptor feeds mainly on smaller birds. This bird is not threatened and possible impacts of the hydro project on this species is minimal.

Aviceda subcristata proxima **Pacific Baza**

This bird is deemed ecologically important because of its CITES protection status (UNEP-WCMC 2013) and this sub-species is also a Solomon Islands endemic (Dutson 2011). This common species has small numbers and is found in forest habitats but is able to be seen throughout the entire range of the study area. This raptor feeds mainly on smaller birds and lizards. This bird is not threatened and possible impacts of the hydro project on this species is minimal.

Accipiter novaehollandiae pulchellus **Variable Goshawk**

This bird is deemed ecologically important because of its CITES protection status (UNEP-WCMC 2013), this sub-species is also a Guadalcanal island endemic (Dutson 2011). The commonest hawk in the region and is found in forest habitats but is able to be seen throughout the entire range of the study area. This raptor feeds mainly on smaller birds and lizards. This bird is not threatened and possible impacts of the hydro project on this species is minimal.

Accipiter meyerianus **Meyer's Goshawk**

This bird is deemed ecologically important because of its CITES protection status (UNEP-WCMC 2013). It is an uncommon species found in forest habitats (Dutson 2011) but is able to be seen throughout the entire range of the study area (see picture in appendix). This raptor feeds mainly on smaller birds and lizards. This species may be locally threatened and possible impacts of the hydro project on this species is minimal.

Haliaeetus sanfordi **Solomon Sea-Eagle**

This bird is deemed ecologically important because of its CITES protection status (UNEP-WCMC 2013) and its vulnerability based on the IUCN Red List assessment (IUCN 2013), this sub-species is also a Solomon Islands endemic (Dutson 2011). This eagle is wide ranging, from coast to upland forests and is found throughout the entire study area (see picture in appendix). This eagle feeds mainly on pigeons, doves, fish, possums and lizards. It is rare but possible impacts of the hydro project on this species is minimal.

Turnix maculosa salomonis **Red-backed Button-Quail**

This bird is deemed ecologically important because this sub-species is a Guadalcanal island endemic (Dutson 2011). This quail is locally common but may also be locally threatened due to habitat disturbance and opportunistic hunting for food. This species if found in the grassland habitat. Possible impacts of the hydro project on this species is minimal.

Nesoclopeus w. woodfordi **Woodford's Rail**

This bird is deemed ecologically important because this sub-species is a Guadalcanal island endemic (Dutson 2011), it is classed as Near Threatened by IUCN's Red List (IUCN 2013) and it is also opportunistically hunted by locals for food. The possible impacts of the hydro project on this rare and threatened rail should be minimal due to minimal impacts to the grassland habitat that this species is located in.

Actitis hypoleucos **Common Sandpiper**

This bird is deemed very ecologically important because it is a migratory species and it is also dependent on the river system (Dutson 2011). This species breeds in the northern hemisphere from May to June and would be absent from the Solomon Islands, possible breeding destinations for these migrants include Russia, Korea and Japan (BirdLife 2013). This sandpiper is water dependent and feeds on larval insects, spiders, molluscs, snails, crustaceans, annelids, frogs, toads, tadpoles and small fish, as well as plant material (including seeds). This bird is also a culturally important species as it's feather is believed to give extra strength or luck if obtained, to further signify the migratory status of this species, locals recall never observing the nest or egg of this bird. This common species is usually solitary and is also territorial (see picture in appendix). Loss of habitat for this species may occur, however the creation of a dam may increase micro-habitats for feeding.

Ptilinopus solomonensis ocularis **Yellow-bibbed Fruit-Dove**

This bird is deemed ecologically important because this sub-species is a Guadalcanal island endemic (Dutson 2011) and it is also opportunistically hunted by locals for food. This dove is found in upland habitats and feeds on fruits and nuts. This bird is not threatened and possible impacts of the hydro project on this species is minimal.

Cacatua ducorpsi **Ducorp's Cockatoo**

This bird is deemed ecologically important because of its CITES protection status (UNEP-WCMC 2013), also this species is also a Solomon Islands endemic (Dutson 2011). This common cockatoo is found in most areas that have large trees so all habitats except grassland and oil palm plantations should have this species. This cockatoo feeds on fruit, nuts and seeds of trees. This species is not threatened and possible impacts from the hydro project are minimal.

Chalcopsitta cardinalis **Cardinal Lory**

This bird is deemed ecologically important because of its CITES protection status (UNEP-WCMC 2013), also this species is also a Solomon Islands endemic (Dutson 2011). This common lory is found throughout all habitat types in the study area with a preference for flowering or fruiting large trees. This bird is not threatened and possible impacts from the hydro project are minimal.

Trichoglossus haematodus massena **Coconut Lorikeet**

This bird is deemed ecologically important because of its CITES protection status (UNEP-WCMC 2013), also this sub-species is also a Solomon Islands endemic (Dutson 2011). This abundant lorikeet is found throughout all habitat types in the study area with a preference for flowering or fruiting large trees. This bird is not threatened and possible impacts from the hydro project are minimal.

Lorius chlorocercus **Yellow-bibbed Lory**

This bird is deemed ecologically important because of its CITES protection status (UNEP-WCMC 2013), also this species is also a Solomon Islands endemic (Dutson 2011). This common lory is found throughout all habitat types in the study area with a preference for flowering or fruiting large trees. This bird may be threatened by logging and possible impacts from the hydro project are minimal.

Charmosyna margarethae **Duchess Lorikeet**

This bird is deemed ecologically important because of its CITES protection status (UNEP-WCMC 2013), this species is also a Solomon Islands endemic (Dutson 2011), this species is also listed as Near Threatened by IUCN's Red List (IUCN 2013). This lorikeet is common in upland habitats especially on flowering trees. This bird may be threatened and possible impacts from the hydro project are minimal.

Micropsitta finschii aolae **Finsch's Pigmy Parrot**

This bird is deemed ecologically important because of its CITES protection status (UNEP-WCMC 2013), this sub-species is also a Solomon Islands endemic (Dutson 2011). This parrot is found in forest habitats and feeds on small termites found in the bark of large forest trees. This common species is not threatened and possible impacts from the hydro project are minimal.

Eclectus roratus solomonensis **Eclectus Parrot**

This bird is deemed ecologically important because of its CITES protection status (UNEP-WCMC 2013). This is a common parrot that can be found in a wide variety of habitats from forests to gardens and feeds on wild fruits and also cultivated fruits such as banana's (Dutson 2011). It is not threatened and possible impacts from the hydro project are minimal.

Geoffroyus h. heteroclitus **Song Parrot**

This bird is deemed ecologically important because of its CITES protection status (UNEP-WCMC 2013). This is an uncommon parrot that can be found in a wide variety of habitats from forests to gardens and feeds on fruits and seeds of trees (Dutson 2011). It is not threatened and possible impacts from the hydro project are minimal.

Ninox jacquinoti granti **Guadalcanal Boobook**

This bird is deemed ecologically important because of its CITES protection status (UNEP-WCMC 2013), this sub-species is also a Guadalcanal island endemic (Dutson 2011). This owl is common in forest habitats and is not likely threatened and feeds on insects. Possible impacts from the hydro project are minimal.

Aceros plicatus mendanae **Blyth's Hornbill**

This bird is deemed ecologically important because of its CITES protection status (UNEP-WCMC 2013), also this sub-species is a Solomon Islands endemic (Dutson 2011). This common hornbill is found in forest habitats and is thought not to be threatened it feeds on forest fruits and nuts. Possible impacts from the hydro project are minimal.

Alcedo atthis salomomensis **Common (River) Kingfisher**

This bird is deemed ecologically important because of its dependence on the river system for feeding on fish and this sub-species is also a Solomon Islands endemic (Dutson 2011). This kingfisher is relatively uncommon and can be found beside streams and large rivers in the riparian habitat. It is not threatened and loss of habitat is possible, however the creation of a dam and reservoir may increase micro-habitats for feeding.

Ceyx lepidus nigromaxilla **Variable Dwarf Kingfisher**

This bird is deemed ecologically important because of its dependence on the river system and this sub-species is also a Guadalcanal island endemic (Dutson 2011). This kingfisher is relatively common and can be found beside streams in riparian habitats (see picture in appendix). It is not threatened and loss of habitat is possible, however the creation of a dam and reservoir may increase micro-habitats for feeding.

Rhipidura c. cockerelli **Cockerell's Fantail**

This bird is deemed ecologically important because it's sub-species is a Guadalcanal island endemic (Dutson 2011) and it is also classed as Near Threatened by the IUCN Red List (IUCN 2013). This uncommon fantail requires undisturbed forest and is threatened by habitat degradation, however possible impacts from the hydro project are minimal. It feeds on insects.

Rhipidura rufifrons rufofronta **Rufous Fantail**

This bird is deemed ecologically important because it's sub-species is a Guadalcanal island endemic (Dutson 2011). This fantail is common in forested habitats and feeds on insects and appears not to be threatened with possible impacts from the hydro project are minimal.

Pachycephala pectoralis cinnamomea **Golden Whistler**

This bird is deemed ecologically important because it's sub-species is a Guadalcanal island endemic (Dutson 2011). This whistler is common in forest habitats and feeds on insects and may be threatened due to habitat loss. Possible impacts from the hydro project are minimal.

Dicaeum aeneum becki **Midget Flowerpecker**

This bird is deemed ecologically important because it's sub-species is a Guadalcanal island endemic (Dutson 2011). This bird is very common in forest habitats especially on flowering plants and ant-plants (see picture in appendix) that it feeds on insects living in the ant plants. It is not threatened and possible impacts from the hydro project are minimal.

Myzomela melanocephala **Black-headed Myzomela**

This bird is deemed ecologically important because it is a Guadalcanal island endemic (Dutson 2011). This bird is common in forest habitats especially on flowering plants and ant-plants where it feeds on nectar from flowers. It is not threatened and possible impacts from the hydro project are minimal.

Aplornis grandis macrura **Brown-winged Starling**

This bird is deemed ecologically important because it's sub-species is a Guadalcanal island endemic (Dutson 2011). This common starling is found in a wide range of habitats from gardens and settlements to forest habitats and feeds on insects, flowers and fruits. It is not threatened and possible impacts from the hydro project are probably minimal.

Aplornis brunneicapilla **White-eyed Starling**

This bird is deemed ecologically important because it is classed as Endangered by IUCN's Red List (IUCN 2013) and is also a Solomon Islands endemic (Dutson 2011). This is a rare bird and is found in forested habitats and feeds on insects, flowers and fruits. It is threatened by habitat lost, however possible impacts from the hydro project are minimal.

1.3.3 Mammals

Guadalcanal is home to some of the most cryptic and rare mammals in the Pacific including flying foxes and giant native rats. These animals are also very threatened and some have not been seen for over 100 years and may be extinct, however in depth searches for these animals have not being carried out and there is a possibility that they may occur in the study vicinity.

Pteropus rayneri **Solomon's Flying Fox**

This bat is deemed ecologically important because of its CITES protection status (UNEP-WCMC 2013), this species is also classed as Near Threatened by the IUCN's Red List (IUCN 2013) and is a Solomon Islands endemic, this species is also opportunistically hunted by locals for food. This large bat is found over a wide variety of habitats though uses forests for roosting, especially large trees and caves and feeds on fruits. This species is threatened by habitat loss and hunting however, possible impacts from the hydro project are minimal.

Pteropus admiraltatum **Island Flying Fox**

This bat is deemed ecologically important because of its CITES protection status (UNEP-WCMC 2013), this species is also opportunistically hunted by locals for food. This large bat is found in forest habitats and feeds on wild and cultivated fruits, it may be threatened and possible impacts from the hydro project are minimal.

Uromys rex **King Rat**

This rat is deemed ecologically important because it is classed as Endangered by IUCN's Red List (IUCN 2013) and it is also a Guadalcanal island endemic. This native tree-rat is believed to be found in upland forest habitats and feeds on fruits, nuts and seeds, it is highly threatened from habitat loss and predation from cats. This species is very rare however it is unlikely to come into contact with the hydro project direct impact area. The establishment of the catchment area into a conservation area may prove beneficial to this species, though more surveying for this species is recommended.

Uromys imperator **Emperor Rat**

This rat is deemed ecologically important because it is classed as Critically Endangered by IUCN's Red List (IUCN 2013) and it is also a Guadalcanal island endemic. This native tree-rat is believed to be found in upland forest habitats and feeds on fruit, nuts and seeds, it is highly threatened from habitat loss and predation from cats. This species may be extinct as no species has been encountered since 1880, it is unlikely to come into contact with the hydro project direct impact area. The establishment of the catchment area into a conservation area may prove beneficial to this species, though more surveying for this species is recommended.

1.3.4 Reptiles

Reptiles are important animals of the forest and provide a large proportion of faunal biomass, thus playing an important role in the food web of the ecosystem. Reptiles are ectotherms and therefore require body heat from the sun and also there body heat is regulated externally similar to amphibians, therefore they can also be susceptible to changes in the micro-habitats.

Cyrtodactylus biordinis **Guadalcanal Bow-fingered Gecko**

This gecko is deemed ecologically important because it is a Guadalcanal island endemic (McCoy 2006). It is commonly found on smaller trees and tree hollows where it lays its eggs, in forested habitats and feeds on insects especially moths. It is believed not to be threatened and possible impacts from the hydro project are minimal.

Corucia zebrata **Prehensile-tailed Skink**

This skink is deemed ecologically important because of its CITES protection status (UNEP-WCMC 2013), this skink is also a Solomon Islands endemic (McCoy 2006) and is classed as Near Threatened by the IUCN Red List (IUCN 2013), it is also opportunistically hunted for food. This species is probably the largest skink in the world and prefers large trees with dense foliage in forest habitats, it is a vegetarian and feeds on leaves from vines and fruits and flowers. This species may be threatened by habitat loss, however possible impacts from the hydro project are minimal.

Tribolonotus schmidti **Schmidt's Crocodile Skink**

This skink is deemed ecologically important because it is a Guadalcanal island endemic (McCoy 2006). This skink is relatively common and prefers moist areas under fallen and rotting timber in forest habitats, it feeds on insects. It is not threatened and possible impacts from the hydro project are minimal.

Candoia paulsoni **Solomons Ground Boa**

This snake is deemed ecologically important because of its CITES protection status (UNEP-WCMC 2013). This common snake occurs in a wide variety of habitats from forests to gardens and feeds on frogs to skinks and smaller snakes. It is not threatened and possible impacts from the hydro project are minimal.

1.4 HABITAT DELINEATION AND VALORIZATION

General habitats were localized and delineated on a Google Earth map. This section describes the value of the general habitat types for terrestrial wildlife (highly valued, moderately valued, weekly valued). The report defines what is considered "critical" in the study area in a strictly biological point of view: areas with protected species colonies, areas with endemic species, areas with migratory species and areas with endangered species. Critical natural habitats described and delineated include grassland, riparian, upland and forests. However certain important species have ranges that cover the entire project area and can be found in all areas.

1.4.1 Habitat Types

Refer to pictures in appendix and delineated areas on Google Earth. All the habitats described are common on Guadalcanal and there are no unique habitats that are found in the project that cannot be found elsewhere on the island of Guadalcanal. Most habitats found in the project area are not in a pristine state and have been used and degraded to a certain extent by local populations.

1.4.1.1 Grassland

Refers to habitats that are dominated by grasses and cover the lower lying hills that are not so steep. These are natural habitats formed from the dryer climate and less fertile soils. They have moderate ecological value mainly because they support fewer species but they do support unique species that are not found in forests.

1.4.1.2 Forest

2.4.1.2.1 Undisturbed forest

Refers to forested areas that have undergone relatively no disturbance by human activities. These forest areas are in pristine condition and are on a high ecological value. They are home to a wide variety of species and the intactness of the forest supports greater biodiversity.

2.4.1.2.2 Disturbed forest

Refers to forested areas that have undergone relatively recent disturbance by human activities, such as in the form of timber extraction. These forest areas are not in pristine condition and are on a moderate ecological value. They are home to a small variety of species because of the disturbed nature.

2.4.1.2.3 Remnant forest

Refers to forested areas that have undergone extensive disturbance with remaining large trees such as *Canarium* nut trees left on purpose. These forest areas are not in pristine condition and are on a moderate ecological value. They are home to a small variety of species but are highly modified landscapes by people.

1.4.1.3 Upland

Refers to habitats further inland and of a higher altitude and usually of a forest nature. Upland areas are usually of a pristine nature due to the distance from human habitation and influence. They also are home to many unique and rare species and this habitat is therefore of a high ecological value.

1.4.1.4 Riparian

Refers to habitats along and adjacent to the Tina river and other waterways. These habitats are of high ecological value because they are home to many unique species that are dependent on the water ecosystems. Riparian habitats of a greater distance from settlement areas are also of the most pristine conditions.

1.4.1.5 Cliff

Refers to habitat on and adjacent to very steep areas, usually always adjacent to the river as well. Cliffs seem to be habitats that are created by the river systems that they are adjacent to. They are of a moderate ecological value because they house unique species that may use the cliffs as feeding and breeding habitats. They are of a relatively pristine nature because cliff areas are hard to be modified by local peoples.

1.4.1.6 Garden

Refers to human cultivated habitats that contain food crops. This habitats are of a weak ecological value as they are human created landscapes. However they do provide certain feeding habitats for some species.

1.4.1.7 Fallow brush land

Refers to habitats that were cultivated in the past but have been left to fallow in recent years. These are areas similar to remnant forest however they have undergone complete cultivation as in the form on a garden and have been left to fallow/regrow. They are of a weak ecological value because they host a minimal number of species.

1.4.1.8 Oil palm plantation

Refers to habitats that are homogenous cultivated with oil palm. These areas are of a weak ecological value as they are human created landscapes and are dominated by a foreign species. However certain species have learned to adapt and take advantage of this habitat such bats.

1.4.1.9 Settlement

Refers to habitats in and around village areas. These areas are of a weak ecological value and threaten native species especially through domesticated animals such as cats, dogs and pigs.

1.5 RECOMMENDATIONS AND CONCLUSIONS

- Field study time should be increased for this report, to increase the accuracy and credibility of information on faunal species.
- The establishment of a protected area for the catchment area may benefit the conservation of most biodiversity of the island, especially the endangered native rats.
- The formation of a dam system may favour some water dependent species such as birds by providing extra micro-habitats for feeding and breeding.

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3. APPENDIX

3.1 SAMPLING STATION PHOTOGRAPHS

Refer to folder in FTP

3.2 SPECIES PHOTOGRAPHS

Refer to folder in FTP

3.3 HABITAT PHOTOGRAPHS

Refer to folder in FTP

Appendix N

Treatment of Community Feedback

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Appendix N

Treatment of Community Feedback

Table N-1 provides a summary of the community feedback received in the 15 ESIA mitigation workshops undertaken in 2014 and the manner in which feedback has been incorporated into project design and key safeguard documents. Minutes of the relevant mitigation workshops can be found in Annex 12.

Table N-2 provides a summary of community feedback arising during community consultations of the revised ESIA in October and November 2016 and Project responses to issues raised.

Table N-1 – Resolution of Community Concerns ESIA Mitigation Workshops 2014

Consultation Feedback	Project Outcome
Grievance Mechanism required for local communities	Grievance mechanisms for local communities provided for land acquisition in the LALRP and for project impacts in the ESIA
Need for a fish pass and protection of key fish species	Further fish study undertaken by Ian Jowett to consider protection of nominated fish species (Gobi, eel, silver fish). Trap and Haul system adopted as more effective fish pass for true swimmer species. ESIA disclosure in November 2016 included presentation of photographs of trap and haul systems and mechanism details.
Concern about impact of dam on downstream commercial gravel activities and request for further investigation	Communities informed in November 2016 ESIA disclosure meetings: - Initial drill hole studies suggest a minimum of 30-50 years of river-bed gravel. - Further and ongoing investigations to monitor gravel quantity will be undertaken on a regular basis through the hydro operations period
Provision of alternative water supplies pre-construction for river dependent communities	Accommodated. Provision of alternative water supplies for Project affected river users downstream of the dam site provided for in ESMP. SPC to prepare a Water Supply Feasibility Study for approval by PO and WB prior to installation of supplies.
Safety of the dam during cyclones and extreme weather conditions a series concern for communities.	Dam design complies with dam safety panel requirements. Dam safety panel visited communities in 2012. Under the ESMP, the TRHDP-PO will run a village level consultation program on modern day dam engineering, construction and operation complemented by community briefings from the World Bank's dam safety panel.
Tambu site protection to be considered and compensation paid for damage	Accomodated. The ESMP's Cultural Heritage Plan Framework provides for tambu sites to be confidentially identified prior to construction, protected where possible, and provided with monetary compensation where damage occurs.
Consideration to be given to protecting community benefit agreements where companies change to avoid difficulties experienced with Gold	To accommodate this concern, the community benefit share payment regime once finalised shall be enforceable through contracts between SPC and Solomon Power (PPA), and between SPC and SIG (Implementation Agreement). Any novation or transfer of the contracts will require consent. Consideration will be given to recommending an Act of Parliament to reflect the contractual agreements once

Consultation Feedback	Project Outcome
Ridge. Suggestion that this be done by way of an Act of Parliament.	implementation confirms success of community benefit share financing arrangement.
Guarantee for communities and landowners to be given priority employment	Accomodated. The Implementation Agreement provides for communities and landowners to receive preferential employment. JSDF funded Community Benefit Share Pilot provides for pre-employment training for landowners and communities.
Malango people as landowners need equal involvement in the Project with Bahomea	Accomodated. Malango people will be included in the community benefit share arrangements, and as landowners, were key players in the negotiation of the Process Agreement for land acquisition. They are also included in the PO's ongoing consultation program.
Traditional use of the river to be documented in the ESIA	Accommodated. ESIA and LALRP include assessment of river uses including fishing, drinking, washing, bathing, and swimming.
Mitigation measures to address removal of vegetation and biomass from the reservoir	Accommodated. ESMP includes measures for reservoir vegetation to be stripped (without pesticides) and mulched, to reduce biomass.
Consideration to be given to oxygen levels in the dam	Accommodated. Investigation of reservoir stratification included in ESIA.
Information needed on how environmental flow will be managed	Accommodated. ESIA community awareness in Nov 2016 provided information on environmental flow requirements and management. Requirements will also form part of the Reservoir Management Plan to be prepared by the SPC.
Overseas study visits needed to show other hydros	Accommodated. Two overseas study visits facilitated by PO, including visits to hydro power stations in Fiji and Australia.
Relocation request for riverside villages even if dam is deemed safe	Not Accommodated. Relocation not compliant with WB Indigenous Peoples safeguards. Village level dam safety workshops, involving the dam safety panel, instead proposed in ESMP.
Impacts of dam on social structures of communities, churches, women and youth to be included in ESIA	Accommodated. Social impact assessment in ESIA accomodates issues raised. Key mitigation measures include compulsory cultural induction training for workers, workers code of conduct, prohibition on a construction worker's camp in the area, and priority job access and job training for local communities.
Request for a police post to be installed in the Tina area	Not Accommodated. RSIPF arrangements are out of scope of the TRHDP. However, extensive security will be provided during construction and operations and there is an opportunity for the Community Benefit Share Fund to consider accommodating police infrastructure needs as a supported project if determined to be a priority.
Request for re-opening of clinics and a high level health service (mini hospital)	Partly Accommodated. SPC/EPC are to open and operate a clinic in or near the Project Area before construction commences. Community Benefit Share Fund is anticipated to support the re-opening of the Konga Clinic in Bahomea in consultation with the Guadalcanal

Consultation Feedback	Project Outcome
	Ministry of Health. Opening of a clinic in Malango is also a likely priority for the fund. Ministry of Health planning for Guadalcanal provides for a referral system to the National Referral Hospital (NRH) in Honiara (30-40 minutes drive). Providing requisite staff, expertise and supplies to a second hospital is not consistent with Ministry of Health policy. Road upgrades will improve transport times to NRH.
Studies should take into account social inconvenience and use of bad language	Accommodated. ESMP requires all new workers to participate in cultural induction training and adhere to a Worker's Code of Conduct
Need to consider seismic events in dam design	Accommodated Dam design built to withstand a 1 in 500 year Operating Base Earthquake (OBE) and a 1 in 10,000 year Maximum Design Earthquake (MDE). A seismic risk assessment was undertaken and incorporated into design requirements as the PPA's 'Minimum Functional Specifications'. The Dam Safety Panel will continue to review dam design in accordance with the WB's Dam Safety Plans under OP 4.37. Seismic event design communicated to Bahomea,Malango and Ghaobata communities in November 2016 ESIA disclosure consultations and will form a key component of dam safety village workshops required under the ESMP.
Emergency plan for dam failure needed	Accommodated Developer to prepare an Emergency Preparedness Plan under the ESMP including disaster/extreme event modelling, dam failure and responses.
Importance of education	Accommodated Community Benefit Share Fund is proposed to focus primarily on education outcomes, including improvements to existing schools, teacher housing, electrification of schools and computer classes. Final priorities will be determined in accordance with the decision making processes of the final fund design.
Information requested on Project timeframes	Accommodated Ongoing community awareness has updated communities on Project activities and timeframes. See Annex 14.
Rehabilitation needed for youths involved in anti-social behaviour during the tensions	Partly Accommodated Community Benefit Share Fund to provide improvements to education from kindergarten to Form 7 to increase employment and further studies opportunities for youth. JSDF Community Benefit Share Pilot to provide pre-employment training to youth, and Implementation Agreement to prioritise local community for employment opportunities. If specific rehabilitation programs are a community priority, these will be incorporated into the Community Benefit Share program. Community consultation will inform the focus on the Community Benefit Share Fund.
Suggestion that fish will not be depleted but may increase in number. Further study requested.	Accommodated. Further fish study by Ian Jowett commissioned. Results confirm feedback and suggest that fish numbers likely to increase in lower flow conditions.
Alternative protein sources to be provided to communities	Accommodated. LALRP provides for 3 x SBD $20,000 annual community payments for the purchase of alternative proteins for

Consultation Feedback	Project Outcome
	feasts/celebrations to compensate for loss of pig hunting grounds/fishing sites during construction years. Households identified as obtaining more than 10% of their livelihood from impacted fishing or hunting activities (vulnerable households) to receive equivalent comparable foods or store vouchers to the value of SBD $25,000 (being 50% of the average income of Bahomea households). (LALRP Entitlements Matrix)
Fish farms to be considered as an alternative if fish depleted	Accommodated. LALRP to provide for a feasibility study of a reservoir fish farm if annual fish studies along the river suggest depletion over baseline studies (NB: clarification on this will be part of the next round of amendments)
Whether people of Bahomea will have access to free power	Not Accommodated. Further consultations with communities raised concerns that free power will attract unwanted settlers and squatters to the area.
Clear example of the fish pass proposed for the dam needed	Accommodated. ESIA disclosure consultations in Nov 2016 included indicative photographs of the proposed trap and haul measure and information on its application
Will people of Choro, Senge and Korepa need to be relocated?	Accommodated. No relocation required, and confirmed to communities in a number of consulations including ESIA disclosure consultations in Nov 2016.
Downstream communities in Ghaobata to be included in alternative water supplies	Accommodated. All river dependent downstream communities to be provided with alternative water supply systems commiserate with affected river use. EPC contractor to prepare Water Supply Feasibility Plan for WB and PO approval. Ngalimbiu community informed of measure at ESIA workshops in 2014 and 2016.
Information needed on the dam fill time after construction	Accommodated. Information on dam fill time provided during ESIA disclosure workshops in November 2016.
Suggestion of an environmental bond to ensure developer compliance	Environmental bond requirements will be a decision of the MECDM as part of the development consent conditions under the *Environment Act*.
Gate to be established at entrance of Project area managed by both the developer and landowners	Accommodated. ESMP provides for access above Mengakiki to be restricted and for the road to remain a private road. SPC operational budget includes a budget for security.
Voltage of power lines and safety concerns of vehicles hitting poles	ESMP requires Solomon Power to carry out educational programs on electricity safety including safety around transmission lines.
Width of road and potential damage and compensation needed for any plants damaged	Accommodated. LALRP includes an asset survey of all plants within the infrastructure corridor.
Enforcement of Environmental laws ordinarily very weak. Additional measures required.	Accommodated. In addition to *Environment Act* compliance, ESMP requires monitoring and oversight of all environment and social measures by Project Office. ESMP compliance forms a key term of the Implementation Agreement. World Bank Project Agreements with SPC will also incorporate monitoring and compliance.

Table N2 – Resolution of Community Concerns ESIA Consultations Oct 2016

	Consultation Feedback	Project Outcome
.Ngalimbiu Communities	Concerns of reduction in gravel available for commercial extraction	Gravel monitoring by a river geomorphologist provided in the ESMP in section 13.2.2. Drill holes demonstrate areas of deep gravel depth, suggesting sufficient gravel for a significant number of years.
	Dam safety concerns for downstream villages. Dam will 'answer to nature's call'	Dam design complies with dam safety panel requirements. Dam safety panel visited communities in 2012. ESMP section 13.2.2 requires a village level consultation program on modern day dam engineering, construction and operation complemented by community briefings from the World Bank's dam safety panel.
	Concern that environment and safety measures discussed will not be implemented or overseen.	Environment and safety measures to be incorporated into all project agreements. New contractual arrangements section 13.7.3 added to ESMP. Project Finance to include funding for TRHDP-PO and MMERE to provide oversight of SPC and HEC E&S implementation.
Bahomea and Infrastructure Corridor Communities	Concerns of dam safety and question regarding possibility of relocation	Dam design complies with dam safety panel requirements. Dam safety advisory panel (DSAP) visited communities in 2012. ESMP section 13.2.2 requires a village level consultation program on modern day dam engineering, construction and operation complemented by community briefings from the World Bank's dam safety panel. Relocation not advised by DSAP. WB safeguards do not support unnecessary relocation.
	Could the dam be used to provide a water supply for communities and Honiara	Not a component of the current hydropower project.
	Village water supplies to be built before construction starts	Section 13.2.2.6 revised to clarify that all downstream communities whose use is affected by the Project will receive alternative water supplies before construction commences.
	Employment to prioritise host communities. Concerns of influx of people and workers from other islands.	Project related employment to prioritise host communities, ESMP section 13.2.2.2. Requirement incorporated into Implementation Agreement between SIG and SPC.
	Will downstream fish migration be impacted by the dam once upstream migration measures are implemented	Downstream fish migration predicted to follow freshes and small floods and make use of spillway.
	Electrification for villages	Electrification for priority infrastructure a component of the JSDF Community Benefit Share Pilot, at section 13.5.1.1.

	Consultation Feedback	Project Outcome
	Important that dust reduction and malaria prevention plans are properly implemented	Air Quality Management and Dust Control Plan and Community Health and Disease Vector Management Plan to be provided by the Developer. Further information on these plans, and details of timeframes and approvals inserted in section 13.4.
	Will there be improvements to education and clinics? Education is priority.	Funding for education and clinics are expected to be key priorities for the Community Benefit Share Fund. Fund priorities to be determined with reference to community consultations as part of fund design and ongoing operations. Discussion of the Benefit Share Fund updated in section 13.5.1.

Appendix O

Construction Environment and Social Management Plan Specifications

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Appendix O

Construction Environmental and Social Management Plan Specifications

This Appendix provides an outline of environmental specifications for assistance of implementation actors in preparing construction contracts in the TRHDP. This document is provided for guidance only and is not intended to create any additional obligations on the Developer in addition to those provided in the ESMP. In the event of any inconsistency the ESMP shall prevail.

1. GENERAL

2. ENVIRONMENTAL DUTIES OF THE CONTRACTOR

The duties of the Contractor(s) include but not limiting to:

a. Compliance with relevant environmental legislative requirements in Solomon Islands
b. Work within the scope of contractual requirements and other tender conditions;
c. Prior to construction commencement, the contractor shall submit to the Project Company a Contractors Health, Safety and Environment Plan (HSE) showing its organization and methods for implementation of the Construction Environmental and Social Management Plan (CESMP) and related management and monitoring plans issued by the Project Company.
d. Organize representatives of the construction team to participate in site inspections undertaken by the Project Company, MMERE Project Office, the independent monitoring agent, and undertake any corrective actions instructed by the Supervision Engineer;
e. Provide and update information to the Project Company regarding works activities which may contribute, or be continuing to the generation of adverse environmental conditions;
f. Stop construction activities which generate adverse impacts upon receiving instructions from the Supervision Engineer and propose and carry out corrective actions and implement alternative construction method, if required, in order to minimize the environmental impacts;
g. Submit Contractor's Compliance Reports on the dates specified in the Contract.
h. Establish a Grievance Redress Mechanism according to the GRM associated with the Project Company's ESMP.

3. CONTRACTOR'S PROGRAM FOR IMPLEMENTATION OF EMP

The Contractor is required to submit a CESMP Implementation Program (CEMPIP) as part of his proposed Construction Method Statements during construction phase. The Contractor's CEMPIP shall provide details such as Contractor's commitment to environmental protection; methodology of implementing the project CSEMP; detailed designs for mitigation measures; environmental monitoring program during different stages of the construction period, and the contractor's proposed resources for the implementation of the CSEMP.

4. CONTRACTOR'S WORKPLACE SAFETY AND ENVIRONMENTAL AND SOCIAL OFFICERS (SESO)

Three Workplace Safety and Environmental/Social Officers (SESO) working full time on-site will be appointed by the Contractor. Each of the SESOs is expected to have at least 7 years relevant working experiences. One shall be specialized in environmental management, training and monitoring in infrastructure construction projects; one shall be specialized in workplace health and safety in infrastructure construction projects; and one shall be responsible for community liaison, including public information, consultations, interactions on community development projects and mitigation measures such as replacement water supplies, and grievances. The SESOs should be familiar with relevant requirements of Solomon Islands legislation and regulations. The Contractor shall assign a sufficient number of inspectors and assistants to provide adequate coverage of the workplace.

The SESOs shall be responsible overall for implementation and management of the CSEMP program. The roles and responsibilities of SESOs are, but not limited to, the followings:

a. Assist in environmental awareness and health and safety training for the contractor's workers within two weeks since mobilization and refresh training at every six months. Conduct additional training as advised by the Environmental Manager of the Project Company
b. Carry out environmental site surveillance to investigate the Contractors' site practice, equipment and work methodologies with respect to pollution control and adequacy of environmental mitigation implemented;
c. Carry out safety inspections, investigate and report on incidents, administer a permit to work system, enforce compliance with workplace safety rules.
d. Monitor the implementation of environmental and social mitigation measures and the contractor' compliance with environmental protection, pollution prevention and control measures, and contractual requirements; Advice to the Contractor(s) on environment improvement, awareness, proactive pollution prevention measures;
e. Carry out investigation and submit proposals on mitigation measures to the Contractor(s) in the case of non-compliance / discrepancies to CESMP are identified. Participate in the monitoring and implementation of remedial measures to reduce environmental impact
f. Review the success of the CSEMP to cost-effectively confirm the adequacy of mitigation measures implemented
g. Prepare Contractor's Compliance Reports to be ready on the dates specified in the contract.
h. Incorporate CESMP implementation progress into contractor's construction progress report
i. Complaint investigation, evaluation and identification of corrective measures.
j. Carry out the monitoring programs issued by the Project Company within the specified timeframe instructed by the Supervision Engineer and/or Project Company and participate in any SIG or World Bank monitoring programs; and
k. Brief the Independent Environmental Monitoring Agent (IEMA), who will carry out environmental sampling and monitoring quarterly, on all environmental-related issues regarding the contractor's works. Provide the IEMC one copy of each environmental document the SEO prepared during and between visits of the IEMC.

The Contractor(s) shall ensure adequate resources are available to the SEO for the implementation of the CESMP throughout the construction phase.

5. CONSTRUCTION ACTIVITIES AND ENVIRONMENTAL RULES FOR CONTRACTOR

The Contractor will prepare and enforce a Workers Code of Conduct based on the model in the ESMP issued by the Project Company to reflect the followings.

5.1 PROHIBITIONS

The following activities are prohibited on or near the project site:

1. Cutting of trees for any reason outside the approved construction area;
2. Hunting, fishing, wildlife capture and poaching, or plant collection;
3. Buying of wild animals or their meat for food or any other purposes;
4. Disturbance to anything with architectural or historical value other than in compliance with the Physical Cultural Resources Management Plan;
5. Building fires outside workers' housing areas without authorization;
6. Use or possession of firearms;
7. Use of alcohol by workers during working hours;
8. Washing car or machinery in streams or creeks.
9. Doing maintenance (change of oils and filters) of cars and equipment outside authorized areas
10. Littering of the site and disposing trash in unauthorized places
11. Workers driving motorbikes without wearing helmets
12. Control construction plants or vehicles by unauthorized person.
13. Driving at speeds exceeding set safety limits.
14. Having caged wild animals (especially birds) in camps.
15. Working without safety equipment (including gloves, boots and masks)
16. Creating nuisances and disturbances in or near communities
17. Disrespecting local customs and traditions
18. The use of rivers and streams for washing of clothes.
19. The use of welding equipment, oxy-acetylene torches and other bare flames where fires constitute a hazard.
20. Indiscriminate disposal of rubbish or construction wastes or rubble.
21. Spillage of potential pollutants, such as petroleum products.
22. Collection of firewood.
23. Latrining outside of the designated facilities.
24. Burning of wastes and/or cleared vegetation.

5.2 TRANSPORT

The Contractor shall use selected routes to the project site, as agreed with the Supervision Engineer, and appropriately sized vehicles suitable to the class of roads in the area. The contractor shall restrict loads to prevent damage to local roads and bridges used for transportation purposes. The Contractor shall be held responsible for any damage caused to local roads and bridges due to the transportation of excessive loads, and shall be required to repair such damage to the approval of the Supervision Engineer.

The Contractor shall not use any vehicles, either on or off road with grossly excessive, exhaust or noise emissions. In any built up areas, noise mufflers shall be installed and maintained in good condition on all motorized equipment under the control of the Contractor.

Adequate traffic control measures shall be maintained by the Contractor throughout the duration of the Contract and such measures shall be subject to prior approval of the Supervision Engineer.

5.3 WORKFORCE AND WORKERS' FACILITIES

The Contractor should, whenever possible, locally recruit the majority of the workforce, including all unskilled and semi-skilled labour, and shall provide appropriate training as necessary. The contractor shall prioritise workers from the local Bahomea and Malango areas.

Minimum Facilities required:
The construction site shall be provided with the following minimum facilities:

- Warning signs at the perimeter of construction areas to restrict public access to hazardous areas.
- Sanitary arrangements, latrines and urinals shall be provided on the following scale:
- Where female workers are employed, there shall be at least one latrine for every 25 females or part thereof.
- Where males are employed, there shall be at least one latrine for every 25 males or part thereof.
- Every latrine shall be under cover and so partitioned off as to secure privacy, and shall have a proper door and fastenings.
- Each latrine or urinal must be lockable from inside, and outside of each block there must be a notice in the language understood by the majority of the workers "For Men" or "For Women" as the case may be.
- The latrines and urinals shall be adequately lighted and shall be maintained in a clean sanitary condition at all times and
- Water shall be provided in or near the latrines and urinals by storage in drums.
- A sick bay and first aid station. First aid box shall be provided at every construction campsite and under the charge of a responsible person who shall always be readily available during working hours of the work place. He shall be adequately trained in administering first aid-treatment. Formal arrangement shall be prescribed to make motor transport available to carry injured person or person suddenly taken ill to the nearest clinic or hospital.
- Waste disposal facilities shall be provided:
- Disposal of sanitary wastes and excreta shall be into septic tanks.
- Kitchen wastes shall be disposed into soak pits. Wastewater from campsites will be discharged and disposed in a kitchen sump located at least 15 meters from any body of water. Sump capacity should be at least 1.3 times the maximum volume of wastewater discharged. The bottom of the pit should be filled with coarse gravel and the sides shored up with board, etc. to prevent erosion and collapse of the pit.
- Solid wastes generated in the construction site shall be reused if recyclable or disposed off in land fill sites
- Fire breaks are important, together with an effective fire prevention policy.

Workers' Camp

The contractor undertakes not to establish a workers' camp. Workers are to be recruited from local communities of Malango and Bahomea as a priority. Foreign and non-local national workers shall be housed in existing townships such as Honiara and Henderson.

Activities in Construction Camp

The following precautions need to be taken in construction of camps:

- Measures to ensure that no leaching of oil and grease into water bodies or underground water takes place
- Wastewater should not be disposed into water bodies
- Regular collection of solid wastes should be undertaken and should be disposed of safely
- All consumables of first aid equipment, cleaning equipment for maintaining hygiene and sanitation should be recouped immediately

The Contractor shall ensure that site offices, storages and workshops are located in appropriate areas as approved by the Supervision Engineer and not within 200 meters of existing residential settlements. Explosive materials storage must be away from residential areas, administrative areas or other public areas, the location of the storage must be accepted, approved by the Ministry of Environment in consultation with the Tina Hydro Project Office and comply with existing Solomon Islands legislation.

The Contractor shall comply with all point source pollution requirements of the Project Company's ESIA and ensure that site offices and particularly storage areas for diesel fuel and bitumen are not located within 100meters of watercourses, and are operated so that no pollutants enter watercourses, either overland or through groundwater seepage, especially during periods of rain. This will require bund walls to be constructed around the area with a settling pond/oil trap at the outlet.

Site Restoration
At the completion of the construction work, the Contractor shall comply with the Post Construction Rehabilitation Plan. Including, all construction camp facilities shall be dismantled and removed from the site unless retention of a facility is requested by the Project Company for use during operation, and the whole site restored to a similar condition to that prior to the commencement of the works or to a condition agreed to with the Project Company in consultation with the owner of the land. Various activities to be carried out for site restoration are:

- Oil and fuel contaminated soil shall be removed and transported and buried in waste disposal areas approved by the Supervision Engineer.
- Construction campsite shall be grassed and trees cut replaced with similar tree species.
- Trees planted shall be handed over to the Project Company for maintenance
- Soak pits and septic tanks shall be covered and effectively sealed off.

5.4 CLEARING THE RIGHT-OF-WAY

The Contractor shall ensure that vegetation clearing of right of way is carried properly.

- Before clearing, a botanical survey will be carried out in accordance with the Forest Clearing Plan to identify trees and plants to be avoided or transplanted. Whenever possible, communities should be allowed to benefit from this vegetation for firewood and other uses.
- Trees should be cut in such a way that they fall longitudinally and not transversally to the right of way alignment. Extra care should be taken to avoid tress from falling down slope with potential risk for communities or traffic below.
- Make use of any usable timber (after community uses) before construction starts.
- The Contractor shall remove and store the organic layer of the soil to be used for revegetation and restoration of affected sites in accordance with the Topsoil and Spoil Management Plan.

5.4 WASTE MANAGEMENT AND EROSION

Solid, sanitation, and, hazardous wastes must be properly controlled, through the implementation of the following measures:

Waste Management:

- Shall be undertaken in accordance with the Waste Management Plan issued by the Project Company

Erosion Control:

- Shall be undertaken in accordance with the Erosion and Sedimentation Control Plan issued by the Project Company

Maintenance:
- Identify and demarcate equipment maintenance areas (>15m from rivers, streams, lakes or wetlands). Fuel storage shall be located in proper areas and approved by the Supervision Engineer.
- Ensure that all equipment maintenance activities, including oil changes, are conducted within demarcated maintenance areas; never dispose spent oils on the ground, in water courses, drainage canals or in sewer systems.
- All spills and collected petroleum products shall be disposed of in accordance with standard environmental procedures/guidelines, and the Point Source Pollution requirements of the Project Company's ESMP. Fuel storage and refilling areas shall be located at least 100m from all cross drainage structures and important water bodies or as directed by the Supervision Engineer.

5.5 Earthworks, Cut and Fill Slopes

All earthworks shall be properly controlled, especially during the rainy season.

The Contractor shall maintain stable cut and fill slopes at all times and cause the least possible disturbance to areas outside the prescribed limits of the works.

The Contractor shall complete cut and fill operations to final cross-sections at any one location as soon as possible and preferably in one continuous operation to avoid partially completed earthworks, especially during the rainy season.

In order to protect any cut or fill slopes from erosion, in accordance with the drawings, cut off drains and toe-drains shall be provided at the top and bottom of slopes and be planted with grass or other plant cover. Cut off drains should be provided above high cuts to minimize water runoff and slope erosion.

Any excavated cut or unsuitable material shall be disposed of in designated disposal areas as agreed to by the Supervision Engineer and in accordance with the Topsoil and Spoil Management Plan.

5.6 Stockpiles and Borrow Pits

Operation of a new borrowing area, on land, in a river, or in an existing area, shall be subject to prior approval of the Supervision Engineer, and the operation shall cease if so instructed by the Supervision Engineer. Borrow pits shall be prohibited where they might interfere with the natural or designed drainage patterns. River locations shall be prohibited if they might undermine or damage the river banks, or carry too much fine material downstream.

The Contractor shall ensure that all borrow pits used are left in a trim and tidy condition with stable side slopes, and are drained ensuring that no stagnant water bodies are created which could breed mosquitoes.

The location of crushing plants shall be subject to the approval of the Engineer, and not be close to environmentally sensitive areas or to existing residential settlements, and shall be operated with approved fitted dust control devices.

In any borrow pit and disposal site, the Contractor shall:
- Identify and demarcate locations for stockpiles and borrow pits, ensuring that they are 15 meters away from critical areas such as steep slopes, erosion-prone soils, and areas

that drain directly into sensitive water bodies (except the sites designed with rock wall to cover the surroundings
- Limit extraction of material to approved and demarcated borrow pits.
- Stockpile topsoil when first opening the borrow pit. After all usable borrow has been removed, the previously stockpiled topsoil should be spread back over the borrow area and graded to a smooth, uniform surface, sloped to drain. On steep slopes, benches or terraces may have to be specified to help control erosion.
- Excess overburden should be stabilized and re-vegetated. Where appropriate, organic debris and overburden should be spread over the disturbed site to promote re-vegetation. Natural re-vegetation is preferred to the extent practicable.
- Existing drainage channels in areas affected by the operation should be kept free of overburden.
- Once the job is completed, all construction -generated debris should be removed from the site.

The Contractor shall present a quarry or borrow pit exploitation plan. The operation of the quarry or borrow pit should follow the following practices: should include aspects like:
- Operations must be conducted in discrete stages with all valuable material fully extracted so that progressive rehabilitation can be carried out.
- It is most important that operators plan for progressive rehabilitation while operations are ongoing. Planning of final rehabilitation of a pit should occur well before the cessation of operations. Any plan for the rehabilitation of a site should include a brief description of the site prior to the commencement of operations, including: soils, landform, flora and fauna, drainage and conservation values.
- Deposits should be worked in a systematic manner, generally across or down the slope, so that worked out sections can be rehabilitated and left to revegetate without further disturbance.
- Where substantial volumes of waste rock or overburden will be produced by the operation of the quarry, this material should be placed in properly designed dumps, which are located and shaped to blend in with the surrounding landscape. Costly reshaping of dumps during the rehabilitation phase is then avoided.
- Minimization of the total disturbed area is the best method of reducing erosion caused by storm water run-off and weed invasion. Use boundary markers, such as stakes and flagging tape, to indicate to machinery operators the extent of areas to be cleared.
- The Contractor shall submit a blasting plan for each site following the Drill and Blast Management Plan issued by the Project Company for review and approval by the Supervision Engineer prior to implementation.
- Avoid blasting in overcast and other adverse weather conditions. A regular blasting time should be adhered to and notified to communities.
- Quarrying should be carried out in a series of working benches if the material is stable. Orientation of benches should take into account the underlying geology and vantage points from which the quarry is visible. All benches should be self-draining. Each bench should act as a table drain, carrying water along the bench to a suitable discharge point or settling pond. If drainage is allowed to flow down the face from one bench to the next, erosion will occur and the benches may be lost.
- Topsoil is usually the darker, upper soil layers. Though only 10 - 30 cm deep, it contains nutrients, minerals, seed, and organic matter which helps bind it all together. Wherever possible, stripped topsoil should be placed directly onto an area being rehabilitated. This avoids stockpiling and double handling of the soil.
- If topsoil must be stockpiled, remember that it does deteriorate in quality while stockpiled. The following practices will help maintain soil quality: o Topsoil should be kept separate from overburden, gravel and other materials; if possible, windrows of topsoil should not exceed one metre in height to reduce “souring';
    - topsoil stockpiles should be protected from erosion;
    - Growing vegetation on the stockpiles (shrubs or grasses) reduces erosion and will maintain biological activity in the soil;

- Topsoil should not be buried or driven on, as this will damage soil structure. o Soil should be stored somewhere out of the way; and o Excessive handling of topsoil should be avoided.

- Sites should be regularly inspected for the presence of noxious weeds, their presence should be recorded, and if necessary a control program implemented.
- All run-offs from working areas, which contains sediment, should be collected in settling ponds before being discharged from the premises. Water from washing, screening, or dust reduction plants should be treated in a like manner. Accepted methods for removal of sediment from run-off include settling ponds, hay bale filters, aggregate filters, wetlands (shallow ponds planted with suitable swamp plants). For quarries in vegetated areas, run-off should be directed through vegetation prior to reaching any watercourse to enable further filtering of sediment.
- Management of noise impact can be achieved through:
- Confining operations to reasonable operating hours is the simplest means of avoiding unreasonable noise impacts. Another effective means is to provide appropriate separation distance to enable the noise to decay to acceptable levels.
- Enclosures may be required around crushing and screening plants. Solid barriers, such as bund walls and topographical features, provide the most effective 'in line' reduction of sound levels. Reliance on a barrier of vegetation alone will result in only marginal reduction in noise levels.
- Hydraulic rock breakers produce less noise than secondary blasting with explosives. In general, operators should avoid using surface detonating cord for charge initiation. Sufficient stemming and appropriate delays between shot holes should always be used. Use of non-electric detonators has won widespread approval as the quietest delay system for initiating blasts.
- The following practices shall be considered to minimize environmental impact on air quality:
- The direction of the prevailing winds and the placement of the stockpile on the site should be considered during the planning stage. Trees should be planted for windbreaks or topography and/or embankments utilized, to shield stockpiles and working areas from prevailing winds. As conveyors and transfer points can be major sources of dust, enclosures, mist sprays, or approved dust extraction equipment may be required. Drop distance between discharge point and top of the stockpile should be kept to a minimum.
- The speed of vehicles is an important factor in the generation of dust. The speed of vehicles on site may need to be restricted. In addition, where transport routes are along unsealed roads, it may be advisable to slow down in the vicinity of residents along these routes.
- Stockpiles and roads can be sprayed with chemicals such as magnesium chloride to produce an impermeable layer, which reduces dust development. Alternatively, regular spraying with water can also be used to suppress dust. Waste oil must not be used as a dust suppressant.
- The nature of the material being transported and its potential to emit dust should be considered in the loading of trucks. Generally, the highest point of the load should not exceed the height of the tray walls, unless the load is covered. Environmental factors play a large role in the nature of air pollution and dust emissions. Extra care should therefore be taken at times of high wind speed, or during other adverse weather conditions, to minimize dust emissions. Decreased vehicle speeds, increased watering of roads and stockpiles and reduction of the amount of product transported per load, may be appropriate in adverse weather conditions.
- Visual impact shall be minimized through:
- Natural vegetation is a valuable resource that should be employed for screening purposes. Vegetation may needlessly be destroyed by brief activities with heavy machinery at the pit boundary. Clearing should be kept to the minimum absolutely necessary for efficient operations. Planting of vegetation will also provide additional screening.
- Quarry faces should be screened from frequently used roads and commonly visited vantage points. Existing topographic features may be utilized as effective screens and

any landscaping undertaken should be designed to be visually compatible with the surrounding natural landscape. Where practical, working faces should be oriented away from vantage points and neighbors and the direction of working should be carefully chosen so that that the working face is hidden from the most critical view. Where possible, uppermost benches should be worked out and rehabilitated as soon as possible.

- New premises should not be opened adjacent to roads frequently used by the public, unless adequately screened by topography and/or vegetation. Access tracks should be aligned to avoid continuous line of sight from vantage points.

5.7 Disposal of Construction and Vehicle Waste

The Contractor shall establish and enforce daily site clean-up procedures, including maintenance of adequate disposal facilities for construction debris

All arrangements for transportation during construction including provision, maintenance, dismantling and clearing debris, where necessary, will be considered incidental to the work and should be planned and implemented by the contractor as approved and directed by the Supervision Engineer.

5.8 Safety during Construction

The Contractor's responsibilities include the protection of every person and nearby property from construction accidents. The Contractor shall be responsible for complying with all national and local safety requirements as well as the Health and Safety Plan issued by the Project Office, and any other measures necessary to avoid accidents, including the following:

- Carefully and clearly mark pedestrian-safe access routes;
- If school children are in the vicinity, include traffic safety personnel to direct traffic during school hours;
- Maintain supply of supplies for traffic signs (including paint, sign material, etc.), road marking, and guard rails to maintain pedestrian safety during construction;
- Conduct safety training for construction workers prior to beginning work;
- Provide personal protective equipment and clothing (gloves, dust masks, boots, etc.,) for construction workers and enforce their use;
- Post Material Safety Data Sheets for each chemical present on the worksite;
- Require that all workers read, or are read, all Material Safety Data Sheets. Clearly explain the risks to them and their partners, especially when pregnant or planning to start a family. Encourage workers to share the information with their physicians, when relevant;
- Ensure that the removal of asbestos-containing materials or other toxic substances be performed and disposed of by specially trained workers;
- During heavy rains or emergencies of any kind, suspend all work and mobilise resources for mitigation actions.
- Brace electrical and mechanical equipment to withstand seismic events during the construction.
- Setting up nets, fences or traps to prevent rocks, trees, and soil from falling down slope and put communities or traffic at risk. Specific high risk points are identified in the Information Sheet.

5.9 Environment Protection and Safety during Blasting

Due to the narrow characteristics of construction site and the presence of population along the right-of-way, mine exploding for road bed only inner exploding method will be allowed in order to limit soil and stone to be pushed away to fill up river/stream and effect to surrounding houses. The Contractor shall present for approval Blasting Plan for each site. The Plan should include the following methods to be applied to ensure safety and minimize environmental impacts:

- A blasting plan for each exploding point. The Plan must be available during construction period)
- Procedures for management on non-exploding mines or missing exploding points. All the safety precautions that will be applied during blasting such as:

Radius of dangerous area must be calculated based on site condition (for example: to small exploding the minimize radius of dangerous area is from 300m to 400m)

- If , practical conditions at the site does not allow the application of standard method to ensure safety for blasting the Contractor shall prepare and submit to the Supervision Engineer and PMB a detail blasting plan for each of the blasting sites that satisfy: (i) create a barrier made of suitable materials to ensure safety, (b) temporary evacuate people and animals before blasting; and (c) blasting using inner exploding method.
- Exploding site must be far away from resident as required by regulations
- Exploding direction must be towards mountain sides or non residential areas and far from traffic road.
- Information systems such as signboards and setting warning surrounding exploding area to local people and traffic.
- Information campaigns to alert local government and communities about blasting schedules and safety measures.
- Provision for lead times (at least 15 min) before actual blasting with sirens that can be heard far away
- Evacuation people out of exploding area.
- Check safety of equipment and workers before returning to normal operations

5.10 NUISANCE AND DUST CONTROL

To control nuisance and dust the Contractor should:

- Maintain all construction-related traffic at or below 15 mph on the road within 500 m of the site;
- Maintain all on-site vehicle speeds at or below 10 mph.
- To the extent possible, maintain noise levels associated with all machinery and equipment at or below 90 db.
- In sensitive areas (including residential neighborhoods, hospitals, rest homes, etc.) more strict measures may need to be implemented to prevent undesirable noise levels.
- Minimize production of dust and particulate materials at all times, to avoid impacts on surrounding families and businesses, and especially to vulnerable people (children, elders).
- Phase removal of vegetation to prevent large areas from becoming exposed to wind.

- Spray water at the site, and on dirt roads, cut areas and soil stockpiles or fill material as needed to ensure that dust level at areas close to housing, commercial areas, and recreational areas meets the exsting Vietnam air quality standard.
- Apply proper measures to minimize disruptions from vibration or noise coming from construction activities.
- Heating bitumen should be carried out at least 50 m from any residential area, the heating areas must be at the end of wind direction, be appropriately covered so as the impacts of smoke, dusts and odour onto the surrounding areas are minimised.

5.11 COMMUNITY RELATIONS

To enhance adequate community relations the Contractor shall:

- Inform the population about construction and work schedules, blasting schedules, interruption of services, traffic detour routes and provisional bus routes, and demolition, as appropriate.
- Limit construction activities at night. When necessary ensure that night work is carefully scheduled and the community is properly informed so they can take necessary measures.
- Inform local community as early as possible and repeat at least one day in advance of any service interruption (including significant changes to the river or the use of roads) the community must be advised through postings at the project site, and key community locations including churches, schools and clinics.
- All community infrastructures such as roads, bridges, water supply systems, micropower generators, boat landings, irrigation systems, etc. affected during construction must be restored to the satisfaction of the communities and approved by the Supervision Engineer.
- All local roads used or by-passed by the Contractor will need to be rehabilitated to their original conditions, and Black Post Road to be rehabilitated to its post-reconstruction condition.
- Establish and maintain an unit to receive, process and reach resolution on community complaints arising from construction activities. This mechanism will be overseen by the Contractor's SEO. Records of such complaints and their resolution must be kept and be available for review by the Supervision engineer and PMB in accordance with the Grievance Redress Mechanism.

5.13 PHYSICAL CULTURAL RESOURCES CHANCE-FINDS PROCEDURES

If the Contractor discovers archeological sites, historical sites, remains and objects, including graveyards and/or individual graves during excavation or construction, the Contractor shall follow the Chance Finds Procedure set out in the Project Company's ESMP.

5.14 HAZARDOUS MATERIALS

The Contractor undertakes not to use hazardous building materials, including asbestos, in any construction.

5.15 HEALTH SERVICES, HIV/AIDS EDUCATION

The Contractor shall provide basic first aid services to the workers as well as emergency facilities for work related accidents including as medical equipment suitable for the personnel, type of operation, and the degree of treatment likely to be required prior to transportation to hospital.

The Contractor shall be responsible for implementing a program for the detection screening of sexually transmitted diseases, especially with regard to HIV/AIDS, amongst laborers is actually carried out.

The Contractor shall at all times take all reasonable precautions to maintain the health and safety of the Contractor's Personnel. In collaboration with local health authorities, the Contractor shall ensure that medical staff, first aid facilities, sick bay and ambulance service are available at all times at the Site and at any accommodation for Contractor's and Employer's Personnel, and that suitable arrangements are made for all necessary welfare and hygiene requirements and for the prevention of epidemics.

The Contractor shall appoint an accident prevention officer at the Site, responsible for maintaining safety and protection against accidents. This person shall be qualified for this responsibility, and shall have the authority to issue instructions and take protective measures to prevent accidents. Throughout the execution of the Works, the Contractor shall provide whatever is required by this person to exercise this responsibility and authority.

The Contractor shall send, to the Supervision Engineer, details of any accident as soon as practicable after its occurrence. The Contractor shall maintain records and make reports concerning health, safety and welfare of persons, and damage to property, as the Engineer may reasonably require.

The Contractor shall conduct an HIV-AIDS awareness program via a third partyservice provider, and shall undertake such other measures as are specified in this Contract to reduce the risk of the transfer of the HIV virus between and among the Contractor's Personnel and the local community, to promote early diagnosis and to assist affected individuals.

The Contractor shall throughout the contract (including the Defects Notification Period): (i) conduct Information, Education and Consultation Communication (IEC) campaigns, at least every six monthly, the first one should be within three weeks from construction commencement, addressed to all the Site staff and labor (including all the Contractor's employees, all Sub-Contractors and Consultants' employees, and all truck drivers and crew making deliveries to Site for construction activities) and to the immediate local communities, concerning the risks, dangers and impact, and appropriate avoidance behavior with respect to of Sexually Transmitted Diseases (STD)-or Sexually Transmitted Infections in general and HIV/AIDS in particular; (ii) provide male or female condoms for all Site staff and labor as appropriate; and (iii) provide for STI and HIV/AIDS screening, diagnosis, counseling and referral to a dedicated national STI and HIV/AIDS program, (unless otherwise agreed) of all Site staff and labor.

5.16 Environmental Emergency Procedures

Prior to construction commencement, the contractor shall submit to the Environmental Supervising consultant and Project Company an Emergency Response

In the event that accidental leakage or spillage of diesel/chemicals/chemical wastes takes place, the following response procedures shall be followed immediately by the Contractor(s): The person who has identified the leakage/spillage shall immediately check if anyone is injured and shall then inform the Contractor(s), Supervision Engineer and PMB.

- The Contractor(s) shall ensure any injured persons are treated and assess what has spilled/leaked;
- Should the accidents / incidents generate serious environmental pollution (e.g. spillage / leakage of toxic or chemicals, large scale spillage / leakage, or spillage / leakage into the nearby water bodies which are used for irrigation / portable water), the SEO immediate inform PMB;
- In such cases, the Contractor(s) shall take immediate action to stop the spillage / leakage and divert the spilled / leaked liquid to nearby non-sensitive areas;
- The Contractor(s) shall arrange maintenance staff with appropriate protective clothing to clean up the chemicals/chemical waste. This may be achieved through soaking with sawdust (if the quantity of spillage/leakage is small), or sand bags (if the quantity is large); and/or using a shovel to remove the topsoil (if the spillage/leakage occurs on bare ground); and
- Depending on the nature and extent of the chemical spill, evacuation of the activity site may be necessary.
- Spilled chemicals must not be flushed to local surface drainage systems. Instead, sawdust or sandbags used for clean-up and removed contaminated soil shall be disposed

of by following the procedures for chemical waste handling and disposal already described.

The possibility exists for environmental emergencies of an unforeseen nature to occur during the course of the construction and operational phases of the project. By definition, the nature of such emergencies cannot be known. Therefore, the Contractor(s) shall respond on a case-by-case basis to such emergencies and shall initiate event-specific measures in terms of notifications and reactions.

The Contractor(s) shall prepare a report on the incident detailing the accident, clean-up actions taken, any pollution problems and suggested measures to prevent similar accidents from happening again in future. The incident report shall then be submitted to the Supervision Engineer and PMB for review and keep in the records. The incident report shall also be submitted to DONRE, if required.

5.17 Environmental Training and Awareness

The Contractor should ensure that all concerned staff area ware of the relevant environmental requirements as stipulated in local environmental legislation and the Contract specifications. The Contractor(s) is responsible for providing appropriate training to all staff. This should be tailored to suit their level of responsibility for environmental matters. The Contractor(s) should also ensure that all site staff members are aware of the emergency response procedures. All staff should receive environmental induction training and managerial staff should receive additional training. The training materials should be reviewed by the SES and submitted to the PMB for approval.

Additional refresher training may be provided and this should be scheduled following periodic internal review of requirements for the Project activity concerned. Records should be maintained for staff environmental training and submitted to the IEMC upon request. Records should be kept on site where possible for each project activity for easy access during site audits or enquiries. Environmental training records (e.g. attendance records for environmental awareness training, topics covered) should be kept.

Remedial Actions

Remedial actions which cannot be effectively carried out during construction should be carried out on completion of the works (and before issuance of the acceptance of completion of works:

(a) All affected areas should be landscaped and any necessary remedial works should be undertaken without delay, including grassing and reforestation;
(b) water courses should be cleared of debris and drains and culverts checked for clear flow paths; and
(c) All sites should be cleaned of debris and all excess materials properly disposed; (d) Borrow pits should be restored.

Appendix P

Biodiversity Management Plan Preparation TOR

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Appendix P

BIODIVERSITY MANAGEMENT PLAN PREPARATION TOR

1. BACKGROUND

Tina River Hydropower Development Project Office (TRHD PO), the Solomon Islands State-owned project delivery entity, is in the final stages of negotiating a loan agreement with International Financial Institutions (IFIs) to construct the 15MW run-of-river hydropower peaking facility on the Tina River, Guadalcanal Province.

The Project will consist of a 53 meter high Roller Compacted Concrete dam in an uninhabited area of Malango Ward at an elevation of approximately 123 masl and roughly 30 river km from the sea. It also 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 2.6km and will have a surface area of about 0.28km^2 at an elevation of 175 masl. The powerhouse will be located 3 to 4 km kilometers downstream from the dam directly alongside the left bank of the Tina River, and water will be diverted to the powerhouse from the reservoir through an underground tunnel. Initially, the powerhouse will have 3 Francis turbine/generator units, each with a capacity of 5MW, allowing a maximum discharge of about 18m^3/s and a minimum discharge of 2.4m^3/s. The powerhouse will be designed with an extra bay to accommodate another 5 MW unit when the demand grows further An environmental flow of 1m^3/s will be maintained between the dam and the powerhouse tailrace, a distance of 5.7km.

A 23 km, 66 kV transmission line system will evacuate the power from the hydropower facility to the Honiara grid, connecting to the existing Lungga Power Station. The transmission lines will extend southward from the Lungga Power Station and then eastward, on the south side of several villages, until reaching the access road and following it to the power station.

Construction activities will last 3 years and all construction activities will take place in the recently acquired “Core Area” and Black Post Road. The Tina Core Land Company (TCLC), a joint venture between customary landowners and government, will hold rights to the lands on which the Project will be constructed and operated (Core Area), including the access road from the power station to the dam site. This land shall be leased to the Independent Power Producer (IPP).

The footprint of the 72m high dam, reservoir, transmission lines, powerhouse, access road, quarry and other ancillary activities will result in the permanent loss of 115.49 ha due to construction activities, although the area of influence of the project is much wider.

Construction on the access road from its current terminus at the end of Black Post Road, and upgrading Black Post Road, is expected to start in late 2017. The main construction works (dam, power house, tunnels, etc.) will start in 2018 once the road is completed.

An ESIA for the Tina River Hydropower Development Project (TRHDP) has been completed in accordance with good international industry practice, and includes an Environmental and Social Management Plan (ESMP).

1.1. KEY TERRESTRIAL ECOSYSTEM FEATURES

A total of 161 plants species were identified during field surveys. Among them 5 species are listed as being vulnerable, and 19 are listed as being threatened.

The primary habitats of the study area are comprised of forested and non-forested ecosystems, which represent a mix of modified and natural habitats. The level of disturbance increases from upstream to the downstream in the catchment. The upper Tina River catchment, upstream of the dam site, is dominated by highly valued, undisturbed lowland forests, whereas, the area downstream of the dam site is dominated by disturbed forests. This is mainly the result of anthropogenic activities (e.g., logging, settlements, garden, trails, etc.). Disturbed areas such as Black Post Road, and the proposed access road and transmission line corridor, are colonized by invasive plant species. There is a concern that the Project may facilitate improved access for loggers into the upper Tina River catchment, thereby accelerating the rate of timber removal from upland forest areas outside of, but immediately adjacent to, the Project.

The fauna baseline study has shown that wildlife species thrive in pristine forests of the upper Tina River catchment, but also in the more anthropogenically altered areas in the middle and lower reaches of Tina River. A total of 60 wildlife species were observed by the ESIA team in the study area, including: 9 amphibian, 5 reptile, 41 bird, and 5 mammal species. Approximately 45% of which are endemic. This includes: 1 endemic amphibian, 1 endemic reptile, and 25 endemic bird species and subspecies.

The project, including areas of inundation during operation, access and construction activity, will be located in those parts of the study area that are largely disturbed forest and modified grassland with extensive and ongoing anthropogenic change.

The pristine montane forests found in the upper Tina River catchment will not be directly affected by the Project.

Invasive faunal species, including the Giant African Snail, cane toad, Norway rat, and feral cats, are found on Guadalcanal Island. The Giant African Snail can be found in lowland areas, adjacent to, but not yet within, the project area. Whereas, the cane toad, Norway rate and feral cats are all found within both lowland areas and the project area, where pose an ongoing threat to local native species that contribute to Guadalcanal's biodiversity.

1.2. KEY AQUATIC ECOSYSTEM FEATURES

Current water quality in the Tina River does not appear to be a limiting factor for aquatic life, given the low level of pollution.

The Tina River is a relatively pristine, low nutrient watercourse originating from bedrock-controlled substrate in the undisturbed montane forests found on the higher elevation slopes of Guadalcanal. Lower trophic level aquatic organisms, such as algae and macro-invertebrate species support many of the fish species found within the Tina River. Species assemblages and populations can be used as an index of aquatic ecological health.

Field studies conducted in support of the ESIA involved only limited sampling of aquatic macro-invertebrates, primarily aquatic dependent insect species, mostly in their emergent adult forms. In the interest of monitoring potential impacts of TRHDP construction and operation on the health of the aquatic habitat, a program of algae and macro-invertebrate monitoring is required. Baseline algae and macro-invertebrate data collection should be undertaken pre-construction during a typical low flow period, when it is safe to enter the river

to collect samples. Periodic algae and macro-invertebrate sampling should be subsequently carried out to measure potential changes to these lower trophic levels that may result from construction and operation of the Project.

Fifty-nine species of fish were recorded within the Tina/Ngalimbiu River system, from the upstream catchment area to the mouth of the river.

In the Solomon Islands, as with other mountainous islands of the Indo-Pacific Region, Gobioid fishes are the dominant fresh water fauna, and are mainly represented by members of the Gobiidae and Eleotridae families. Baseline fish surveys showed that the Gobioid group was represented by 34 species (25 Gobiidae, 8 Eleotridae and 1 Rhyacichthidae).

Like other tropical islands of the Indo-Pacific Region, all native species encountered in inland fresh water are migratory species with a life cycle that alternates between ocean and river. Two main migration patterns are followed: catadromous and amphidromous.

Fishing is a significant source of livelihood only at the mouth of the Ngalimbiu River, where semi-commercial fishing occurs using mosquito seine net, gill net, and other methods.

The upper Tina River catchment plays an important role in fish life cycle but not a critical one since:

- fish within the Solomon Islands do not show natal stream homing behavior. Rather, juveniles will colonize any rivers for which they can gain access; and
- the mouth of the Ngalimbiu River is more critical to the life cycle of most fish species than upstream areas, as it is the only entry point to all fish that live within the catchment.

Based on current knowledge, the upper Tina River catchment is a highly valued aquatic habitat but not a “critical habitat” for fish species present in Guadalcanal. This remains under assessment, as a number of fish found during ESIA surveys are awaiting confirmation of identification. Notwithstanding, the Project has elected to provide for upstream and downstream fish passage.

The trap-and-haul method of affecting upstream fish passage was selected as the preferred means for moving fish up and over the dam, as it offers potentially greater effectiveness, better opportunity for adaptive management, lower capital cost, and provides ongoing social benefits in the form of employment to operators of the facility.

Consideration has been given to include two forms of trap-and-haul, an engineered trap-and-haul system to accommodate climbing fish species, plus, a system involving netting and hauling for swimming species, as part of an adaptive management approach to monitor their migrations and congregations with a view to designing an effective but inexpensive engineered structure, should the results of monitoring support this. Each type of system will need to be monitored during operation to determine whether changes to design or operation are required to ensure fish passage over the dam.

Spilling flows will be used to move adult eels downstream during migration periods.

1.3. LAND ACQUISITION AND LIVELIHOODS ISSUES

There will be no physical relocation of homes or settlements resulting from the Project. Instead, the principal effects will be a reduction on the availability and loss of access to the natural capital available on 428ha of land acquired for Project construction and operation (core land), the Tina River, and the infrastructure corridor. A further important livelihood effect will be the potential damage to physical capital in the form of private and community structures, such as homes, huts, and tracks.

1.4. PROXIMITY OF PROTECTED AREAS AND CRITICAL NATURAL HABITAT

There are no formal protected areas or proposed protected areas that could be affected by the TRHDP. However, there are nearby areas that are considered to be of great landscape and biodiversity value, and are either protected or official protection status is pending. Informal protection of many small, natural sites called “Tambu” is provided by the local population, which protects these areas in a traditional manner.

At least two authoritative sources recognised by the World Bank, the IUCN and Birdlife International, have identified the upper watersheds on Guadalcanal as Critical Natural Habitat. Within the Tina River catchment, this area is within undisturbed montane forest located above 400masl to the south, west and east of the dam site and reservoir. Below this elevation the habitat has been either moderately or significantly anthropogenically altered. Therefore, the TRHDP will not significantly impinge directly on the Critical Natural Habitat of the upper Tina River catchment.

2. OBJECTIVES

A Biodiversity Management Plan (BMP) is required as one of the sub-plans under the ESMP. Preparation of a BMP is also an appropriate (and in some cases necessary) approach to meet the requirements of World Bank Performance Standard 6 *Biodiversity Conservation and Sustainable Management of Living Natural Resources,* which is applicable to TRHDP. The BMP needs to be completed and implemented prior to mobilisation of the EPC contractor to the site.

The goals of the Biodiversity Management Plan include:

1. Protecting and, if possible, enhancing remaining significant habitats within, and particularly adjacent to, the project area, in particular, reducing pressure on the upper Tina River catchment area, upstream of the Project. In particular, achieve no net loss of biodiversity, in areas of natural habitat, where feasible.
2. Protecting and, if possible, improving the chances of survival of listed species in the project area. The plan must provide clear guidance on how to protect and restore habitats in the project site, to protect and manage listed species and to prevent the further incursion of invasive species. However, the approach to biodiversity management is expected to be ‘adaptive’. This means there should be continuous monitoring of success, and the plan should be flexible to allow changes to the approach, depending on the on-going achievements or setbacks in the field.

According to the ESMP timetable, the Biodiversity Management Plan shall be in place at least one month prior to the EPC mobilising to the field, and will remain operative through the pre-construction, construction, inundation and operational phases of the project.

The BMP will be implemented by the SPC, and it is anticipated that SPC will require support from expert ecologists / biologists and possibly community groups from the project area.

4. RESPONSIBILITIES

Organisation	Responsibility
BMP Consultant	As described in this scope of work.
SPC	Oversee the scope of work□Ensure that the plan is undertaken in accordance with the ESMP. Attend training.□Supervise BMP implementation. Update the ESMP to be consistent with the Biodiversity Management Plan. Update the relevant sub-plans, for which they are responsible, that have links with the Biodiversity Management Plan. Operate in accordance with the Biodiversity Management Plan.
TRHDP PO	Review draft plan. Ensure that the plan is undertaken in accordance with the ESMP. Attend training. Monitor BMP implementation.
HEC	Update the relevant sub-plans they are responsible for that have links with the final Biodiversity Management Plan.□Attend training.□Operate in accordance with the Biodiversity Management Plan.
Solomon Power	Participate in stakeholder meetings.□Receive copies of the Biodiversity Management Plan.

5. □SCOPE OF WORK

There are five key outputs in this scope of work as follows:

1. Complete an Issues and Options report based on a site visit and review of previous studies and other background materials. □
2. Prepare a Biodiversity Management Plan based on good international industry practice and strengthened through stakeholder and community consultation. □
3. Provide detailed information in a technical report to update the ESMP and other relevant environmental and social protection sub-plans so that they are consistent with the Biodiversity Management Plan. □
4. Deliver training on the Biodiversity Management Plan, and provide training materials for future training events. □
5. Provide materials to support awareness raising and community engagement.

5.1. ISSUES AND OPTIONS REPORT

Complete an “Issues and Options Report” that is based on the following activities:

- Review background documents and raw data from previous flora and fauna surveys and studies in the project area, and the ESIA. In particular analyse data and recommendations made in the ESIA (TRHD PO 2016) and fish habitat evaluations (Jowett 2016). □
- Project site visit (2 – 3 days) – At least one field trip to site by relevant members of the team is anticipated to become familiar with the environmental setting. No additional field-work or primary data gathering is anticipated. □
- Stakeholder consultation – with the support of TRHD PO’s Community Liaison Assistant, identify and meet with key stakeholders, including relevant agencies, and conservation and wildlife NGO’s. The purpose is to gather information, identify relevant skills and resources in the Government and NGO sector and to establish a

multi-sector stakeholder group (or work with TRHDP-PO's existing stakeholder groups). □

- Prepare a list of issues and options for biodiversity management, and the rationale, costs, complications and benefits of each option. □
- Prepare clear recommendations on practical, achievable approaches to meet the objectives of the Biodiversity Management Plan. □

5.2. BIODIVERSITY MANAGEMENT PLAN

Prepare a BMP based on the recommendations of the Issues and Options Report, including:

- Community consultation – assist SPC/TRHDP PO to run a series of meetings with interested community groups and leaders to inform them of the BMP, seek their input into biodiversity management, and consider development of a community group that could be engaged in the implementation of the plan. □
- Forest mapping using satellite imagery where appropriate to link the BMP to the Forest Clearance Plan and/or to monitor changes in forest cover in the upper catchment.[1] This measure should be implemented in close consultation with SIG.
- Minimum required mitigation measures – should be equal to, or have higher standards than, the mitigation measures listed in the TRHDP ESMP. A table providing an overview of minimum measures applicable during the operations period is provided at Annex 1. This table should be read together with the ESIA and ESMP.
- Establish an invasive species management program.
- Consideration for whether reservoir-operating rules in the Reservoir Management Plan need to be adjusted to consider biodiversity issues, given the size and volume of the proposed reservoir.
- Provide clear instructions as to how the BMP will be monitored, evaluated and updated, since it represents an 'adaptive management' approach. □
- Using the Adaptive Management process as a guide, develop an appropriate and detailed methodology and program for managing the key biodiversity issues. This should include (but is not limited to):
  - A clear strategy for biodiversity management, with objectives and policies. □
  - Organisation of the stakeholder group – who will be involved, their roles and responsibilities, how the group will work, etc.
  - A detailed plan and methodology for consultation and engagement with locals and the construction workforce. □
  - Restoration plan and 'no net loss biodiversity plan' for areas to be returned to their natural state, with maps, planting plans (species, program of planting, source of plants), budgets, etc. □
  - Methodologies for protecting the 'species of interest' and 'habitats of interest'. Detailed methods for translocation (if relevant), protection measures during construction and operation, including a program, required expertise and resources, schedules and budgets for each species / habitat. □
  - Detailed design of trap and haul system for upstream migration
  - Detailed monitoring programmes and budgets, including Algae Macro-invertebrate and Fish Monitoring Plan. □
  - Scope of works for completing further studies, including baseline and follow-up algae and macro-invertebrate studies, study of the efficacy of fish passage during

[1] Imagery with 10-m resolution may be available from the European Space Agency.

operation and potential need to adjust operation of fish passage facilities or redesign, etc. □

- An overall program showing critical paths and key milestones, acknowledging the project's overall construction and operational program. □

As a minimum, the BMP should be structured as follows:

- Executive Summary
- Methodology
- Biodiversity Context
- Priority Biodiversity Features
- Biodiversity Objectives and Targets
- Recommended Management Actions (legal requirements; biodiversity actions; responsible parties; etc.)
- Implementation Mechanism
- Monitoring and Surveillance (including adaptive management process)
- Budgets and Timelines
- Internal and External Reporting
- References
- Appendices (maps; photo documentation; etc.)

5.3. INSTRUCTIONS / INFORMATION FOR UPDATING ESMP AND SUB-PLANS

Provide instructions and / or detailed information necessary to update relevant sections in the TRHDP ESMP framework, and related sub-plans, and to the overall project plan that may affect, or relate to, the BMP, such as:

- Key milestones and critical paths for the project program (particularly with regard to land clearance, significant earthworks, and reservoir filling). □
- Monitoring data, methodologies, and programs. □
- Construction mitigation measures that relate to biodiversity management.□

Tasks may include:

- Preparing a technical report with clauses and sections to be inserted into the ESMP framework and sub-plans. □
- Meetings, presentations and / or workshops with TRHD PO, KWater (EPC Contractor) and construction contractors to explain and discuss the cross-overs with the ESMP and sub-plans. □

The relevant sub-plans which may be influenced by the BMP include:

- Operation and Maintenance Plan
- Emergency Preparedness Plan
- Cultural Heritage Management Plan
- Community Health and Disease Vector Management Plan
- Construction Environmental and Social Management Plan (CESMP)
- Influx Management Plan
- Waste Management Plan

- Hazardous Materials Management Plan
- Spill Prevention and Emergency Response Plan
- Forest Clearance Plan
- Watercourse Crossing Management Plan
- Spoil and Topsoil Management Plan
- Drainage, Erosion and Sediment Control Plan
- Reservoir Preparation Plan
- Drill and Blast Management Plan
- Accidents and Malfunctions Plan
- Air Quality Management and Dust Control Plan
- Stormwater Management Plan
- Point Source Pollution Management Plan
- Post-construction Rehabilitation and Revegetation Plan
- Operations Environmental and Social Management Plan (OESMP)
- Reservoir Management Plan
- Suspended Sediment Monitoring Plan
- Water Quality Monitoring Plan

5.4. TRAINING

Provide training and materials for a training program, including:

- Deliver at least four training sessions as follows:
    - TRHDP PO and KWater (EPC Contractor) environmental staff and senior project managers □
    - Contractors' environmental staff and senior project managers □
    - Two 'Training the trainers' workshops □
- Develop a training module (presentation slides, hand outs, notes for the trainers, etc.) for TRHDP PO, KWater and the Contractors to use to train their staff on the issues and how to implement the BMP.

5.5. COMMUNITY CONSULTATION AND ENGAGEMENT

Prepare community consultation and engagement materials. Develop an ongoing awareness and community engagement campaign for SPC to deliver. Written materials, methodology, communication methods and delivery program.

6. DELIVERABLES

The following deliverables will be provided under the BMP contract:

- Issues and Options report.
- Biodiversity Management Plan

- Training module for Biodiversity Management Plan
- Three training workshops completed
- Technical report recommending relevant changes to the ESMP and other sub-plans.

NOTE: The BMP report should be presented by the Consultants in a draft form to a meeting of SPC and TRHDP PO staff (which may also be attended by Word Bank representatives) within two weeks of submission of the report. A final report shall be prepared based on comments and recommendations received during the meeting.

7. INDICATIVE PROGRAM

There is some urgency with the timeframe to ensure that the BMP is operative prior to mobilization of the EPC Contractor, and especially before mobilization of the contractor that will construct the access road. An indicative program is provided below:

Indicative deliverable / output	Details	Estimated timeline from engagement
Kick off meeting	Meet with SPC, TRHD PO and World Bank representatives to confirm the program, deliverables, outputs, information requirements, site visit logistics, etc.	1 week
Stakeholder consultations	As required throughout the program, but at least one to be completed prior to the Issues and Options Report.	2 weeks
Site visit	Familiarity site visit to project area.	2 weeks
Issues and Options report	Report discussing issues and options for biodiversity management, and clear recommendations for the BMP.	3 weeks
Community consultation	Engage with community leaders and local groups and consult about the BMP, if required.	4 weeks
Draft BMP and technical report	A draft BMP with detailed program and methodology and draft budgets. Draft technical report outlining recommendations for updates to the ESMP framework and other sub-plans.	2 months
Draft training module materials	Proposed training method, list of potential attendees, location, logistics, training materials (draft slides, hand outs, notes for trainers, etc.)	2.5 months
Final BMP and technical report	Final BMP encompassing comments from SPC, TRHD PO, World Bank, and other key stakeholders.	3 months

Four training workshops completed.	Training environmental staff and senior project managers. Training trainers.	4 months
Awareness campaign	Develop an ongoing awareness and community engagement campaign for SPC to deliver, including preparation of materials and delivery program.	4.5 months

8. EXPERTISE REQUIRED

Experts must have international experience in the protection and restoration of forest habitats, in particular experience with the species listed in this TOR, and with the lowland and montane forest habitats of Guadalcanal, Solomon Islands. The consultants will form a team they consider appropriate for the tasks in the TOR. **One individual may have the expertise to carry out more than one role or all roles.** The following table is intended to be a guide of the possible core team.

Team member	Minimum experience	Role
Lead ecologist (1) / Project Manager	15 years of ecological assessment and / or conservation ecology; Project Management experience; experience preparing Biodiversity Management Plans; experience working in the Solomon Islands; at least 10 years' experience working internationally.	Manage the team. Control the preparation of the reports. Lead contact with SPC. Coordinate meetings. Coordinate training workshops. Manage quality reviews.
Terrestrial fauna biologist / forest ecologist (1)	7 years' experience in the conservation of terrestrial fauna ecosystems found in tropical forests of South Pacific Islands. Experience with invasive fauna management.	Provide advice and recommendations on the management and protection of terrestrial fauna (amphibians, reptiles, mammals), and forest habitats.
Avifuana biologist / ecologist (1)	7 years' experience in the conservation of birds in tropical ecosystems of South Pacific Islands.	Provide advice and recommendations on the management, protection and restoration of bird habitat.
Aquatic biologist / ecologist (1)	7 years' experience in the conservation of aquatic ecosystems of South Pacific Islands	Provide advice and recommendations on the management of riverine ecosystems, fish passage facilities using adaptive management processes.

Annex 1 – Overview of ESMP Biodiversity Management Measures during Operations

No.	Impact	Key Biodiversity impact	Measure or Activity	Implementing Actor	Oversight Actor	Means of Verification	Timing and Frequency of Monitoring	Reporting Requirements	KPIs
1	All	All	Preparation of Operational E&S Plans (to be finalised pre COD). Many plans will have been developed by EPC Contractor and can be amended for operations This will comprise the Operations Environment and Social Management Plan (OESMP) and a number of sub-plans	O&M Contractor	PO, MECDM, WB and ADB	Plans finalised	n/a	n/a	Plans available to and understandable by all project staff and contractors two months prior to COD.
2	All	All	Implement adaptive management, using data from monitoring to revise Action and Management Plans over time as necessary. Review of Plans necessary where any KPIs in this BMP or other Plans are not met			Records of review and adaptive management	At least annual	Report on review of Plans and any changes made	Each unmet KPI addressed by review and change of relevant Plans within four weeks

No.	Impact	Key Biodiversity impact	Measure or Activity	Implementing Actor	Oversight Actor	Means of Verification	Timing and Frequency of Monitoring	Reporting Requirements	KPIs
3	All	All	Environmental and social safeguards management specialist with relevant experience engaged by the SPC (SPC ESS Specialist) to ensure that all general mitigation measures are implemented	SPC	TRHDP PO	Appointment of qualified SPC ESS Specialist; records and reports of that specialist	Audits by PO ESS Specialist three times/year	Incident reporting log of SPC ESS Specialist; monthly reports; audit reports by PO ESS Specialist	SPC ESS Specialist appointed. Audits reveal no significant non-compliances
4	All	All	Environmental and social safeguards specialist with relevant experience engaged by the Project Office (PO ESS Specialist) to audit implementation of mitigation measures three times/year	TRHDP PO		Appointment of qualified PO ESS Specialist. Audits conducted three times/year	n/a	Audit reports	PO ESS Specialist appointed.

No.	Impact	Key Biodiversity impact	Measure or Activity	Implementing Actor	Oversight Actor	Means of Verification	Timing and Frequency of Monitoring	Reporting Requirements	KPIs
5	All	All	New Employee Induction Training (undertaken on average once per year, this will vary depending on staff turnover), including Wildlife Protection			Training records	At least annual	Training records	Every employee undergoes induction within six months of hiring; induction tests demonstrate new employees learning key wildlife rules
6	All	All	Community Consultation and Grievance - Community Liaison Committee meetings and management - Community Awareness and Consultation Meetings These consultations will cover ESMP communication requirements including encroachment of invasive flora and fauna			Records of consultations	At least quartely initially, at least bi-annually after first year of operations or more often as grievances require	Consultation records	All biodiversity-related grievances fully addressed within six months

No.	Impact	Key Biodiversity impact	Measure or Activity	Implementing Actor	Oversight Actor	Means of Verification	Timing and Frequency of Monitoring	Reporting Requirements	KPIs
7	Aquatic	Aquatic	Fish, algae and macro-invertebrate monitoring (both upstream and downstream, with at least eight consistent sample stations in the Tina, Toni and Ngalimbiu areas)			Monitoring reports		Monitoring reports	Monitoring of sufficient depth and quality to provide information needed for other KPIs (e.g., activities 11-12)
8	Aquatic	Aquatic	Water quality monitoring: - at the environmental flow outlet of the dam - in the by-passed river reach (i.e., upstream of the powerhouse), and - downstream of the powerhouse, for the key pollution indices. Weekly for the first 2 to 3 months following commissioning, then quarterly for the first year, followed by annually when annual testing is conducted of the project electro-mechanical systems.			Monitoring reports		Monitoring reports	Monitoring of sufficient depth and quality to provide information needed for other KPIs

No.	Impact	Key Biodiversity impact	Measure or Activity	Implementing Actor	Oversight Actor	Means of Verification	Timing and Frequency of Monitoring	Reporting Requirements	KPIs
9	Aquatic	Aquatic	Flow monitoring			Monitoring reports	At least monthly	Monitoring reports	Monitoring of sufficient depth and quality to provide information needed for other KPIs (e.g., activities 11-12)
10	Potential for project impacts on White-eyed Starling	Potential for project impacts on White-eyed Starling	Low-level surveillance monitoring for presence of White-eyed Starling, via posters offering reward for confirmed live sightings and awareness raising with local community			Monitoring records of SPC ESS Specialist	Ongoing	Monitoring records of SPC ESS Specialist	Community aware of SPC's interest in species' presence

No.	Impact	Key Biodiversity impact	Measure or Activity	Implementing Actor	Oversight Actor	Means of Verification	Timing and Frequency of Monitoring	Reporting Requirements	KPIs
11	Reduced Flow Between Dam and Powerhouse	Impacts of changes of flow downstream of dam on aquatic life	Maintain a minimum environmental flow of 1 m3/s at all times in the bypassed section of river between the dam and power station, in line with Environmental Flows Management Plan	Developer	TRHDPPO	Flow, fish, algae and macro-invertebrate monitoring	At least annually; monthly in early stages of project	Project and consultant monitoring reports	Environmental flow of 1 m3/s maintained at all times in bypassed section; Fish in the Tina River remain at >90% of original quantity, all original species are retained, and diversity does not change by >10%

No.	Impact	Key Biodiversity impact	Measure or Activity	Implementing Actor	Oversight Actor	Means of Verification	Timing and Frequency of Monitoring	Reporting Requirements	KPIs
12	Reduced Overnight Flow	Impacts on aquatic life of reduced flow	Maintain a minimum flow of 3.4 m3/s flow below the power station during over night reservoir refill. One option for achieving this is to maintain the 1m3/s environmental flow and continue to run 2.4m3/s through the power generators. Actions to be in line with Environmental Flows Management Plan	Developer	TRHDPPO	Flow, fish, algae and macro-invertebrate monitoring (both upstream and downstream, with at least eight consistent sample stations in the Tina, Toni and Ngalimbiu areas)	At least annually; monthly in early stages of project	Project and consultant monitoring reports	Minimum flow of 3.4 m3/s maintained below power station overnight; Fish in the Tina River remain at >90% of original quantity, all original species are retained, and diversity does not change by >10%

No.	Impact	Key Biodiversity impact	Measure or Activity	Implementing Actor	Oversight Actor	Means of Verification	Timing and Frequency of Monitoring	Reporting Requirements	KPIs
13	Reduced Sediment Transport	Impact of reduced sediment transport on aquatic life	Flushing to be undertaken periodically. An outlet of 3x3m is proposed near the power intake at 160masl. Once sediments reach this level, the outlet will be used either for local flushing or for lowering the reservoir to permit dredging/excavating of accumulated sediments. Any flushing should be within the bounds of flows associated with natural flash floods in this river	Developer	TRHDPPO	Water quality monitoring, including for suspended solids downstream	At least annually; monthly in early stages of project	Project and consultant monitoring reports	Fish in the Tina River remain at >90% of original quantity, all original species are retained, and diversity does not change by >10%

No.	Impact	Key Biodiversity impact	Measure or Activity	Implementing Actor	Oversight Actor	Means of Verification	Timing and Frequency of Monitoring	Reporting Requirements	KPIs
14	Introduction of invasive species to the reservoir	Accidental or deliberate introduction of non-native plants, fish or other species to the reservoir, with potential to affect all aquatic biodiversity	Monitoring for, and immediate removal of, all non-native species to avoid their spread			Monitoring of invasive plant and animal species (inc. Water Hyacinth) to assess presence in the reservoir and quick response if found	Twice-yearly	Monitoring records of SPC ESS Specialist, and records of any necessary removal actions taken	No invasive species persist within reservoir for more than a month

No.	Impact	Key Biodiversity impact	Measure or Activity	Implementing Actor	Oversight Actor	Means of Verification	Timing and Frequency of Monitoring	Reporting Requirements	KPIs
15	Barrier to Fish Passage	Barrier to passage of migratory fish species	Implement a trap and haul system in accordance with Appendix G of the ESIA and Fish Passage Plan	Developer	TRHDPPO	Fish monitoring in accordance with a fish monitoring plan to be prepared by the Developer in accordance with section 13.3.3.3.	According to fish monitoring plan	Project and consultant monitoring reports	Migratory fish above and below dam remain at >90% of original quantity, all original species are retained, and diversity does not change by >10%

No.	Impact	Key Biodiversity impact	Measure or Activity	Implementing Actor	Oversight Actor	Means of Verification	Timing and Frequency of Monitoring	Reporting Requirements	KPIs
16	Fish Entrainment	Barrier to passage of migratory fish species	Increase the normal operating level to near full supply level, during the first month of the wet season, to facilitate the downstream movement of adult eels over the spillway during floods. The loss of generation resulting from increasing spill would be partially offset by the increased generation from the extra head on the turbines	Developer	TRHDPPO	Fish monitoring in accordance with a fish monitoring plan to be prepared by the Developer in accordance with section 13.3.3.3; flow monitoring during first month of wet season.	At least quarterly (according to fish monitoring plan).	Project and consultant monitoring reports	Migratory fish above and below dam remain at >90% of original quantity, all original species are retained, and diversity does not change by >10%
17	Fish Entrapment	Barrier to passage of migratory fish species	Install 15-25 mm screens in front of the intake structure to prevent the ingress of large eels	Developer	TRHDPPO	Screens installed; maintenance records	At least annually	Monitoring records of SPC ESS Specialist	Screens maintained in fully working order

No.	Impact	Key Biodiversity impact	Measure or Activity	Implementing Actor	Oversight Actor	Means of Verification	Timing and Frequency of Monitoring	Reporting Requirements	KPIs
18	Road Access	Induced increases in human access upstream, with potential for increased degradation/loss of all biodiversity	Extension of Black Post Road from Mangakiki to dam site to remain a private access road that will be gated. Access will be restricted by the Project Company and the TCLC to local population and hydropower facility operator. Commercial logging trucks will be prohibited.	SPC and Tina Core Land Company	TRHDPPO	Register of permissible vehicles; gate access logbook	Ongoing	Register of permissible vehicles; gate access logbook	Zero vehicles beyond access gate, other than those registered as permissible
19	Road Access	Induced increases in human access upstream, with potential for increased degradation/loss of all biodiversity	A settlement policy will be developed and implemented with the assistance of the TCLC. The settlement policy will include enforcement measures to prevent the use of the land for a workers camp. It will also address restrictions on the use of the private project road through the Core Area by people seeking to build new settlements beyond the Core Area.	SPC	TRHDPPO	Settlement policy	n/a	n/a	Settlement policy established.

No.	Impact	Key Biodiversity impact	Measure or Activity	Implementing Actor	Oversight Actor	Means of Verification	Timing and Frequency of Monitoring	Reporting Requirements	KPIs
20	Road Access	Induced increases in human access upstream, with potential for increased degradation/loss of all biodiversity	The TCLC and Developer will not permit anyone to live or construct housing within the land leased for the project, except where strictly necessary for project activities, including housing for rangers or security staff.		TRHDP PO	Monitoring records of SPC ESS Specialist; incident reporting systesm	At least monthly	Monthly mitigation monitoring reports; incident reporting logbook	Zero violations of settlement policy
21	Road Access	Spread of invasive species along project roads	Regular live trapping and removal of non-native rats and feral cats from the project area; incidental monitoring of project area for other invasive species by SPC ESS Specialist		TRHDP PO	Reports of consultants	Monthly live trapping sessions; ongoing monitoring	Consultant reports of trapping sessions; incident recording system	No increase in occurrence of non-native rats or feral cats over time

No.	Impact	Key Biodiversity impact	Measure or Activity	Implementing Actor	Oversight Actor	Means of Verification	Timing and Frequency of Monitoring	Reporting Requirements	KPIs
22	Road Access	Direct mortality of wildlife from vehicles	Vehicle speed limits will be controlled along the access roads, to ensure that drivers are able to prevent running over wildlife that may be lying on, or crossing, the access road	Developer	TRHDPPO				Zero incidents of vehicles exceeding speed limit or of wildlife mortality on project roads
23	Vegetation and Forest Clearance during Transmission Line Maintenance	Spread of invasive species	Training will be conducted for Solomon Power or its contractors to ensure workers clearing the transmission line identify and leave low-level native vegetation to prevent spread of invasive weeds	Solomon Power	TRHDPPO	Monitoring records of SPC ESS Specialist; training records	At least quarterly	Quarterly mitigation monitoring reports; training records	Complete adherence to established guidelines on maintaining native vegetation

No.	Impact	Key Biodiversity impact	Measure or Activity	Implementing Actor	Oversight Actor	Means of Verification	Timing and Frequency of Monitoring	Reporting Requirements	KPIs
24	Workers Affects on Fauna	Harm to wildlife (e.g. killing of snakes)	Workers and contractors prohibited from harming wildlife. Workers to receive wildlife awareness training informing them of the requirement to request the project's environmental specialist capture and remove animals that are either in danger or are dangerous to construction workers	Developer	TRHDPPO	Monitoring records of SPC ESS Specialist and incident reporting system; training records	Patrols of project area at least monthly	Monthly mitigation monitoring reports; incident reporting logbook; training records	Zero incidents of harm to wildlife by workers/contractors
25	Lighting Disturbance	Disturbance to, and disorientation of, wildlife	Regular use of artificial lights during operational period shall be avoided	Developer	TRHDPPO	Monitoring records of SPC ESS Specialist	At least monthly	Monthly mitigation monitoring reports	No lights regularly used during operational period

No.	Impact	Key Biodiversity impact	Measure or Activity	Implementing Actor	Oversight Actor	Means of Verification	Timing and Frequency of Monitoring	Reporting Requirements	KPIs
26	Transmission Line Operation	Collision and electrocution risk for bats, birds and marsupials	Metal shields to be installed on wooden power poles in forested areas to prevent Cuscus from climbing poles and becoming electrocuted. Best-practice design and mitigation (e.g., APLIC or BirdLife) to be applied for the powerline	Solomon Power	TRHDPPO	Monitoring records of SPC ESS Specialist	At least quarterly	Quarterly mitigation monitoring reports; incident reporting logbook	All mitigation still installed and intact; zero incidents of animal collisions or electrocutions as a result of the powerline
27	Harvesting by Workers	Overfishing, overhunting, and overcollecting	Workers and contractors prohibited from fishing in the Tina River, hunting in the watershed, and collecting plants (other than at personal traditional levels out of work hours)	Developer	TRHDPPO	Monitoring records of SPC ESS Specialist and incident reporting system	At least monthly	Monthly mitigation monitoring reports; incident reporting logbook	Zero incidents of fishing, hunting and collecting of plants by workers/contractors (other than at personal traditional levels out of work hours)
28	Temporary loss of habitat	Terrestrial	Post-construction rehabilitation			Gains in extent and quality of forest, measured by monitoring	At least annually	Rehabilitation monitoring reports	Gains in extent x quality of forest sufficient to compensate for temporary project impacts

No.	Impact	Key Biodiversity impact	Measure or Activity	Implementing Actor	Oversight Actor	Means of Verification	Timing and Frequency of Monitoring	Reporting Requirements	KPIs
29	Permanent loss of habitat	Terrestrial	Offset through rehabilitation of at least 9.5 ha of modified habitat within the Project Area			Gains in extent and quality of forest, measured by monitoring	At least annually	Offset monitoring reports	Gains in extent x quality of forest on track to meet defined rehabilitation targets (e.g., gain of 5 Quality Hectares over 20 years)
30	Permanent loss/ degradation of forest	Terrestrial	Offset of 12,500 ha in upstream watershed (details on second tab)			Averted losses of forest, measured by monitoring in comparison to control areas	At least annually	Offset and control site monitoring reports and audits	Averted loss of forest extent / quality sufficient to compensate for residual project impacts
31	Potential for permanent loss/ degradation of Tina River	Aquatic	Offset on the Toni River if monitoring demonstrates residual project impacts on the Tina River (details on third tab)			Gains in quality of Toni River, measured by monitoring	At least annually	Offset monitoring reports and audits	Restoration of aquatic extent x quality sufficient to compensate for residual project impacts

1	All	All	Preparation of Operational E&S Plans (to be finalised pre COD). Many plans will have been developed by EPC Contractor and can be amended for operations This will comprise the Operations Environment and Social Management Plan (OESMP) and include the following subplans: • Biodiversity Action Plan • Emergency Preparedness Plan • Disease Vector Management Plan • Stormwater Management Plan • Project Decommissioning Plan • Hydrocarbon Management Plan • Health and Safety Plan • Stakeholder Engagement Plan • Accidents and Malfunctions Plan • Grievance Mechanism Plan • Spill Prevention and Emergency Response Plan • Traffic Management Plan • Waste Management Plan • Hazardous Materials Management Plan			Plans finalised	n/a	n/a	Plans available to and understandable by all project staff and contractors by DATE.

No.	Impact	Key Biodiversity impact	Measure or Activity	Implementing Actor	Oversight Actor	Means of Verification	Timing and Frequency of Monitoring	Reporting Requirements	KPIs
			• Safety Management Plan • Wildlife Management Plan						
2	All	All	Implement adaptive management, using data from monitoring to revise Action and Management Plans over time as necessary. Review of Plans necessary where any KPIs in this BMP or other Plans are not met			Records of review and adaptive management	At least annual	Report on review of Plans and any changes made	Each unmet KPI addressed by review and change of relevant Plans within four weeks

Appendix Q

Critical Habitat Assessment

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Appendix Q

Critical and Natural Habitat assessment, impacts, mitigation, and monitoring

John Pilgrim

May 2017

1 Executive Summary

This rapid review addresses the specific concerns of the Asian Development Bank (ADB) Safeguard Policy Statement (2009) in relation to Critical Habitat and Natural Habitat, so far as these are not already dealt with in the main ESIA.

A Critical and Natural Habitat assessment, based on information in the ESIA, finds that **the project is situated within a watershed containing substantial Natural Habitat**, comprising both undisturbed and disturbed/remnant forests as well as the Tina River and its tributaries (Section 2.4 & Figure 1).

The undisturbed (both lowland and montane) forests in the watershed are globally restricted as an ecosystem type and hold a particularly unique assemblage of species. This, their recognition as part of a Key Biodiversity Area, Important Bird Area and proposed World Heritage Site, and their importance in providing ecosystem services for local communities, mean that **the upper and outer forests of the Tina watershed qualify as Critical Habitat** (Section 2.3.4 & Figure 1). **Two restricted-range bird species (Guadalcanal Boobook and Black-headed Myzomela) and one reptile (Guadalcanal Bow-fingered Gecko) also appear to qualify the Tina watershed as Critical Habitat** (Section 2.3.2).

Direct impacts on this Critical Habitat appear to be non-significant, given the remaining extent of high quality forest on Guadalcanal (Section 3.1.1 & Table 1). **Nonetheless, significant risks remain of induced increases in clearing** of upper watershed forest. These will need to be carefully managed.

It is possible that the Endangered King Rat and White-eyed Starling might also remain undetected in the area (Section 2.3.1) and – if present – would also qualify it as Critical Habitat (Section 3.1.2). Further, the identification of a number of fish species remains in question (Section 2.3.2). These might possibly represent restricted-range species or species new to science, both of which are likely to qualify the Tina River as Critical Habitat. **It is a priority to resolve identification of unidentified fish species collected during ESIA surveys, to assess whether the project impacts Critical Habitat for those species and – if so – to plan additional mitigation** (Section 3.3) and, if necessary, offsets (Section 4.3).

Direct and indirect impacts on Natural Habitat are small, but not insignificant (Section 3.2 & Table 2). Mitigation has been systematically identified in order to minimize impacts, but residual impacts will necessarily require offsets. An ambitious offset program has been proposed, in order to compensate for project residual direct and indirect impacts (Section 4.1 & Table 2) on terrestrial Critical and Natural Habitat. Despite considerable uncertainties and major (albeit largely precautionary) assumptions, **it appears very likely that the proposed offset would – if successfully implemented – allow the project to achieve No Net Loss for terrestrial biodiversity** (Section 4.2). The proportion of the costs of establishment and implementation of this conservation program covered by the project will need to be sufficient

to generate and sustain biodiversity gains necessary to offset residual project impacts. These costs are likely to be high relative to the overall project budget (ESIA Section 2.4).

Key areas of monitoring necessary to assess changes in the state of biodiversity, changes in threats to this biodiversity, and progress of project mitigation/offsets are outlined in Table 3 (Section 5).

2 Critical and Natural Habitat Assessment

2.1 Summary of Results of Critical and Natural Habitat Assessment

The ADB Safeguard Policy Statement (ADB 2009) requires assessment of whether the project is planned in an area that may qualify as Critical Habitat or Natural Habitat. This assessment followed more detailed guidance in International Finance Corporation Performance Standard 6 and its accompanying guidance note (IFC 2012a, 2012b). A broad terrestrial area and a relatively long freshwater area were considered, to incorporate all potential project impacts (Figure 1).

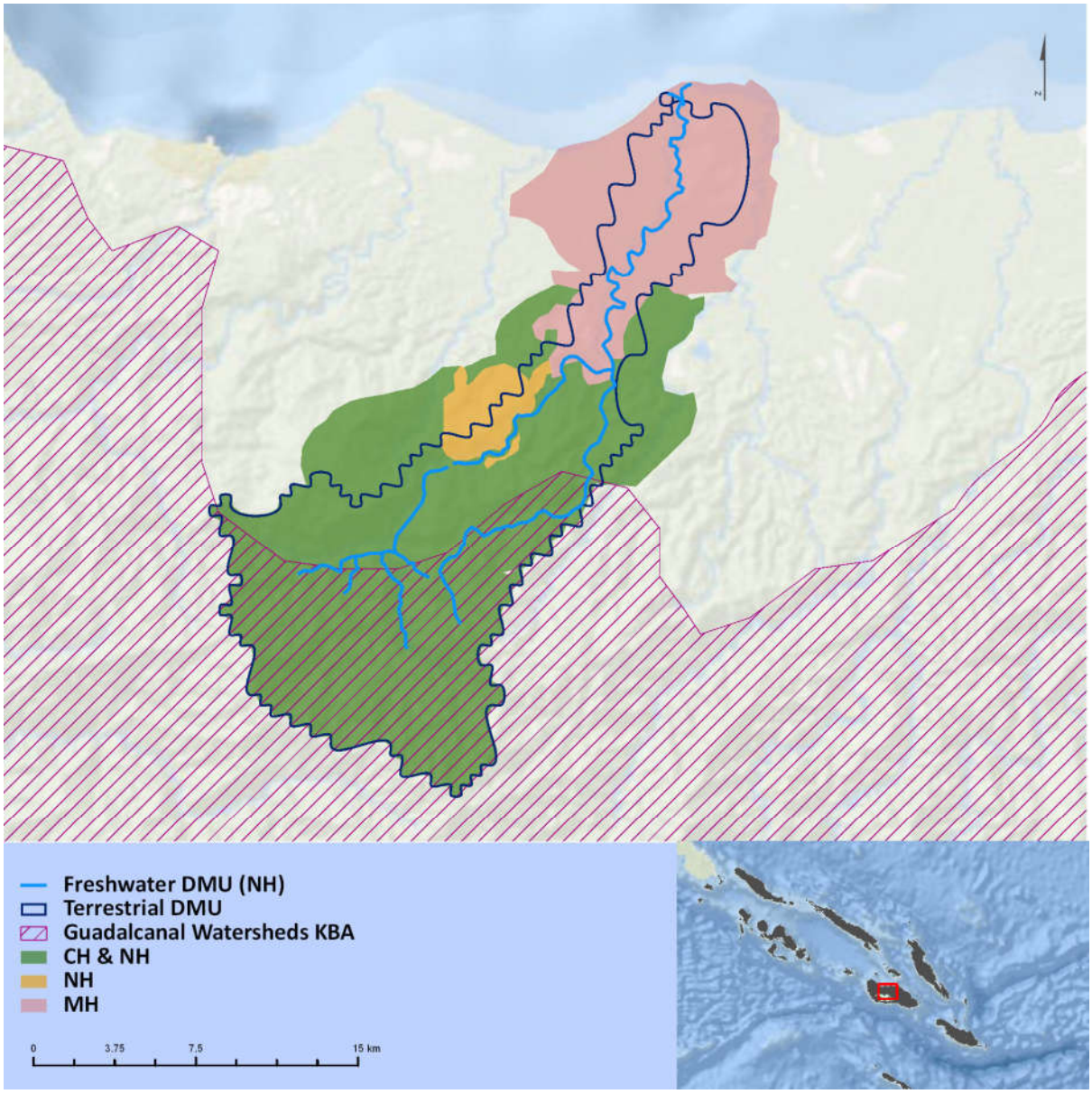

Figure 1. Map of discrete management units, showing areas of Critical, Natural and Modified Habitat (based on land use mapped in ESIA Figure 6-12)

Downstream from the project, large areas of Modified Habitat exist, owing to intensive logging and small-scale agriculture – as well as widespread incursion of invasive species. Despite some logging, the project area and surrounds have retained forest cover and basic ecological integrity, and can be considered to largely comprise Natural Habitat. The upper and outer watershed, upstream from the proposed dam location and further down away from the river itself, remain largely undisturbed and represent Critical Habitat. The freshwater area appears to have retained most of its original ecological functionality, despite extensive fishing and household use by communities, and the Tina River and its tributaries can thus be considered Natural Habitat.

There is not currently evidence that any species present in the project area or surrounds qualify the area as Critical Habitat. It is, nonetheless, apparent that some threatened species might remain undetected in the area and – if present – would qualify it as Critical Habitat. The project should thus continue low-level monitoring for these species (King Rat and White-eyed Starling). On a precautionary basis, the project can best manage these unknown risks by acting as though the area might be Critical Habitat for these two species, and so ensuring that appropriate mitigation and offset measures are in place. Further, concern remains that some fishes collected during the ESIA may represent undescribed species which could qualify the project area as Critical Habitat. These represent a significant risk to the project, and the project should pursue accurate identification of collected fish specimens as soon as possible, in order to verify the situation.

More broadly, as well as providing a number of important ecosystem services to local communities, natural forests in the Tina Watershed can be considered Critical Habitat owing to the limited global extent of this forest ecosystem type and the particularly unique nature of the species' assemblage it supports.

2.2 Discrete management units

Critical Habitat and Natural Habitat assessment ideally takes place across sensible ecological or political units that are sufficiently large to encompass all direct and indirect impacts from the project. These areas of assessment, referred to as 'discrete management units' (DMUs) are thus often much broader than the direct project footprint. DMUs may be separate or combined, depending on the ecology of the biodiversity concerned.

As outlined in Section 2.3, the species of concern in this area are freshwater fish, birds and mammals. Birds and mammals are likely to be impacted by a hydropower project in similar ways (e.g., direct terrestrial footprint, induced clearance) and so are considered together. The Tina River watershed (including the Toni) forms a relatively discrete ecological unit, and is likely to be the focus of any project-related direct and indirect impacts. This watershed was thus taken as an appropriate terrestrial DMU, covering approximately 243 km^2. Given the potential for project impacts both upstream (e.g., blocked fish migrations) and downstream (e.g., owing to altered flows) of the dam, and the interconnected nature of freshwater ecosystems, the whole Tina River and its tributaries were considered together as one freshwater DMU. These two discrete management units, with mapped areas of Critical, Natural and Modified Habitat, are outlined on Figure 1.

Identification of these 'discrete management units' does not mean that the project has management obligations across them. The aim of this Critical and Natural Habitat Assessment is to identify whether the broad units qualify as Critical Habitat and, if so, for what biodiversity features. This information helps to prioritise impact assessment and to focus mitigation efforts.

2.3 Assessment of biodiversity which may qualify the area as Critical Habitat

Each of the following sections considers candidate Critical Habitat-qualifying biodiversity identified within the ESIA as actually or potentially present. In each case, reasons are identified for each biodiversity feature likely meeting or not meeting Critical Habitat. Two categories of biodiversity that might qualify the area as Critical Habitat were only considered briefly here, and should be assessed further by social experts – specifically areas that provide key ecosystem services and areas with biodiversity that has significant social, cultural or economic importance to local communities.

2.3.1 Critically Endangered and Endangered species

Only species assessed globally by IUCN are included here, since there is no national Red List. Species are included if they were found during surveys, or there is indication of their presence from literature.

Emperor Rat (*Uromys imperator*)

This globally Critically Endangered species is only known from northern Guadalcanal. There have been no confirmed sightings since the last specimen was collected in 1888, although local sightings reported by Flannery (1995) suggest that the species' range receded to higher mossy forest and that it persisted there until at least the early 1960s. It appears that this species was largely terrestrial, and so invasive species (e.g., predation from feral cats or disease from introduced rats) may thus have had significant impacts on the species' range and distribution. Even if the species is not yet globally Extinct, it seems unlikely that the project area continues to hold this species, given that it is partially degraded and already significantly impacted by invasive species. The discrete management unit thus does not qualify as Critical Habitat for Emperor Rat.

King Rat (*Uromys rex*)

This species is globally Endangered, and only known from a small number of records. In contrast to the Emperor Rat, this species is arboreal and thus more likely to be able to resist impacts from (more terrestrial) invasive species. Although likely to prefer primary forest, it has been recorded relatively recently (in 1988) even from a patch of remnant forest close to Honiara (Flannery 1995). In 1989, two individuals were captured at 600m elevation at Gold Ridge, very close to the project. A local hunter (per Kevin Jeanes, December 2016) reported the species was last seen in the Tina catchment in the 1980s. Relatively recent records in and near the project area, and some apparent tolerance of the species to forest fragmentation and invasive species, suggest that the King Rat may still persist in the project area. The absence of records on project surveys should not be taken as evidence of the species' absence, since it is extremely difficult to survey for rare, nocturnal, arboreal rodents.

The species' area of occupancy is considered to be less than 500 km^2 (Helgen *et al.* 2016). The discrete management unit includes about 192 km^2 of forest which might be considered Natural Habitat and thus potentially suitable for this species. On a precautionary basis, and given that the population distribution of this species is not well understood, this watershed could thus potentially be considered of significant importance to the King Rat, and the loss of the area could potentially impact the long-term survivability of the species. On such a precautionary basis, the area would qualify as Critical Habitat for King Rat (IFC 2012, Criterion 1d). In the absence of any evidence of its presence, however, it seems over-precautionary to treat the area as Critical Habitat for the species. It is thus recommended that the area should not be considered as Critical Habitat for the species, but ***the project should act as though the area might be Critical Habitat for King Rat and so ensure that appropriate mitigation and offset measures are in place***.

White-eyed Starling (*Aplornis bruneicapillus*)

This Endangered bird occurs rarely and patchily on at least Guadalcanal, Choiseul, Rendova and Bougainville, but is very poorly-known and may occur more widely. While the species does appear to have some reliance on primary forest for nesting (in colonies in trees with high epiphyte cover), it also regularly feeds in semi- and heavily-degraded areas, where small fruit trees provide abundant food (Guy Dutson, *in litt.* 2017; Chris Filardi, pers. comm. 2017). While project surveys did not detect the species, it is is not always easy to find during field surveys even when present (Chris Filardi, pers. comm. 2017), is most regularly observed nearby (at Mount Austen, around five miles from the project site), and appears to have seasonal or interannual movements which are not yet understood. There is thus potential for the species to use the project area, for example on a seasonal or periodic basis in response to fruit availability. In the absence of any evidence of its presence, it is recommended that the area should not be considered as Critical Habitat for the species. It would, however, be advisable to put in place some adaptive management by implementing low-level monitoring for the species over the project lifetime, and help to protect nesting colonies should they be located in the project area.

2.3.2 Endemic or restricted-range species

Following the IFC PS6 Guidance Note (IFC 2012b), species were considered restricted-range if their global extent of occurrence was 50,000 km^2 or less (for terrestrial vertebrates) and 20,000 km2 or less (for freshwater fish). Species are included if they were found during surveys, or there is indication of their presence from literature. 'Endemism' *per se* was not considered – this can be a useful approach for species such as plants for which distributions are poorly known, but is less useful for better-known vertebrate species (many of which, in the Solomon Islands, are endemic to just several islands). Based on current knowledge, none of the plant species observed during ESIA surveys appear to have a restricted-range (the most restricted being *Palaquium firmum*, potentially endemic to the Solomon Islands, and *Syzygium onesima*, which appears to be restricted to the eastern Papua New Guinea islands and the Solomon Islands).

Solomons Flying Fox (*Pteropus rayneri*)

This Near Threatened bat species has an extent of occurrence of 29,500 km^2. It is known from the project area, and occurs more widely across the Solomon Islands – as well as on Bougainville and Buka in Papua New Guinea (Hamilton & Leary 2008). While this is a restricted-range species, it is still relatively widespread and the project DMU is too small in its entirety to hold 1% of the species' global population. This species thus does not qualify the project area as Critical Habitat.

Guadalcanal Rail (*Hypotaenidia woodfordi*)

Guadalcanal Rail is a Near Threatened bird known only from Guadalcanal, with an estimated range of 6,500 km^2 (BirdLife International 2017a). It occupies grassland and thickets up to c. 600 m elevation (Dutson 2011). The project DMU contains c. 51 km^2 of Modified Habitat, of which a subset (and some degraded Natural Habitat) is likely to be suitable for this species. It thus seems unlikely that the DMU holds more than 1% of the species' global range or population, and thus this species does not qualify the project area as Critical Habitat.

Buff-headed Coucal (*Centropus milo*)

Buff-headed Coucal has a range of almost 47,000 km^2 and also occurs on several other islands, including New Georgia, Vella Lavella and Rendova (BirdLife International 2017a). It has been observed in the project area, but the Tina Watershed as a whole is too small in comparison to the species' distribution to be likely to hold more than 1% of the population of this species. It thus does not qualify the project area as Critical Habitat.

Guadalcanal Boobook (*Ninox granti*)

Guadalcanal Boobook has been recently recognized as a bird species separate from *Ninox jacquinoti* (BirdLife International 2017a). It is considered Vulnerable and is known only from forests up to 1,500 m elevation on Guadalcanal (BirdLife International 2017a). The project DMU contains c. 180 km^2 of forest within this elevational range, representing about 3% of the known range of this species. It thus seems quite possible that the DMU holds more than 1% of the species' global range or population, and therefore ***it is quite possible that Guadalcanal Boobook qualifies the Tina River watershed as Critical Habitat***. Without further information on the distribution and ecology of this species in the project area, higher quality forest within the project DMU is preliminarily assessed as Critical Habitat for this species (Figure 1).

Black-headed Myzomela (*Myzomela melanocephala*)

This fairly common restricted-range species occurs only on Guadalcanal, including in the project area, and nearby Nggela Sule. It has a range estimated at 10,200 km^2 (BirdLife International 2017a) and occurs up to 1,550 m elevation (Dutson 2011). The project DMU contains c. 180 km^2 of forest within this elevational range, representing about 1.7% of the known range of this species. As such, ***it is quite possible that Black-headed Myzomela qualifies the Tina River watershed as Critical Habitat***. Without further information on the distribution and ecology of this species in the project area, higher quality forest within the project DMU is preliminarily assessed as Critical Habitat for this species (Figure 1).

Other potentially restricted-range birds

White-eyed Starling is considered a restricted-range species and has the potential to occur in the project area. This species is already assessed in Section 2.3.1.

Another set of observed species were considered restricted-range by Stattersfield *et al.* (1998) but current information (BirdLife International 2017a) clarifies that their extents of occurrence exceed 50,000 km^2, and they can thus no longer be considered restricted-range. These species comprise Sanford's Sea-eagle (*Haliaeetus sanfordi*); Red-knobbed Imperial-pigeon (*Ducula rubricera*); Crested Cuckoo-dove (*Reinwardtoena crassirostris*); Solomons Corella (*Cacatua ducorpsii*); Yellow-bibbed Lory (*Lorius chlorocercus*); Green Pygmy-parrot (*Micropsitta finschii*); Chestnut-bellied Monarch (*Monarcha castaneiventris*); Solomons Pied Monarch (*Symposiachrus barbatus*); Midget Flowerpecker (*Dicaeum aeneum*); Brown-winged Starling (*Aplonis grandis*); White-billed Crow (*Corvus woodfordi*). A further set of such species were considered potentially present in Appendix D of the ESIA: Melanesian Scrubfowl (*Megapodius eremita*); Yellow-banded Fruit-dove (*Ptilinopus solomonensis*); Pale Mountain-pigeon (*Gymnophaps solomonensis*); Cardinal Lory (*Chalcopsitta cardinalis*); Duchess Lorikeet (*Charmosyna margarethae*); West Solomons Boobook (*Ninox jacquinoti*); Solomon Cicadabird (*Edolisoma holopolium*); White-winged Fantail (*Rhipidura cockerelli*).

Guadalcanal Bow-fingered Gecko (*Cyrtodactylus biordinis*)

This fairly common restricted-range species occurs only on Guadalcanal. It is known from elevations of 300-500 m, rarely lower, and mainly lives on smaller trees and vines in the

understorey of forest (Allison 2013). It appears to have been recorded from the project area, on the basis of local knowledge (ESIA Appendix C). Within the project DMU, there is only about 33 km^2 of suitable habitat. Nonetheless, given the limited range of this species, this is likely to represent more than 1% of the species' global distribution and population. As such, pending confirmation that the species does occur in the project area, ***it is quite possible that Guadalcanal Bow-fingered Gecko qualifies the Tina River watershed as Critical Habitat***. Pending further information on the distribution and ecology of this species in the project area, higher quality forest between 300-500 m elevation within the project DMU is preliminarily assessed as Critical Habitat for this species.

Solomons Bent-toed Gecko (*Cyrtodactylus salamonensis*)

This Near Threatened species is stated to have an extent of occurrence of less than 10,000 km^2 (McCoy 2013), and so qualifies as a restricted-range species. It has not yet recorded from the project area, but does appear to occur nearby (ESIA Appendix C) and so may yet be found in the project area. It is a lowland species, being found in undisturbed and moderately disturbed forests up to 400 m elevation. As such, the Tina Watershed offers relatively little remaining habitat of suitable quality for this species, and is unlikely to hold more than 1% of its population or distribution. This species thus does not qualify the project area as Critical Habitat.

Schmidt's Crocodile Skink (*Tribolonotus schmidti*)

This restricted-range species is listed as potentially present in the project area by the ESIA, based on occurrence nearby (ESIA Appendix C). It is considered very common in forest on Guadalcanal between sea level and 1,500 m (Harlow 2013), so it is surprising that it was not recorded during ESIA surveys. If it does occur in the Tina River watershed, the area may well hold more than 1% of its population or distribution (given that the watershed holds c. 180 km^2 of Natural Habitat within its elevation range, representing about 3% of the known range of the species). In the absence of any evidence of its presence, however, it is recommended that the area should not be considered as Critical Habitat for the species. In any case, the species does not face any particular threats other than habitat loss, so impacts and necessary mitigation measures would very much reflect those for the forest as a whole. It is thus unclear whether this species qualifies the area as Critical Habitat but, even if it does so, no additional mitigation or offset measures are foreseen to be necessary.

Malukuna Webbed Frog (*Cornufer malukuna*)

This species, sometimes known as *Discodeles malukuna*, is stated by Richards & Parker (2004a) as known only from the vicinity of the type locality, which lies in the upper Tina River catchment. It has since, however, been found on several islands throughout the New Georgia group and may potentially be patchily more widespread in the Solomon Islands (Scott Travers, *in litt.* 2017). It is thus unlikely to qualify as a restricted-range species, or to qualify the area as Critical Habitat.

Faro Island Treefrog (*Litoria lutea*)

This is also considered a restricted-range species by Richards & Parker (2004b) and is listed as potentially present in the project area by the ESIA. It is not clear, however, that this species' extent of occurrence is <50,000 km^2, and thus whether it actually qualifies as restricted-range. It is thus not considered to qualify the area as Critical Habitat

San Cristobal Treefrog (*Papurana kreffti*)

This species, sometimes known as *Hylarana kreffti*, is stated by Richards & Parker (2004c) as likely to have an extent of occurrence of <20,000 km^2. It would thus qualify as a restricted-range species. However, as well as being widespread in the Solomon Islands it is known from New Ireland and Buka in Papua New Guinea. While it has a small overall area of occupancy, it thus has an extent of occurrence exceeding 50,000 km^2 and does not qualify the project area as Critical Habitat.

Restricted-range fishes

Three *Schismatogobius* (*S.* cf. *ampluvinculus*, *S.* cf. *marmoratus* and *S.* cf. *roxasi*) and three *Stiphodon* (*S.* cf. *atropurpureus*, *S.* cf. *multisquamus* and *S.* cf. *ornatus*) were found, but not conclusively identified, by ESIA surveys (R. Hevalao, *in litt.* 2017). This is understandable, given the paucity of information available to draw from in identifying freshwater fish in the Solomon Islands. The known range of the six species which these specimens resembled (e.g., *S. ampluvinculus*) suggests that these actually represent other species.. Knowledge of *Schismatogobius* taxonomy and distribution is advancing rapidly, with many new species described to science recently from the Pacific – including three that occur in the Solomon Islands (Keith *et al.* 2017). It is quite possible that some of these unidentified fishes represent species described by Keith *et al.* (2017), or described by those authors as now known from the Solomon Islands. An alternate possibility is that these represent undescribed species. Fish from some other genera (*Apogon*, *Caranx*, *Scomberoides*, *Gerres*, *Polydactylus*, *Redigobius*, *Stenogobius*, *Lentipes* and *Sicyopus*) were not identified to species, leading to similar concerns. All of these fish species urgently need identification. If any are identified as *Schismatogobius* or *Stiphodon* species known from the Solomon Islands, many of these are known to be ***restricted-range species and would be likely to qualify the Tina River and its tributaries as Critical Habitat. Any undescribed fish species would inherently likely be restricted-range and thus qualify the Tina River and its tributaries as Critical Habitat***, and represent a significant risk to the project. As such, the project should pursue accurate identification of collected specimens of these fishes as soon as possible.

2.3.3 Migratory or congregatory species

Common Sandpiper (*Actitis hypoleucos*)

This is the only species identified in the ESIA which is migratory. It is globally common and widespread, and winters regularly in the Solomon Islands. The population of the species in the project area is likely to be quite considerably less than 1% of the species' global population. This species thus does not qualify the project area as Critical Habitat.

Solomons Flying Fox (*Pteropus rayneri*)

This restricted-range bat species often roosts in large colonies. As assessed in Section 2.3.2, the project DMU is too small in its entirety to hold 1% of the species' global population. This species thus does not qualify the project area as Critical Habitat.

Admiralty Flying Fox (*Pteropus admiralitatum*)

The ESIA considers this poorly-known colonial bat species as possibly present in the project area. It may actually comprise several different species, of which one would be restricted to

the islands of Western Province, Guadalcanal and Malaita. In the absence of any evidence of its presence, it is recommended that the area should not be considered as Critical Habitat for the species. Even if the species was found to be present, the species' extent of occurrence is more than 67,000 km^2, and so the project area would not contain a significant enough proportion of its population to be considered Critical Habitat.

Geoffroy's Rousette (*Rousettus amplicaudatus*)

This colonial bat species may ultimately be found to contain more than one species (Csorba *et al.* 2008). However, as currently understood, it has a very wide range across South-East Asia and Melanesia. Given this wide distribution, the project area is very unlikely to hold more than 1% of the species' global population. This species thus does not qualify the project area as Critical Habitat.

2.3.4 Unique assemblages of species that are associated with key evolutionary processes

The Solomon Islands are notable for their high levels of bird and mammal endemism, because their fauna has a continental origin, but many of the islands – including Guadalcanal – have experienced long-term isolation owing to deep marine trenches between islands.

IFC (2012b) takes a view that unique assemblages of species can often be identified by their association with 'highly threatened and/or unique ecosystems' (GN90-93). Martin *et al.* (2015) make a first, global-level assessment of which marine ecosystems might qualify as Critical Habitat under this criterion, and a similar effort is ongoing for terrestrial ecosystems.

In the current absence of an assessment of which terrestrial ecosystems might qualify as Critical Habitat, it is necessary to assess whether any ecosystems in the project area might be considered 'highly threatened' or 'unique'. The most useful ecosystem classification, while imperfect, is that of the WWF ecoregions, since it has achieved global coverage and thus allows global comparison. This is thus used here as a basis for assessment.

Solomon Islands Rainforest

Most of the project area was originally covered by forest, classified by WWF as one ecoregion, 'Solomon Islands Rainforest' (Wikramanayake *et al.* 2001). This has a small global extent (c. 36,000 km^2) and holds a particularly unique assemblage of species (e.g., 90 endemic or near-endemic bird species). The value of this ecosystem on Guadalcanal is acknowledged by other authorities. For example, CEPF (2012) and BirdLife International (2017b) recognize the 'Guadalcanal Watersheds' area as a Key Biodiversity Area and Important Bird Area, respectively. Further, the interior forests of Guadalcanal around Mount Popomanaseu – including the upper reaches of the Tina River watershed – were proposed in 2008 by the Government of the Solomon Islands as the 'Tropical Rainforest Heritage of Solomon Islands' World Heritage Site. For all of these reasons, **Solomons Islands Rainforest qualifies the project area as Critical Habitat** (Figure 1). This ecosystem can be considered to comprise those forest types identified in the ESIA as relatively intact, namely 'undisturbed forests', 'montane forests' and 'riparian' (per, e.g., Table 10-2 and Figure 6-12), totaling about 184 km^2 in the DMU. The riparian ecosystem is naturally more disturbed and less forested than the other two, but is included here on a precautionary basis. It is clear that actual project impacts on high quality areas of Solomon Islands Rainforest will be small (c. 32 ha of direct footprint and increased access with potential to induce additional clearance), as discussed further in Section 3.1. Direct project impacts on this ecosystem are

not considered significant, given the small scale of project residual impacts (Table 2) compared to the extent of the ecosystem.

2.3.5 Areas having biodiversity of significant social, economic, or cultural importance to local communities (including ecosystem services)

Section 8.1.6.2 of the ESIA discusses local livelihood strategies, including – relying on biodiversity – small-scale timber-milling and a fishery at mouth of the Tina River. Sections 8.1.11.5-7 expand on local use of natural resources.

Section 8.1.11 of the ESIA discusses Natural Capital, noting that the forests of the project area and Tina Watershed are important to local communities for:

- timber and non-timber materials for housing (i.e., timber, loya cane, thatch, bamboo, and bark):
- game wildlife for hunting, such as wild pigs, possums, flying foxes, lizards, skinks, frogs, hornbill, pigeons, and ducks:
- plants used for medicinal purposes and magic;
- wild foods such as fruits, wild palm, wild yam, various nuts, and ferns, megapode eggs, and emergency foods when required;
- materials for handcrafts, such as baskets;
- regulation of run-off from the heavy rains that occur on Guadalcanal especially around the high mountains, and climate regulation; and
- aesthetic appeal, and places for recreation and relaxation.

It is beyond the scope of this assessment to delve more deeply into which of these ecosystem services may qualify the project area as Critical Habitat, and there is little previous precedent for doing so. It is clear, however, that the forests of the Tina Watershed are important not only in their own right (Section 2.3.4), but also in providing ecosystem services for local communities living in the area.

Section 8.2.3 of the ESIA discusses cultural heritage sites. Little information was obtained on these sites, but they appear to be site- or history-based, rather than biodiversity-based.

2.4 Assessment of Natural Habitat

Guadalcanal as a whole would originally have been largely forested. Across the lower reaches of the project discrete management unit, forest has been degraded and/or removed by logging and small-scale agriculture, and a number of invasive species are now prevalent in the area. These degraded and deforested areas in **the lower Tina watershed can thus be considered Modified Habitat** (covering 51 km^2 of the DMU). These comprise the potentially-impacted ecosystems identified in the ESIA (e.g., ESIA Table 10-2) as ‘garden’, ‘fallow brush land’, ‘grasslands’, as well as areas of farmland and oil palm nearer the coast. Although this is a coarse classification, grasslands in lowland Melanesia are, for the most part, not natural ecosystems and are comprised largely of non-native or widespread generalist species.

Despite some degradation of forest and some incursion of invasive species – particularly in the mid-reaches and closer to the river – the majority of the discrete management unit away from the coast remains largely forested and ecologically functional. Therefore, **the forests of the majority of the Tina watershed can be considered Natural Habitat** (covering 192 km^2 of the DMU). It is more challenging to assess the current level of functionality in the

freshwater ecosystems. There has clearly been some level of degradation from gravel mining and fishing, as well as general household use, but it appears that these ecosystems retain the majority of their original ecological functionality and thus that **the Tina River and tributaries can be considered Natural Habitat**.

Many of the terrestrial areas of Natural Habitat within the DMU (covering 184 km^2) are also considered Critical Habitat, owing to the intact nature of their restricted ecosystems and the unique assemblages of species they contain (Section 2.3.4), including two very restricted birds and one reptile (Section 2.3.2).

3 Impacts on Critical and Natural Habitat

Direct project impacts on the various ecosystems in the project area are summarized in Table 10-2 of the ESIA, and reinterpreted below in Table 1.

Table 1. Summary quantitative estimation of direct project impacts on terrestrial Critical, Natural and Modified Habitat.

Habitat type	**Ecosystem (from Table 10-2)**	**Direct impact area (ha; from Table 10-2)**
Critical Habitat	Undisturbed forests	9.54
	Montane forests	0
	Riparian	21.62
Sub-total (Critical Habitat)		***31.16***
Natural Habitat	Disturbed forests	29.65
	Remnant forests	21.87 (of which 10 ha is temporary)
	Cliffs	16.12
Sub-total (Natural Habitat, including Critical Habitat)		***98.80***
Modified Habitat	Grasslands	6.09
	Garden	0
	Fallow brush land	6.40
Sub-total (Modified Habitat)		***12.49***
Total		**111.29**

3.1 Impacts on terrestrial Critical Habitat

3.1.1 Solomons Island Rainforest

Solomons Islands Rainforest is considered to represent Critical Habitat (Section 2.3.4). ESIA Table 10-2 clarifies that direct project impacts on undisturbed forests represent <0.2% of the

extent of this forest type in the Tina catchment, with further impacts on riparian forest. Project direct impacts on Critical Habitat total just over 31 ha (Table 1), or about 0.3% of Critical Habitat within the catchment. Moreover, the majority of Guadalcanal remains forested, with much of that area still in a good condition and thus representing Critical Habitat for similar reasons. Direct project impacts on Critical Habitat are thus not considered significant, and will not impair the Critical Habitat's high biodiversity value or ability to function. Induced project impacts present more of a risk.

Through construction of an access road, and development of a reservoir, the project will increase the potential for access by local people and visitors to the upper, less disturbed, reaches of the Tina watershed in order to take advantage of forest resources such as fruits, nuts, medicinal plants, wild game, timber for construction, fuel wood or aggregates at the upstream end of the reservoir (ESIA Section 10.8.1.2.1). Mitigation has been outlined for the risk of induced increases in access by non-local people (ESIA Section 10.8.1.2.2). This will involve declaring the Black Post Road extension a private road, and gating it to allow access only to the company and local people. The Tina TCLC will not permit anyone to live or construct housing within the land leased for the project, except where strictly necessary for project activities. Further, a settlement policy will be developed and implemented with the assistance of the TCLC, to restrict the use of the private project road through the Core Area by local people seeking to build new settlements beyond the Core Area. However, it will not be accepted by local communities that this road be strictly prohibited to new settlements (ESIA Section 10.8.2.2.1). The details of access restrictions remain to be resolved, and implementation of such restrictions requires substantial awareness raising (briefly mentioned in ESIA Section 10.8.2.2.2) and a complex level of coordination among various stakeholders. There thus remains a significant risk of indirect project impacts on Critical Habitat owing to induced increases in access to less disturbed forests in the Tina watershed, particularly by local people, and consequent small-scale logging or other destructive activities. Nonetheless, the improved/extended access road is relatively short and largely surrounded by already degraded (though Natural) forest (ESIA Figure 6-12). With appropriate restrictions on access, impacts on Critical Habitat of deforestation and degradation from project-induced access are likely to remain low in the short-medium term. These are very unlikely to impair the Critical Habitat's high biodiversity value or ability to function at any meaningful scale (compared to the current extent of Solomon Islands Rainforest across the island).

No estimates of the scale of indirect impacts on Critical Habitat are available in the ESIA, and are difficult to predict with the changing socio-economic situation in the area as a result of this project. As a first estimate, it is estimated that induced residual impacts on terrestrial Critical Habitat will be of a similar scale to direct impacts (e.g., complete loss of another 32 ha of forest; or a halving in condition of a wider area of 64 ha of forest). This estimate is likely precautionary, and can likely be refined and reduced by assessment of historic change in the project area or by review of induced impacts in similar previous situations (such as the nearby Gold Ridge mine).

3.1.2 Species

Two bird species were identified as qualifying forests in the Tina River watershed as Critical Habitat. These have the potential to be impacted by the project in similar ways, mostly related to loss and degradation of forest habitat. Induced access from the Black Post Road extension could lead to small-scale logging, degradation or fragmentation of forests. The project ESMP (ESIA Table 13-7) already contains a set of good practice mitigation measures which have the potential to benefit both species, including: minimizing footprint; preventing disturbance from construction workers; preventing access along this road by non-local people; and restrictions on settlement along the road by local people. Project impacts on these species are not considered likely to differ significantly from those on forest more

generally. Mitigation and offset measures already designed for forests are thus appropriate and sufficient to achieve No Net Loss for these species (Sections 3.2 and 4.2).

It also remains possible – if unlikely – that some species (King Rat and White-eyed Starling) have remained undetected in the project area, or will use it at some times, and these species would qualify the area as Critical Habitat (Section 2.3.1). On a precautionary basis, the project should act as though the area might be Critical Habitat for these species. If present, these have the potential to be impacted by the project in similar ways to the birds listed above, but also by induced increases in access leading to increased hunting or spread of invasive species which may compete with, predate or spread disease to these species. The project ESMP (ESIA Table 13-7) already contains good practice mitigation measures which have the potential to benefit both species, including: preventing hunting from construction workers; preventing access along this road by non-local people; restrictions on settlement along the road by local people; and setting up an invasive species management program (see also ESIA Appendix P). It would be advisable for the project to establish a low-level surveillance program for these species, in order that mitigation can be adapted/enhanced should the species be found in the area during the project life. Such surveillance could be achieved at low cost by, for example, developing simple posters with small rewards for anyone who finds these species in the area and can take project staff to see them.

3.2 Impacts on terrestrial Natural Habitat

ESIA Table 10-2 clarifies that direct project impacts on undisturbed forests represent <0.2% of the extent of this forest type in the Tina catchment, with further impacts on riparian forest. Project direct impacts on Natural Habitat total almost 100 ha (Table 1), or about 0.5% of Natural Habitat within the catchment. The majority of Guadalcanal remains forested Natural Habitat, with much of that area still in a good condition. Direct project impacts on Natural Habitat might thus not be considered significant at the scale of Guadalcanal, or even at the scale of the Tina River watershed. Nonetheless, the project is committed to achieving no net loss of Natural Habitat.

As is the case for Critical Habitat, induced project impacts present more of a risk to Natural Habitat than direct impacts. As the Black Post Road extension runs through Natural Habitat, and local use and settlement will be restricted but not prohibited, it can be expected that significant degradation or loss of this habitat will occur over time. No estimates of the scale of these impacts are available in the ESIA, and are difficult to predict with the changing socio-economic situation in the area as a result of this project. As a first estimate, which can be refined by assessment of historic change in the project area or by review of induced impacts in similar previous situations (such as the nearby Gold Ridge mine), it is estimated that induced residual impacts on terrestrial Natural Habitat will be of a similar scale to direct impacts (e.g., complete loss of another 100 ha of forest; or a halving in condition of a wider area of 200 ha of forest).

3.3 Impacts on freshwater Critical or Natural Habitat

The Tina River and its tributaries represent Natural Habitat (Section 2.4). The project is expected to result in unavoidable short-term impacts on water quality during construction and long-term impacts on flow regimes (e.g., ESIA Section 11.4.4.4.1). Mitigation has been planned to avoid and minimize these impacts as much as possible, based on current information (e.g., ESIA Appendix L).

With a number of fish identifications remaining uncertain, and a high likelihood that at least some of these refer to restricted-range species and/or species new to science, there also remains significant potential that the Tina River and its tributaries represent Critical Habitat (Section 2.3.2). Just as the identification of these fish species remains uncertain, so does their ecology, and thus project impacts upon them. ESIA Appendix L thus assesses

environmental flow requirements and fish passage mitigation requirements based upon modelled habitat suitability criteria for eight more common species and an understanding of the broad ecological requirements and life history strategies of the genera of fish present in the river. This represents good practice given available data, but falls short of a precautionary plan to ensure no net loss for any habitat required by any fish species which may prove to qualify the area as Critical Habitat.

It is a high priority to obtain expert identification (likely by the French National Museum of Natural History in Paris, given the concentration of expertise on relevant fish species in that institution) of unidentified fish collected during the ESIA. Once these fish are identified, it will be necessary to assess whether the Tina River and tributaries represent Critical Habitat for these species. If so, further studies will be urgently required to better understand the species' ecology, habitat requirements and life history, and thus whether the project is likely to have a significant impact on these species and whether current planned mitigation is sufficient to avoid a net residual loss to these species' populations or habitats.

4 Offsets for residual impacts on Critical and Natural Habitat

4.1 Estimates of the magnitude of residual terrestrial impacts

The developer has committed to development of a Biodiversity Management Plan (BMP), with the objective of achieving no net loss of biodiversity as a result of natural habitat conversion. This BMP will be in place at least one month prior to the Engineering Procurement and Construction mobilising to the field. The BMP will include an offset comprising measures to protect the remaining Natural Habitat in the Core Area (ESIA Appendix P) and a program to rehabilitate at least 9.5 ha of Modified Habitat (ESIA Section 10.7.1.1.2; ESIA Appendix P). This 9.5 ha of rehabilitation is not factored into estimates of residual impacts in this section.

Direct impacts on Natural Habitat are likely to affect c. 100 ha, of which c. 32 ha comprise Critical Habitat (Section 3). Given the absence of quantitative spatial estimates of the scale of indirect impacts on forest ecosystems, first estimates here are that these will be at a similar scale to direct impacts, i.e. another 100 ha of Natural Habitat, of which c. 32 ha comprise Critical Habitat (Sections 3.1.1 and 3.2). Given these preliminary assumptions, the project is assumed to result in residual impacts of c. 200 ha of Natural Habitat (including c. 64 ha of Critical Habitat). Refined estimates are presented in Table 2.

Assessment of project offset needs requires quantification of the scale and severity of project impacts. No significant residual impacts are currently expected for species, beyond those for which their habitat already represents a useful proxy. Offset estimates regularly use 'extent × condition' metrics[1] (e.g., Quality Hectares or QH) to account for variable quality of impacted ecosystems and varying severity of impacts. A pristine or 'benchmark' ecosystem would be judged to be 100% quality. Few data are available in the ESIA to enable estimation of the current condition of the Critical and Natural Habitat. In general, the Critical Habitat areas are described as essentially in natural/undisturbed/pristine condition (e.g., ESIA Appendix F) and may thus – for the purposes of this exercise – be taken as a 100% benchmark condition. ESIA Appendix F and Section 6.3.5 note that many non-Critical Natural Habitat areas of 'disturbed' forest in the project area have been affected by logging and only have a moderate ecological value, although they still show rich plant diversity, and

[1] e.g., see Parkes *et al.* (2003) Assessing the quality of native vegetation: The 'habitat hectares' approach. *Ecological Management and Restoration* 4, supplement.

rapid vegetation regeneration. For the purposes of this assessment, these are classed as of 60% condition. Some ('remnant forest') areas are stated to have undergone extensive disturbance, with few large remaining trees. For the purposes of this assessment, these are classed as of 30% condition. All of these forest condition estimates could be refined by in-field measurement of relevant condition variables such as canopy cover and canopy height.

Table 2. Preliminary quantitative estimation of residual direct and indirect project impacts on terrestrial Critical and Natural Habitat.

Habitat type	Ecosystem (ESIA Table 10-2)	Impact area (ha)			Ecosystem condition ('quality')	Impact (Quality Hectares)
		Direct (ESIA Table 10-2)	Indirect (estimated)	Total		
Critical Habitat	Undisturbed forests	9.54	9.54	19.08	100%	19.08
	Riparian	21.62	21.62	43.24	100%	43.24
Sub-total (Critical Habitat)		***31.16***	***31.16***	***62.32***	**-**	***62.32***
Natural Habitat	Disturbed forests	29.65	29.65	59.30	60%	35.58
	Remnant forests	11.87[2]	11.87	23.74	30%	7.12
	Cliffs	16.12	16.12	32.24	100%	32.24
Sub-total (Natural Habitat, including Critical Habitat)		***88.80***	***88.80***	***177.60***	**-**	***137.26***

4.2 Estimates of the magnitude of terrestrial offset gains

ESIA Appendix K outlines the opportunity for protection of an extensive area of Critical Habitat in the upper watershed of the Tina River. This opportunity is at a very early stage of consideration, and considerable engagement with stakeholders, including customary landowners, will be necessary before it is clear whether this is a realistic option.

The area under consideration covers about 12,500 ha. An offset as proposed would represent an 'averted loss' offset in which offset gains comprise the area of forest which would have been expected to have been lost in the absence of the offset action. In the Solomon Islands, particularly at higher altitudes, the most likely reason for forest loss is logging. At a national level, annual deforestation rates have been estimated at about 0.2%/year (FAO 2015). Real rates are likely to be higher, but to disproportionately impact

[2] An additional 10 ha represents temporary footprint for topsoil storage. The project plans to restore this area afterwards. It is likely that restoration will be able to restore this area to the previous low condition ('30%'), so this 10 ha is omitted from calculations here.

more accessible area at lower elevations nearer coasts. In the absence of any data specific to the project area, a precautionary baseline to estimate offset gains might be 0.1%/year, and that this would relate to heavy deforestation (resulting in an ecosystem of lower quality than that considered 'remnant forest' in the ESIA, assumed here to be of only 10% quality). The life of the project, and its accompanying offset, is expected to be very long-term. However, for the purposes of no net loss assessments, a reasonable timescale such as 25 years is usually taken.

An offset as proposed might thus be expected to produce 11.25 QH of gains in its first year (0.001 [deforestation rate averted] × 0.9 [quality loss averted] × 12,500 [offset area]). Over 25 years, this would equate to approximately 300 ha, more than double the necessary level to compensate for project residual impacts of c. 138 ha (Table 2, Section 4.1). Despite considerable uncertainties and major (albeit largely precautionary) assumptions, it thus appears very likely that the proposed offset model would – if fully funded and successfully implemented – be sufficient to allow the project to achieve No Net Loss with regard to terrestrial impacts.

The project is only planning to support a proportion of the costs of establishment and implementation of this conservation program, but it will be important to ensure that the proportion covered remains sufficient to generate and sustain biodiversity gains necessary as an offset for residual project impacts. Present, very preliminary calculations in this section suggest that the project would thus need to contribute almost half of the costs, which are likely to be very high. Further efforts by the project to refine assumptions and estimates in this preliminary calculation are likely to reduce costs (as estimates here are largely precautionary).

4.3 Freshwater offsets

The ESIA does not currently identify the need for any freshwater offsets, on the basis that identified mitigation (particularly minimum environmental flows) will not result in any significant residual project impacts on freshwater ecosystems. As outlined in Section 3.3, it may be too early to be confident of this conclusion. If residual project impacts are identified upon freshwater Critical (or Natural) Habitat, and no further adjustments to mitigation or HPP operation are feasible to eliminate these impacts, an opportunity may exist to offset such impacts in the Toni River. While smaller, the Toni River is connected to the Tina River and likely to contain a very similar set of species. Further, it has experienced some degradation as a result of the (now non-operational) Gold Ridge mine in the neighbouring catchment (C. Filardi pers. comm. 2017). There is thus an opportunity to restore some ecological functionality of the Toni River.

5 Biodiversity monitoring

Section 13.3 of the ESIA outlines project monitoring activities, and a process for independent auditing of monitoring. ESIA Section 13.3.2 lists monitoring plans to be developed, including on 'Aquatic Life' and 'Flora and Fauna' (the latter to include monitoring of invasive species). Physical environmental monitoring is elaborated for suspended sediments (ESIA Section 13.3.3.1) and water quality (ESIA Section 13.3.3.2). ESIA Section 13.3.3.3 outlines plans for fish, algae and macro-invertebrate monitoring. Each monitoring plan will identify the parameter being monitored, how it will be monitored, how frequently and who will be responsible for monitoring.

To assist development of future monitoring plans, Table 3 briefly outlines key areas of monitoring necessary to assess changes in the state of potentially Critical Habitat-qualifying ecosystems and species, changes in threats to this biodiversity, and progress of project mitigation/offset actions. Together, these approaches to monitoring 'state', 'pressure' and

‘response’ for Critical Habitat-qualifying biodiversity will enable the project to assess progress towards No Net Loss.

Aquatic monitoring outlined in Table 3 will be important not only for any Critical Habitat-qualifying fish species, but more broadly given current limited knowledge of the ecology of the Tina River, and thus limited confidence in the effectiveness of proposed environmental flows and fish passage methods. Results of aquatic monitoring will thus inform adaptive management through project life.

For all aspects of monitoring, it will be necessary to establish higher and/or lower thresholds which outline the expected natural variation within indicators. Should monitoring show indicators above/below these safe boundaries, adaptive management of project mitigation or operation will need to be considered.

Table 3. Key areas of monitoring necessary to assess changes in the state of important ecosystems and species, changes in threats to this biodiversity, and progress of project mitigation/offset actions

	Solomon Islands Rainforest (including Guadalcanal Boobook, Black-headed Myzomela and Guadalcanal Bow-fingered Gecko[3])	**King Rat and White-eyed Starling**	**Aquatic biodiversity, including potentially restricted-range fish species**
State monitoring (to assess the ongoing extent/distribution and condition/population of important biodiversity)			
Surveillance to assess presence in area	N/a	Necessary	N/a
Remote sensing to assess direct and induced forest loss and degradation	Necessary	Necessary if confirmed in area	N/a
Measurement of regrowth (habitat condition) in areas restored after temporary topsoil storage	Necessary	Necessary if confirmed in area	N/a
Water dissolved oxygen, temperature, river sedimentation and geomorphology (already in ESIA Table 13-7)	N/a	N/a	Necessary during both construction and operation, at decreasing frequency over project life
Species richness and population density, at least for key species (from both a Critical Habitat and livelihood perspective)	N/a	N/a	Necessary, both upstream and downstream of the dam (including control monitoring on the Toni River). Baseline yet to be established. Very regular monitoring required to inform

[3] It is not anticipated that these species will be affected by the project in any way that is not closely related to that of the forest and its species assemblage as a whole, thus no specific monitoring is proposed for, e.g., any of these species' populations.

			adaptive management.
Number of individuals per species using trap and haul system	N/a	N/a	Necessary. Very regular monitoring required to inform adaptive management.
Pressure monitoring (to verify the scale of direct and indirect project impacts in relation to those predicted in the ESIA)			
Ambient noise	Necessary during construction	Necessary if confirmed in area	N/a
Spread of invasive species beyond ESIA baseline	In particular, cats, rats and cane toads	Cats and rats	In particular, water hyacinth and non-native fishes
Ground-truthed mapping of project-cleared areas within forest	Necessary	Necessary if confirmed in area	N/a
Presence of non-local people (except project staff) beyond end of current Black Post Road	Necessary	Necessary if confirmed in area	Necessary
Extent of new local settlements beyond end of current Black Post Road	Necessary	Necessary if confirmed in area	Necessary
Workers identified/reported harming or purchasing wildlife (including fish) (already in ESIA Table 13-7)	Necessary	Necessary if confirmed in area	Necessary
Response monitoring (to verify the occurrence and effectiveness of project mitigation and offset measures in comparison to predictions in the ESIA)			
Progress of program to control/remove non-native species	In particular, cats, rats and cane toads	Cats and rats	In particular, water hyacinth and non-native fishes
Maintenance of environmental flows at all times (already in ESIA Table 13-7)	N/a	N/a	Necessary

Operation of trap and haul system at regular intervals (already in ESIA Table 13-7)	N/a	N/a	Necessary
Progress of restoration for temporarily disturbed areas after construction period	Necessary	Necessary if confirmed in area	N/a
Progress of offset conservation program	Necessary	Necessary if confirmed in area	Likely necessary if restricted-range fishes are identified

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