TOOLSIE PERSAUD TIMBER TRADERS INC.
SFEP 2/2013

REPORT OF THE

ENIVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT
RE SEFP 2/2013

PREPARED FOR THE EPA

JULY 24, 2018, Revised December 6, 2021

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ACRONYMS

ACTO	Amazon Cooperation Treaty Organization
ATV	All-terrain vehicles
CDC	Community Development Council
CI	Conservation International (Guyana) Inc.
CITES	Convention on International Trade in Endangered Species on Wild Fauna and Flora.
COP	Code of Practice for Forest Operations 3rd Ed, 2013 for TSA & WCL Holders.
EAB	Environmental Advisory Bureau
ESIA	Environmental and Social Impact Assessment
EPA	Environmental Protection Agency
DOE	Department of Environment, Ministry of the Presidency
FAO	Food and Agricultural Organization of the United Nations
FTCI	Forestry Training Centre Incorporated
GFC	Guyana Forestry Commission
GGMC	Guyana Geology & Mines Commission
GGMDA	Guyana Gold and Diamond Miners Association
GLASC	Guyana Lands & Surveys Commission
GOG	Government of Guyana
GPF	Guyana Police Force
GSDS	Green State Development Strategy
IIC	Iwokrama International Centre
ITTO	International Tropical Timber Organization
IUCN	International Union for the Conservation of Nature
LCDS	Low Carbon Development Strategy
MNR	Ministry of Natural Resources
MOPH	Ministry of Public Health
MOPI	Ministry of Public Infrastructure
MOTP	Ministry of the Presidency
NDS	National Development Strategy
NEAP	National Environmental Action Plan
NTFPs	Non-timber Forest Products
PAC	Protected Areas Commission
RDC	Regional Development Council
REDD+	Reduced Emissions from Deforestation and Forest Degradation
SFA	State Forest Authorization
SFEP	State Forest Exploratory Permit
TEEB	The Economics of Ecosystems and Biodiversity
THD	Transport & Harbours Department
TIN	Tax Identification Number
TPL	Toolsie Persaud Limited
TPTTI	Toolsie Persaud Timber Traders Inc.
TSA	Timber Sales Agreements

UNEP	United Nations Environmental Programme
UNFCCC	United Nations Framework Convention on Climate Change
WTTCL	Willems Timbers & Trading Company Limited
WWF	World Wildlife Fund, Guyana

ACKNOWLEDGEMENTS

TPTTI acknowledges the support and guidance of the EPA staffs in taking forward this work.

TPTTI also acknowledges the technical assistance provided by the Forest Resources Information Unit, Forest Resources Management Division, Guyana Forestry Commission, particularly in preparing the maps used in this report.

TPTTI values the information and advice provided by field operatives of the GGMC, at Georgetown HQ and at Puruni Landing and field operatives of the GFC based at Iteballi Landing. TPTTI also acknowledges the information and advice readily provided by numerous boat captains, miners, taxi drivers, businesspersons, '*old timers'* and *'sailors'* at Bartica, Teperu and along the Iteballi-Puruni Road and the Iteballi-Arimu Road.

TPTTI values the work of the consultants who visited virtually every corner of the forest concession and traversed the rapids of the lower Cuyuni River area at great personal risk and discomfort, to collect data.

Finally, TPTTI acknowledges the contributions of all stakeholders who participated at scoping meetings or agreed to formal interviews with the consultants.

A. INTRODUCTION

Overview

1. The widespread recognition of ecosystem services and values associated with (tropical) forest sources (TEEB) has intensified stakeholders' scrutiny of projects requiring major interventions in local forest resources.

2. Stakeholders' concerns are justified. The Guiana Shield- and its abundant ecosystems and ecosystem services- make it one of the more critical global assets (UNDP, 2012) and Guyana's entire territory contributes 9.4% of the area of the Guiana Shield (Hammond, 2005). However, Guyanese stakeholders, may take comfort from the sterling work of several agencies, *including but not limited* to the GFC, the GGMC, the EPA, ITTO, FAO, DFID, WWF, CI, and UNDP.

The SFEP

3. Toolsie Persaud Timbers Traders Inc. (TPTTI), a local company, intends to contribute to the development of Guyana by harvesting merchantable timber from a forest concession in the Kartabu Triangle and selling the timber locally and overseas. (TPTTI is associated with Toolsie Persaud Limited, a company with more than 60 years' experience in the local forestry sector).

4. TPTTI's first step was to acquire a SFEP for an area of 66,873.36 ha in the Kartabu Triangle from the GFC. However, the SFEP does not allow the company to conduct timber harvesting operations; instead, the SFEP allows the company to identify and evaluate all the technical, ecological, environmental, and social variables associated with its proposed timber harvesting operations and then present a plan to the EPA and other stakeholders to demonstrate how any negative impacts of logging will be mitigated or managed. *In other words, while the company has an interest in merchantable timber, it must address the concerns of other stakeholders who have an interest in other attributes of the local forest resources within the concession area*.

Engagement with the EPA

5. The agency with the mandate to determine to what extent stakeholders' concerns are addressed is the Environmental Protection Agency (EPA). Based on TPTTI's application for an Environmental Authorisation, and in view of stakeholders' interest in the logging project proposed by TPTTI, the Agency instructed TPTTI to conduct ***an environmental and social impact assessment.*** The EPA provided the company with terms of reference regarding the nature and scope of the work to be done and the format of the report required. Once satisfied that TPTTI can manage any conflict(s) emerging from the logging operation, the Agency will grant TPTTI an *Environmental Authorisation*. Based on the approved environmental authorization, the GFC will grant TPTTI a *State Forest Authorization* to proceed with logging operations.

B. TECHNICAL ASSISTANCE

Consultants and their work

6. TPTTI recruited FTCI for technical support to undertake, *inter alia*, the ESIA process; FTCI in turn recruited several multi-disciplinary specialists to conduct the work and prepare the ESIA report for the approval of the EPA (and EAB and other stakeholders). In the identification, the study and the reporting on the environmental and social issues associated with the project, the consulting team was guided by the terms of reference for the work prescribed by the EPA.

7. In taking forward the ESIA process, the consulting team made thirteen, five-day field trips to the concession area; the most recent being September 9, 2021. In addition, there was a three-week field trip to conduct ML forest inventory. The team leader also participated in a fly-over of the concession area, which was organized by TPTTI.

Consultations

8. There were both informal and formal consultations with many persons. Informal consultations were held with staffs of GGMC, members of the logging community, the business community, Kartabu triangle, boat captains at Bartica and Puruni Landing, and miners. In addition, a total of fifty (50) persons residing or working in four *communities* along the Iteballi-Puruni route were *formally* consulted with the aid of questionnaires. The team also benefited from discussions at a sector scoping meeting in Georgetown and the public-sector meeting at Iteballi.

Challenges

9. The consulting team faced three main challenges in the pursuit of the work. The first is that the water quality for rivers in the concession area is not suitable for direct consumption due to very high sediment loads generated by itinerant mining activity. The water quality also made finding campgrounds an onerous activity. The team was therefore forced to carry a large volume of bottled water into the field. The second challenge was the unpredictable weather; for the Puruni District, the May-June rainfall season started in April 2018. Finally, there are some security concerns traversing forested areas where there are miners.

10. During period 2019-2021, RL Sukhram and Sons, holders of SFEP 02/2017, situate west of TPTTI's concession, constructed a road through TPTTI's SFEP area; the road included the construction of bridges across the Mara-Mara and Ekabago Rivers and facilitated easier access to TPTTI's SFEP area.

C. CONTEXT FOR THE PROJECT

The Kartabu-Puruni Road[1]

11. The project area is located within the Kartabu-Triangle, an area with a substantial history of mining and logging. There are four communities within the area:

[1] Includes the Iteballi-Puruni Road

Iteballi, on left bank Mazaruni River; *Takutu Community*-a set of miners' camps and small businesses along the Kartabu-Puruni Road; *Tiger Creek Junction*-a small cluster of businesses and Puruni Landing, left bank Puruni River, at the point where the Kartabu-Puruni Road crosses the Puruni River. All these communities are linked by the Kartabu-Puruni Road and all the communities are **outside** the project area, however timber from the project area will be transported via the Kartabu-Puruni Road and traverse the Tiger Creek, Takutu and Iteballi Communities. The main administrative base for TPTTI is at Iteballi where the company has a 25-acre property including an office, staff accommodation, a timber depot, workshop, vehicle parking facility and a wharf.

12. *Mining and logging occur already occur within the Kartabu* triangle to the extent that there are forest concessions all along the eastern boundary of the (new) concession area (see Figure a.). Also, the *entire* Kartabu-Puruni Road traverses forest concessions and mining concessions. There is another main access road-The Arimu Road (see Figures a, b) that passes through the northern part of the Kartabu Triangle, and even traverses the concession area, but the company will not use this road because it was not designed for vehicles with pole trailers, hauling logs up to 18m in length. It is estimated that, based on a study of the traffic density on the Kartabu-Puruni Road over several weeks, that logging traffic-*vehicles hauling timber*- takes up *less than 5% of all vehicular traffic using the Kartabu-Puruni Road*. (Vehicles conveying fuel, mining supplies, rations and personnel for the mining community take up about 85% of the traffic density, while ATVs, light pickups, mini-buses, and taxis take up the other 10%).

Public agencies

13. Three public agencies maintain a presence in the Kartabo Triangle. The GFC maintains a forest station at Iteballi, and officers there conduct patrols as far as Puruni Landing. The GGMC maintains a station at Puruni Landing and officers there patrol the district by ATV and by boat on the Puruni River. The GGMC and the GPF jointly manage a 24hr outpost/check point about 5 km west of Iteballi along the Kartabu-Puruni Road. At Puruni Landing, there is a GGMC Station and a Medical Centre. From 2020, the Police maintained a small unit at Puruni Landing, while the GDF maintained an outpost there for a few months.

D. CONCESSION AREA

Location

14. The concession area is bounded generally by the Cuyuni River in the north, the Puruni River in the south, the Ekabago River to the west and the Mara-Mara River to the east. It is situated well away from any communities.

Access

15. TPTTI evaluated the Arimu Road and the Kartabu-Puruni Road and decided that it will access the concession via the Kartabu-Puruni Road: At the point where the company will set up its field base, it is about 106 km from Iteballi, 65 km from

Takutu Community, 17 km from Tiger Creek Junction, and 34 km from Puruni Landing. The base camp will be two hours' drive by car or pick-up from Iteballi, three hours' drive by road from Bartica, and seven hours by road -via Wismar, Kumaka-Sherima and Teperu, from Georgetown. There is the option to travel from Georgetown via Parika, then by boat to Iteballi; the trip to the camp using this route would take about four hours and thirty minutes.

16. The mining road between Tiger Creek Junction and Mara-Mara River has been in existence for more than ten years. Miners have been traversing the southern part of the concession by fording the Mara-Mara riverbed during the dry season. (The creek bed itself shows evidence of strengthening with mining rock waste). During the rainy season, water levels in the Mara-Mara Creek is too elevated to allow for the crossing of vehicles. TPTTI intends to create year-round access to its forest concession by bridging the Mara-Mara River (see Figure c). During period 2019-2021, RL Sukhram and Sons, holders of SFEP 02/2017, situate west of TPTTI's concession, constructed a road through TPTTI's SFEP area; the road included the construction of bridges across the Mara-Mara and Ekabago Rivers and facilitated easier access to TPTTI's SFEP area.

17. Miners also access the *northern* part of the concession via the Arimu Road (see Figure b.) to access mining authorizations in, and beyond (west of) the concession area, mainly for taking in heavy machines such as excavators and bulldozers. Many miners also access the northern part of the concession area by river via the *Waiamu Landing* or the *Quartzstone Landing*, on right bank Cuyuni River, using daily boat services between Bartica and Waiamu Landing, a hazardous trip that traverses the rapids of the lower Cuyuni. This route is restricted to the wet season; in the dry season, there are too many rock outcrops to travel safely or travel with cargo. (It is impractical for TPTTI to use this route to extract timber or transfer logging equipment to the concession area).

Topography

18. The concession area varies from undulating to very hilly, with areas north of Arimu Road much hillier than the rest of the concession. Elevations of up to 700ft have been noted and several peaks of 400ft+ are quite common.

19. Five rivers dominate the concession area: two large unnamed tributaries on the right bank Cuyuni River to the north western end of the concession area, the Quartzstone River, right bank Cuyuni River at the north eastern part of the concession area; the upper Arimu River on the central eastern part of the concession area; the Mara-Mara River, left bank Puruni River on the south-eastern boundary of the concession area; and the Ekabago River, right bank Cuyuni River on the western side of the concession area. The prevailing stream pattern is dendritic, and the drainage density is estimated at 12m/ha.

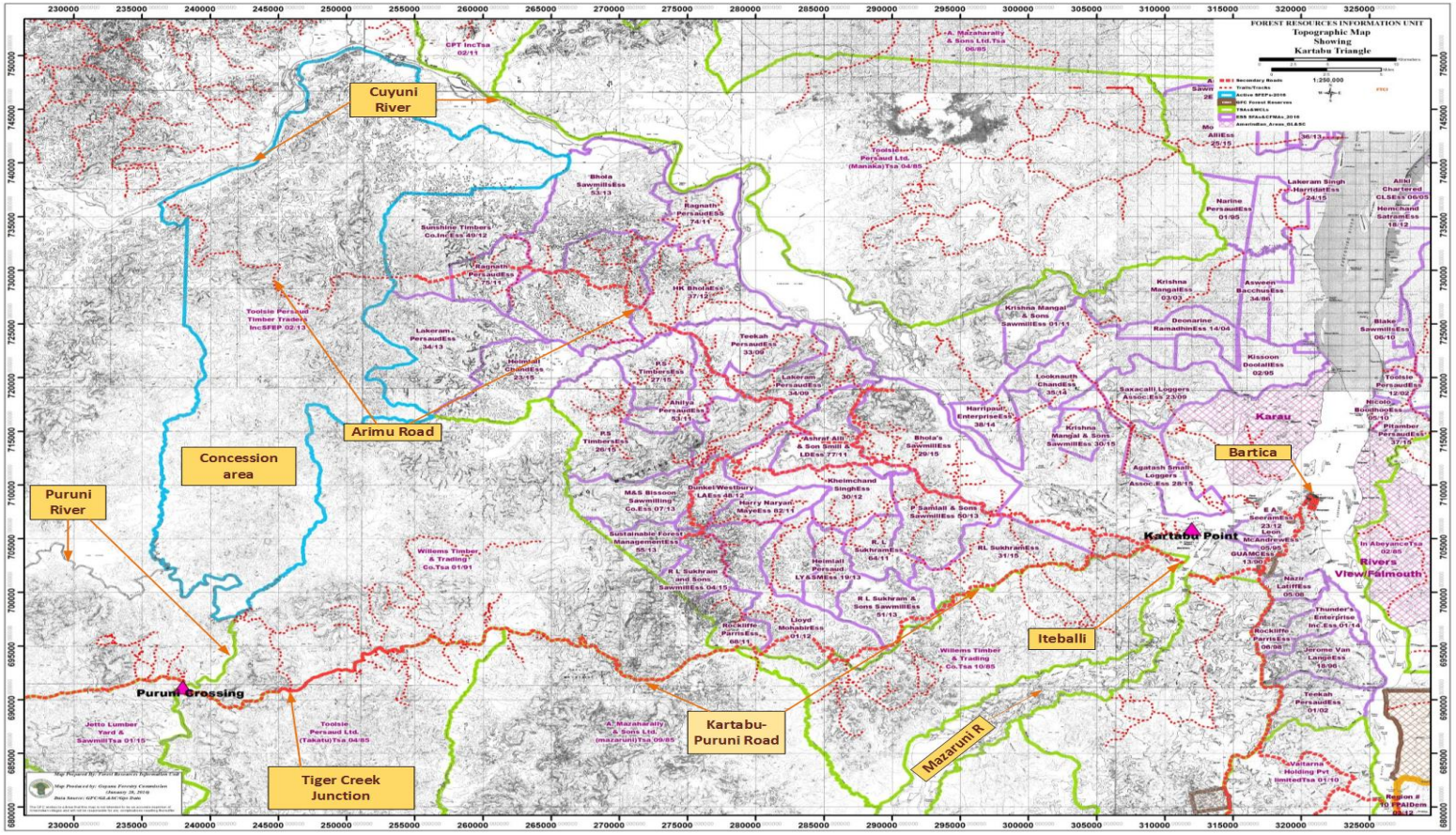


Figure a: Indicative map showing forest concessions in the Kartabu Triangle

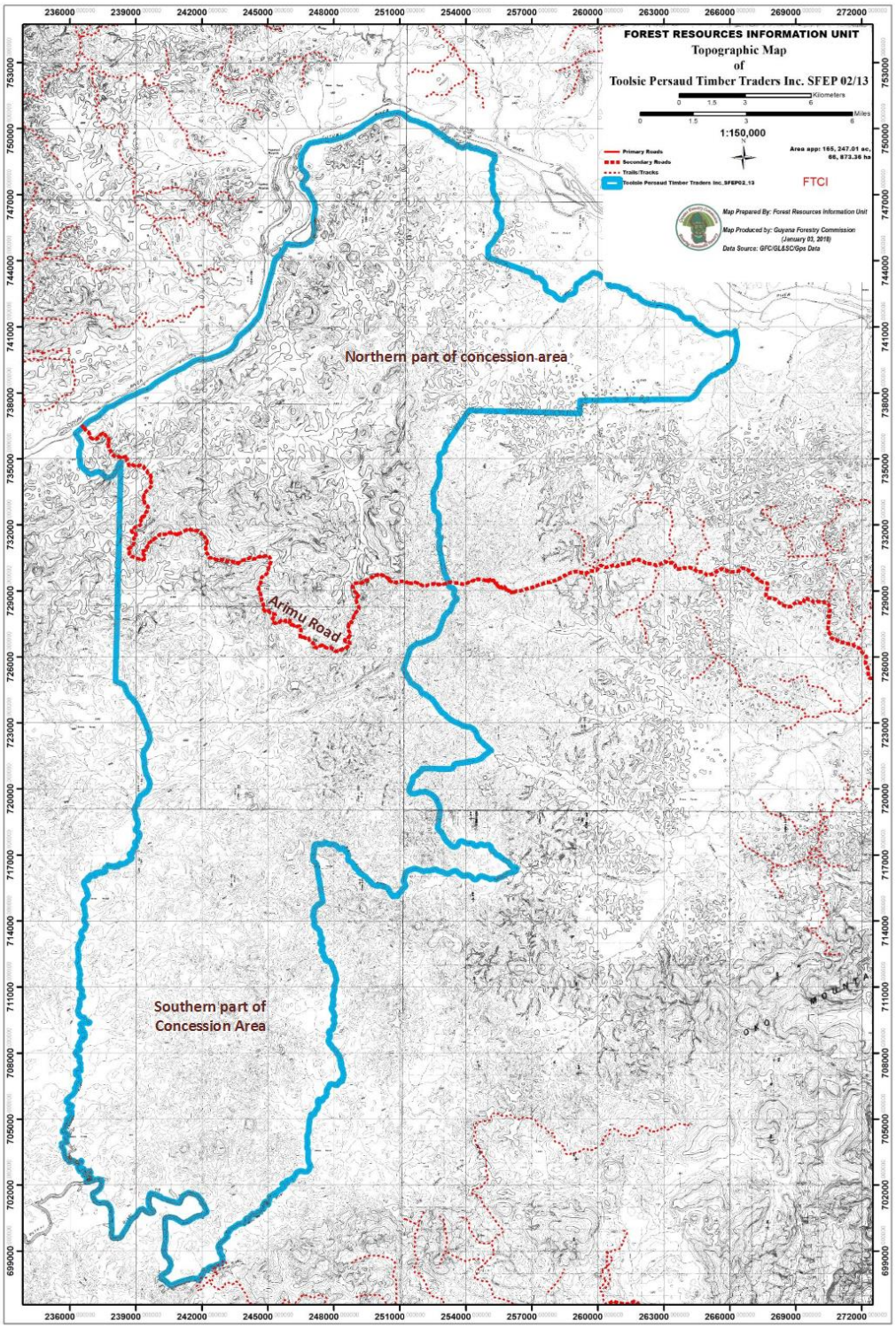


Figure b: Outline map of SFEP 2/2013

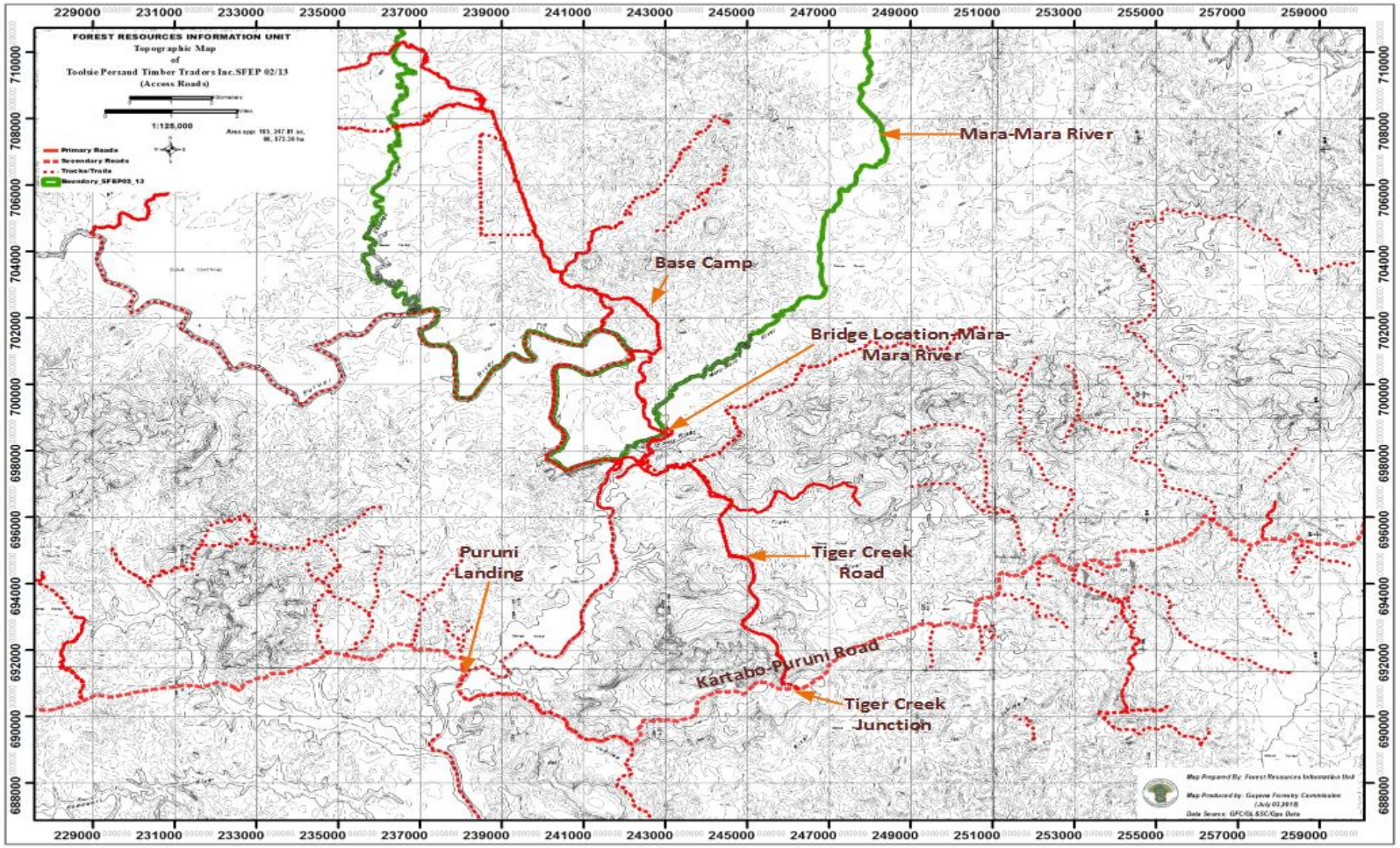


Figure c: Map showing the access point for TPTTI

Soils

20. The dominant soil type in the concession area is Kanhapludults (89%). These are red, yellow podzolic soils and red latosols; they are well drained shallow or deep soils with slight to high erosion potential depending on terrain. In the more hilly, elevated terrain, there are also soils designated Ustochrepts (11%). These are light textured red-yellow latosols, that are either well drained, very deep soils in the lower elevations or very shallow soils with excessive drainage at higher elevations; the deep soils have a low erosion potential while those shallow soils on rock beds have a high erosion potential. The soil properties were validated based on soil samples taken and analysed during field work.

Forest Resources

21. Forests cover the entire concession area save for small gaps linked to mining activity. Data based on GFC's vegetation maps indicate that Mixed forests on undulating to hilly terrain is the dominant forest type within the concession area. During the ML inventory, some marsh forests as well as swamp forests were noted in ravines, along rivers.

22. The forest resources in the concession area are typical of that within the Kartabu Triangle, which Ter Steege (2000) described as Central Guyana Wet Forests: forests characterized by a high abundance of commercial species including Wamara (*Swartzia leiocalycina)*, Greenheart (*Chlorocardium rodiei*), Mora *(Mora excelsa)*, Morabukea (*Mora gonggrijpii*), Haiariballi *(Alexa imperatricis)* and Aromata *(Clathrotropis spp.).*

23. *A Management Level inventory* data set generated by Barama Housing-a company that had interest in the northern part of the concession area, data sets generated by the consultants and 100% preharvest inventory over 700ha respectively conducted by TPTTI all reveal information consistent with the ter Steege's report. The consultants also found that the northern part of the concession is more diverse in species composition than the southern part.

24. Overall, the stocking of merchantable timber in the concession area is economically attractive.

Land use

25. There are **no communities** within the concession area and no evidence of cultivated lands anywhere. There is evidence however of people traversing the concession on foot and by ATV. Also, a few ex-mining camp sites were noted.

26. Mining authorizations have been granted *throughou*t the concession area but most of these remain undeveloped. There are signs of exploratory pits everywhere, however 98% of the active mining within the concession area occur in the areas north of Arimu Road. During field exercises, a total of about four persons, one Guyanese and three Brazilians were *encountered* on the concession area. On another occasion, the team stumbled into a large mining camp of mostly Brazilians; they moved out after about a week apparently due to low gold yields (and FTCI promptly used the camp site for its inventory crews). TPTTI will use the location of an ex-mining camp to set up its (first) base camp on the concession area.

27. There are about 48 km of mining roads already existing with the concession area; most of these may only be used by heavy 4x 4 vehicles in the dry season. The ATV is the primary means of traversing the existing roads in the concession area.

E. THE PROJECT

Introduction

28. TPTTI intends to sustainably harvest merchantable timber within the concession area, using reduced impact logging practices. Timber harvested in the concession area will be hauled primarily via the Kartabu-Puruni *public road* to Iteballi, a minimum distance of at least 106km, for a start and around 130km within ten years.

29. TPTTI's **main administrative base will be at Iteball**i where the company has a 25-acre property, obtained through GLASC. TPTTI will also maintain a simple administrative base at the location of an ex-mining camp with UTM coordinates 21N 242500, 702250. This camp will cater for planning crews, inventory crews and logging crews.

30. **TPTTI *will not* engage in any kind of wood processing operations within the concession area. Further all major mechanical services and fuel and oil storage will be done at Iteballi**.

31. Logging is cyclic. Only nine (9) blocks will be harvested each year. TPTTI will remove up to 2000m^3 of timber from each 100ha block approved for felling, then move on to another block, in such a manner that it would require a 60-year period before any block is re-logged.

Project parameters.

32. TPTTI will operate on a 60-yr. felling cycle which allows the company to:
    a) harvest up to 20.0m^3/ha;
    b) harvest annually an area of 900ha (9 blocks);
    c) harvest a total of 17,000m^3 of merchantable timber per annum

Project elements

33. In the pursuit of its logging operations, the company will undertake the following core operations (see summary of activities in Figure d).

    a) Organize the concession area into compartments and 100ha blocks: each compartment will be given a name and each block will be given a unique alpha-numerical code.

    b) Set up a base camp within the concession area. (TPTTI will take advantage of an ex-mining site to avoid new clearings).

    c) Evaluate existing roads and develop a primary and road network of its own.

    d) Conduct management level and 100% forest inventory exercises, respectively.

    e) Prepare tree location maps based on 100% inventory data for each block.

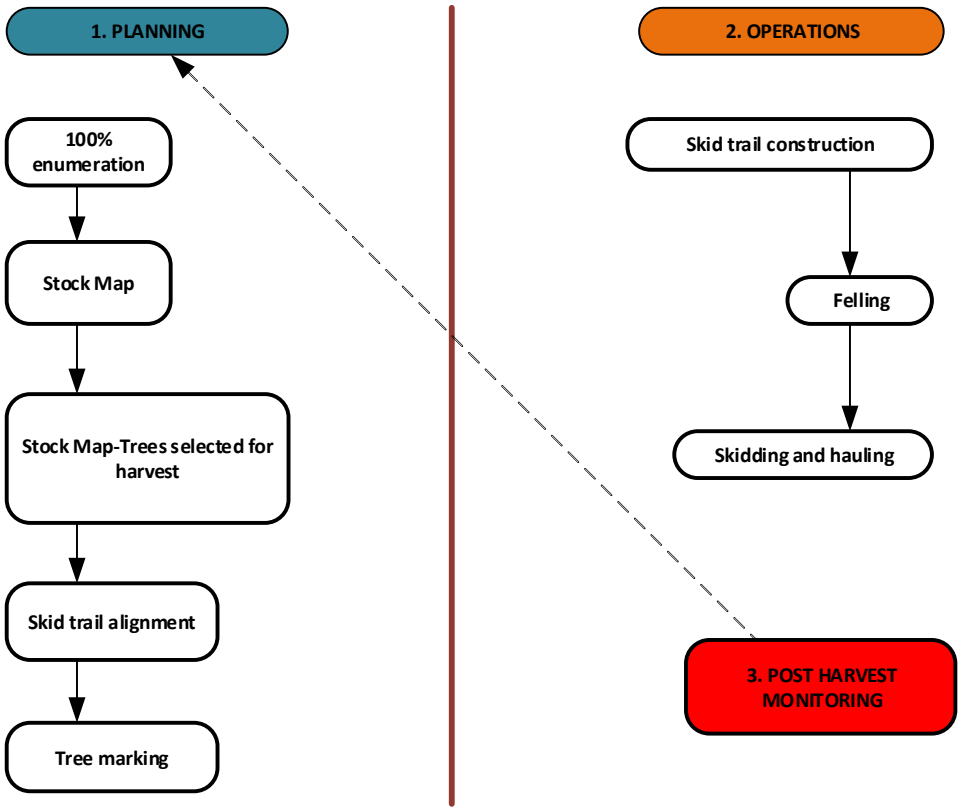


Figure d: Summary of project elements-TPTTI's Logging Project

f) Generate a list of species to be harvested (harvesting stock) and construct secondary roads, log markets and skid trails.

g) Conduct tree marking exercises to validate the quality and stocking of the harvesting stock and to plan its extraction efficiently.

h) Haul logs in south easterly direction through the concession area to Mara-Mara River, thence across the river, thence through an existing road -within TSA 1/91 held by WTTCL- to Tiger Creek Junction, Kartabu-Puruni Road, thence easterly along the Kartabu-Puruni Road to Iteballi, a minimum haul distance of 106km. (At Iteballi, logs will be transferred to a barge thence to coastal locations.

34. To carry out the activities listed under project elements (a) to h); the company will:

a) Recruit, train and deploy up to thirty (30 persons) on the concession area to address road construction works, forest inventory, and logging operations.

b) Deploy several heavy-duty vehicles (bulldozer, grader, excavator, front-end loader, and trucks) for earth works linked to road, bridge and culvert construction, land clearing for base camps, forward camps and log markets, the construction of skid trails;

c) Deploy two or more felling crews for felling trees by chainsaws;

d) Deploy skidders for extracting logs from stump to log market; and

e) Deploy a log loader at log market for loading trucks; aim to get logs out of the concession area within three days of their 'preparation'.

F. CORE ENVIRONMENTAL AND SOCIAL IMPACTS

Overview

35. Logging by its very nature require major interventions into the forest resources to the extent that residual forest conditions, after even selective logging, are substantially different from the original intact forests.

36. Impacts of the project will be experienced primarily at the concession area; however, there will be impacts at three points along the route and at Iteballi, the destination for the logs. different points (see Figure e):

a) Impacts confined to the concession area: these impacts will affect TPTTI's employees, as well as miners, other loggers, and hunters transiting the concession area; the consultants estimate some 40 persons will be impacted;

b) Impacts along the Tiger Creek Road: there are miners on left bank Mara-Mara River as well as on left bank Puruni River who use the Tiger Creek Road; the consultants estimate some 15 people will be impacted.

c) Impacts at Tiger Creek, Junction: there are a cluster of dwellings there, and TPTTI's lorries will pass about 50m east of the nearest building.

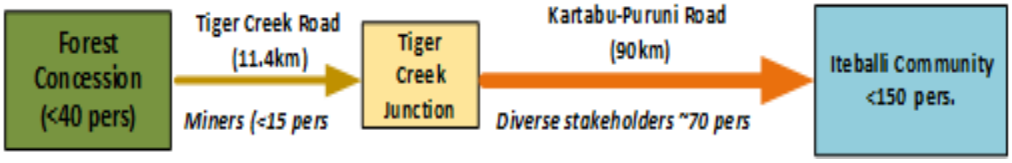


Figure e: Timber flows versus stakeholders

d) Impacts along the Kartabu-Puruni Road: there are miners and other businesspersons' resident at Takutu; then there are miners and other businesspersons who travel between Iteballi and Puruni Landing & beyond or between Iteballi and numerous mining claims north or south of the Kartabu-Puruni Road; the consultants estimate that less than 5% of vehicular traffic on the Kartabu-Road comprise vehicles hauling logs. The consultants estimate that TPTTI's hauling operations will not cause the value to exceed 5%.

e) Some impacts will be felt at Iteballi, where TPTTI has a 25-acre property and where it will transfer logs to a barge for the trip to Georgetown and environs. The consultants estimate that, as TPTTI's facility lie to the extreme north of Iteballi, timber will be hauled through the entire village. (Iteballi is the hub for ferry service between Teperu and Iteballi: therefore, for every one of the twelve trips made per day, every day, Iteballi is exposed to and dust from heavy-duty trucks).

Impacts on the physical environment

37. Road works require a significant amount of earth works (grubbing the roadway, grading and compaction of the roadway, establishing borrow pits, and excavations linked to side drains, bridges, and culverts). These activities loosen soil making them vulnerable to the erosive forces of wind and (storm) water and leading to accelerated erosion, especially on sloping ground. Heavy vehicles produce vibration which loosen soil particles and makes such particles easily erodible. Alternatively, heavy machines compact soil which can stymy its permeability and lead to water ponding after rainfall. Water ponding weakens the load bearing properties of roads which in turn leads to the formation of potholes. Waterlogged could alter soil physical and chemical properties because it attracts new plant communities that thrive in waterlogged conditions. Waterlogged soils also facilitate the expansion of amphibian communities.

38. Machines may shed oil or fuel on the forest floor, and these have a polluting effect on soil and on water quality.

Impacts on the biological environment

Flora

39. Logging requires that trees be felled. Most of the trees felled will be targeted for that purpose; however, trees are also felled during road construction works, including timber for bridges, during clearings for forward camps and during skid trail construction. The removal of trees during timber harvests leads to forest degradation by altering forest structure in terms of distribution of diameter classes and in terms of species composition. Logging targets trees of good form and this implies that there could be some genetic erosion in the tree population after harvests.

40. The removal of trees at the level of the canopy allows more light onto the forest floor, modifies wind flows and relative humidity in the understory which may stymy the development of seedlings of merchantable trees felled.

Fauna

41. Heavy machines kill slow moving fauna. Felling trees destroys nests of birds in the canopy and other hiding places arboreal fauna. Noise, vibration, and tree removal disrupts the habitats of animals in the understory, placing them under stress and forcing their *temporary* migration. The temporary forced migration of fauna most likely affects forest functions such as seed predation and seed dispersal. Animals forced to migrate or flee *under stress* may probably become more vulnerable to predators.

Impacts on the social environment

42. . RL Sukhram constructed *a bridge over the Mara-Mara River* and a road linking Mara-Mara River with Ekabago River. ensuring year-round access. Miners expect uninterrupted *use* of (TPTTI's) road networks, and this could be a source of conflict between miners TPTTI's management.

43. Dust (see Figure f), noise and vibration may be major irritants for miners traversing the Tiger-Creek-Mara Mara access road, for the mass of people using the Kartabu-Puruni Road, and for residents of Iteballi.

44. TPTTI will recruit and train persons living in the Kartabu-Triangle. In fact, during social surveys in the area, many of the interviewees ask that TPTTI help create employment opportunities within the area. Any capacity building activity will create positive benefits for young people in the Kartabu-Triangle.

45. TPTTI will prevent hunting by its own employees. ***NO HUNTING SIGNS*** will be posted along the company's roadways.

46. Finally, all machines in movement will generate extensive dust travelling along public roads, especially in in the dry season. Dust is a major nuisance for road users, and for persons living along the road corridor.

Figure f: Example of dust nuisance along the Kartabu –Puruni Road

G. GENERAL STRATEGIES FOR MANAGING NEGATIVE IMPACTS

Overview

47. TPTTI developed an environmental policy, and the concessionaire will keep updating that policy to ensure that it runs a model logging operation compatible with national level forest conservation goals and the expectations of other stakeholders.

48. The following minimal general practices will be undertaken:

    TPTTI will designate two officers, its *Forest Operations Coordinator* and its *Forest Monitoring Officer* who together will be responsible for monitoring TPTTI's management of environmental matters and for briefing TPTTI's field operatives and other stakeholders on TPTTI's environmental practices

    a) TPTTI will be proactive in seeking feedback from core stakeholders.

    b) TPTTI will maintain a budget for managing environmental issues.

c) TPTTI will maintain five permanent monitoring stations across the concession area.

d) TPTTI will continue to develop and apply its own environmental policies and its safety policies.

Management of impacts on the physical environment

49. The minimal practices to be employed by TPTTI are as follows:

a) TPTTI will ensure that workers generally and managers in particular are committed to proper environmental practices; all staffs will be asked to share responsibility for environmental management.

b) TPTTI will acquire and use applicable technologies-including the use of drones-for monitoring environmental practices and environmental impacts.

c) TPTTI will embrace RIL principles and practices which emphasizes planning and controlling all interventions into the forest resources to avoid unnecessary environmental damage. Specifically, the use of heavy-duty machines will be planned with great care. Also, , any only urgent and critical earthworks will be carried out in the rainy season.

d) Vehicle maintenance and main fuel storage will be done at Iteballi, to help reduce environmental impacts at the concession level

e) All vehicles will be maintained in a fully functional state so that there is no undue spillage of fuel or oil. (Safeguards put in place by the manufacturers will be maintained).

f) TPTTI will train all employees in basic forest conservation practices and waste management practices. Copies of GFC's COP will be available to workers always.

g) Any water-logged ponds arising from operational activities will be duly drained;

h) TPTTI will encourage other resource users to comply with messages set out on no-littering signs and limitations on road use.

i) Solid waste such as used wet cell batteries will be taken to Iteballi and sold to persons who recycle or otherwise utilise such materials. Other waste including dry cell batteries, tyres and assorted plastic materials will be placed in drums and buried at designated points on the concession area.

Management of impacts on the biological environment

50. The minimal practices to be employed by TPTTI are as follows:

    a) TPTTI will not sanction hunting and fishing by its employees. 'No hunting' signs will be posted all over the concession area.

    b) Employees will be asked to eschew killing snakes or any other animal unless in a life threating situation.

    c) No (open) fires will be lit in the forests; and

    d) No debris or hazardous materials will be used or left on the forest floor to avoid pollution of streams or soil and injury to fauna.

Management of impacts on the social environment

51. The minimal practices to be employed by TPTTI are as follows:

    a) TPTTI will work Mondays to Saturdays: only one haul trip per day per truck will be made per logging truck.

    b) All trucks will carry rotating beacons on their cabs and an array of reflectors. and will always travel with their headlights ascended.

    c) To the maximum extent possible, all trucks will operate during daylight hours.

    d) Trucks will always slow down to <20km/hour when passing the Takutu Community, any other 'residential area'.

    e) Trucks will not travel more than 24kmh when passing through Iteballi and its outskirts; and

    f) No barge loading operations will occur at night.

H. WASTE MANAGEMENT PRACTICES

Overview

52. TPTTI has developed an **Environmental Policy** that will be the basis of its environmental management practices.

53. TPTTI is also committed to full compliance with Camp Hygiene prescriptions set out in GFC's Code of Practice for Forest Operations, 2018[2], conditions set out in its Environmental Authorization and all applicable laws and guidelines, including those prescribed by the Ministry of Health and Regional and Local Authorities.

54. The management of waste generally, and of hazardous materials in particular, is a significant component of TPTTI's field operations. TPTTI, on the one hand, intends to make sure that all waste discharged at the forest concession can be processed by microorganisms that decompose, detoxify, and eventually recycle waste materials. On the other hand, TPTTI also wants to ensure that its waste do not lead to the growth of pathogenic microorganism that cause serious illness among humans or lead to pollution of the soil and water and eventually environmental degradation.

Administration of Hazardous materials

55. The Supervisor-Iteballi Operations will be directly responsible for the administration of hazardous substances at Iteballi. His responsibility will also include managing hazardous waste generated at field bases and forward camps and brought to Iteballi.

56. TPTTI anticipates annual consumption of hazardous materials as follows:

#	Substance	Unit	Annual Consumption	Frequency of Purchases
1	Diesel	litre	400,000	Fortnightly
2	Gasoline	litre	200,000	Monthly
3	Grease	litre	1,300	Quarterly
4	Hydraulic fuel	litre	2500	Quarterly
5	Battery water	litre	108	Quarterly
6	OTC Insecticide	litre	108	Quarterly
7	Paint	litre	120	Quarterly

Core strategies for waste management

57. TPTTI 's core strategies for waste management generally and hazardous waste in particular are (a) TPTTI's Management to commitment to proper environmental management, and (b) a shared approach to environmental management across the entire organization. Management commitment would ensure that resources are available to enable all staffs to apply approved environmental management considerations in the course of their work.

58. In summary, five kinds of waste are predicted: (a) Human waste, (b) solid domestic waste, (c) liquid domestic waste, (d) hazardous waste and (e) wood waste.

[2] Chapter 8 deals with Operational Hygiene and includes Section 8.3 which deals specifically with "Fuel, Oil and Hazardous Chemical Handling and Storage as well as Section 8.4 that deals with 'Waste Management'. Chapter 9 deals with Camp Hygiene.

Human and domestic waste

59. (Overhead tanks will be used for distributing potable water. Screens and filters will be used to improve the quality of water available to staffs). For the base camp and at Iteballi septic tanks will be used for managing human waste. A mass of charcoal will be placed at the outlet of septic tanks, in essence filtering liquid waste emanating from the septic tank; the filtrate will then be channelled via a PVC pipe with diameter ≥152.4mm to a pit covered with stone, sand and wood debris; the pit would be placed at least 100m from any natural water way.

60. At temporary forward camps, latrines will be used for human waste. Latrines will be well ventilated and constructed not less than 100m from any natural way.

61. Solid domestic waste, particularly food materials, wrappers and paper products, empty cans and bottles and clothing will be thrown into pits constructed specifically for the purpose. These pits will be excavated at points not less than 150m from staff accommodation and as far as possible, natural depressions in the soil surface will be used. All tins (especially those that contained foodstuffs such as sardines will be squashed (to avoid injury to scavengers such as foxes) before being placed in the pit.

62. Liquid domestic waste-originating mainly from washstands, bathrooms and kitchen sinks will be channelled to pits constructed for the purpose. The pits will also contain wood debris or natural vegetation tolerant of domestic waste and pits will be placed at distances not less than 100m from waterways.

Hazardous waste

63. Hazardous waste includes fuel & oil, paint and grease, batteries, residual insecticides, and their containers. TPTTI's core management strategy for Hazard waste is employee awareness of the environmental hazards and their consequences for human health and the environment. TPTTI will store the bulk of hazardous items at special concrete and wooden bonds at its Iteballi Administrative Base where it can manage and **secure** such items. Fuels and Oils will be stored in bunded concrete & zinc sheet structures. Bonds will have ample signage-for example 'No Smoking'-, ample lighting, appropriate fire extinguishers[3] , sand buckets and 24 hr security. Special protocols will be put in place to deal with leaks or spillages. At Iteballi, other hazardous substances such as hydraulic fluids, batteries, paint, and insecticides will be stored in locked, ex-shipping containers. Relatively minor hazardous materials will be deployed at field locations because most vehicle refuelling, and servicing will occur at Iteballi. Fuel storage at field locations will be avoided, mainly for security issues. Fuel for field equipment such as skidders and bulldozers will be taken to the field and placed in the machines immediately.

[3] Classes A, B

64. Hazardous waste management at Iteballi will focus on the avoidance of spills, the storage of hazardous waste generated at Field Bases and Forward Camps.

65. Field crews would be required to do everything possible to conserve a wholesome forest environment by avoiding all forms of pollution. Hazardous waste management at field bases and forward camps would focus on the avoidance of spills, the proper use of hazardous materials and the proper storage of hazardous waste in bins provided for the purpose.

66. Field supervisors will be directly responsible for overall waste management at forward camps and along roadways.

Wood Debris

67. Wood debris generated at log markets on the forest concession and from tree fall will be placed on the forest floor and left to degrade naturally.

68. Wood debris at forward camps will be put into pits receiving liquid waste to encourage filtering of the liquid waste, and to facilitate the infiltration of water into the soil. Slow infiltration rates allow soil fauna and flora to aid the degradation of the wastewater.

Overall Responsibility for Environmental Management

69. The Forest Monitoring Officer will be responsible for environmental management. He/she is also responsible for engaging stakeholders for promoting a shared approach to environmental management. The Forest Monitoring Officer will also be responsible for building all employees' awareness via appropriate training materials, signage, and briefing meetings.

I. FEASIBILITY OF OPERATIONS

70. The major cost centre for the proposed operations are concession-based earthworks linked to logging road construction and maintenance. TPTTI has the capability to manage road construction and road maintenance works. The 106+ km haul distance is well within the **norm** for the local timber industry and TPTTI will be using two new MACK truck per day. Therefore, TPTTI believes that given the stocking on the concession area, it can run a feasible logging operation.

J. RISKS

71. There are two main risks associated the project. Firstly, the entire area has been allocated for gold mining. Miners have moved away from mining alluvial soils along creeks to land based operations where they use excavators 24hrs per day: this is the situation currently within two

nearby concessions (TSA 04/85 held by Toolsie Persaud Limited and TSA 01/91 held by Willems Timber & Trading Company). Fortunately, there has never been a 'shout' or 'a find of substantial gold reserves' that leads to the development of most of the mining concessions- which could lead to rapid degradation of the timber resource, however it is a possibility. (There are encouraging initiatives by GGMC and GMSTCI to improve the quality of mining and these initiatives are expected to bear fruit in a few years).

72. The second major risk relates to the use of the Kartabu-Puruni (public) Road (because there is no alternative routes in the short term). Occasionally, the road and bridges deteriorated to the extent that no log haul was feasible. . TPTTI's projections are that the density of traffic on that road will keep increasing due to the expansion of economic activity in the general area. TPTTI will closely monitor the state of the road and proactively engage with the authorities as necessary.

K. PROJECT OPTIONS

73. The entire concession area has been totally allocated for mining and the mining practice require that trees are removed to get at the sub-soil (see Figure g). This has been happening for many years now and will continue indefinitely once gold mining remains a lucrative business. Logging will ensure that merchantable timber available on the concession area is used to foster national development. Therefore, a no-logging option is not recommended.

Figure g: Ex-mining site: most of the merchantable stands of timber were destroyed

74. Despite a long history of itinerant mining, the concession is well stocked with *merchantable timber* and this timber could be extracted *sustainably* without any major negative impact on the forest environment or on forest functions. Timber harvesting will create employment opportunities and position the company, the sector and indeed Guyana to garner foreign exchange. During interviews with stakeholders in the area, *95% opined that the project will bring benefits to the communities (and businesses) in the area.* Further, more than 75% of persons interviewed would like to see more employment opportunities in the area for young

people and more community development. (The other major concerns are the need for a couple of police outposts and health centres in the area). The consultants believe that this logging project will not only create more economic activity in the district but will also expand the residual economic benefits for residents, especially at Iteballi. If the authorities are looking for an increase in economic activity to provide more social infrastructure in the general area, then this project will certainly provide it.

75. Currently, ground conditions, including the aesthetic values of water in creeks and rivers do not support eco-tourism *in the short term*. (The GGMC has several initiatives in train to improve the quality of mining practices, but these may not bear fruit in the short term given the itinerant nature of spatial distribution of mining activity). On the other hand, logging can support wildlife conservation and environmental measures adopted by TPTTI can influence mining community to improve their own practices. (The consultants garnered information, through *informal chats* with miners that they are much more interested in forest conservation than they appear to be). There are two other interesting issues: no miners were seen fishing or hunting; and no wildmeat was ever seen on sale at Puruni Landing. Chicken, beef and fish -Banga Mary and Trout-were however available at the *'supermarkets'* there). TPTTI will therefore be a model of proper environmental management. While deforestation is inevitable for mining operations, miners may assist with environmental management at post mining as well as non-mining areas.

L. STATEMENT

76. The consultants believe that the technology, policies, and practices adopted by TPTTI will ensure that the overarching interests of stakeholders regarding the forest resources will be preserved. The consultants have also reviewed comments by stakeholders, all of whom are looking for increased economic activities in the area, and the consultants believe that the logging project could help meet their expectations.

77. The consultants believe that TPTTI will honour commitments set out their Environmental Authorizations. Indeed, the fact that the company already has a *Safety Policy*, *a Human Resources Policy* and an *OSH Policy* reflects a company that cares about its corporate image and its corporate discipline.

78. The consultants are also confident that the GFC will be able to monitor TPTTI's operations effectively. Also, GGMC's initiatives to improve mining practices are expected to show results in the short term (3-5 years).

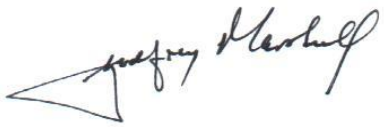
79. The consultants have reviewed the economic activities in the Kartabu Triangle generally and do believe that this logging project will lead to major *residual* economic benefits for residents, at Iteballi in particular. By adding to the volume of economic enterprises in the Kartabu

Triangle, TPTTI will contribute to more political attention to the district, and consequently the allocation of more budgetary support for the development of the Triangle.

80. A wooden bridge has been constructed across the Mara-Mara River and there is a road linking the Mara-Mara River to the Ekabago River. Already, public agencies such as the EPA, the GGMC and the GFC have been using that road to boost forest monitoring efforts. TPTTI's projections are that it will inject U$600,000 per year directly into the economy of the Kartabo Triangle. TPTTI will also support will be invested in the economy of the Kartabu Triangle and support preventative maintenance of the Iteballi-Puruni Road.

81. The consultants are of the view that the award of an Environmental Authorization (and consequently a State Forest Authorization) will promote forest conservation efforts and environmental management in the Puruni District. TPTTI's environmental conservation measures will help sensitise other land users on conservation issues and encourage them to do the same.

82. The consultants unreservedly support the issue of an Environmental Authorization to TPTTI.



G. Marshall
Team Leader

1.0 INTRODUCTION

1.1 Context

Toolsie Persaud Timber Traders Incorporated (TPTTI) acquired State Forest Exploratory Permit (SFEP) 02/2013 from the Guyana Forestry Commission for an area of 66,873 ha of State forests situated within the general Kartabu Triangle Region No.7. The SFEP allows the company, *inter alia*, to access the area and to determine the feasibility of conducting logging operations there, subject to the interest of other stakeholders, including public agencies, other loggers, and nearby communities.

Once such feasibility is established, then TPTTI would apply to the GFC for a State Forest Authorisation (SFA) which will formally grant the right to undertake timber harvesting subject, to all applicable provisions of the Forests Act,2009, the EP Act 1996, and the Code of Practice, 2018. An Environmental Authorization from the Environmental Protection Agency (EPA) is also (and first) a prerequisite for the acquisition of a State Forest Authorisation (SFA) from the Guyana Forestry Commission (GFC). The EPA grants environmental authorizations when a company submits an ESIA report acceptable to the agency and the EAB.

TPTTI will harvest logs from the concession area which will be transported some 106km to Iteballi, then transhipped via barge to coastal locations. No sawmilling (or any other form of wood processing) is contemplated within the concession area. Timber harvesting will be guided by all applicable legislation, Codes of Practice and GFC guidelines. TPTTI's projections are that it will harvest an area of 900 ha per annum for a projected annual yield of **17,031.42m3**.

The **Arimu Road** represents the most direct route to the concession area (please see Annex XI). however that road is in a very poor state and there is no *organized system* in place to rehabilitate it. ATVs are the main vehicles using the road. The most feasible option, already demonstrated by another logger, RL Sukhram & Sons, is to access the concession from the southern end via the Kartabu-Puruni Road and an access road at Tiger Creek Junction, thence across the Mara-Mara River

The concession area straddles the Mining Districts Nos.3 and 4 (GLASC, 2013). GGMC has approved within the same area 1,207 mining units. The GFC has also allocated 37 concession agreements one of which is this project under consideration. Numerous roads have been constructed by the mining community in the northern part of the concession; however, their alignment in terms of adverse grades and the layout of turns and their proximity to active mining activity make those roads unsuitable for the use of logging trucks. As such the preferred point of accessing the concession area is via the Iteballi-Puruni Road, thence via the Old Granny Road to left bank Mara-Mara River.

The Kartabu Triangle has an estimated population of about 4,000 persons of which 90 % are employed in the logging and mining sector. The two communities that are critical for development of enterprises in the area are Iteballi (~400 persons) and Puruni Landing (~300 persons). TPTTI has invested about US$1.5 million on exploratory operations by July 2018 while another US$2 million was spent to conduct management level inventory, develop a road network, organize the concession area into compartments and blocks, and conduct 100% forest inventories at the southern end of the concession area.

TPTTI's projections are that it will inject U$600,000 per year directly into the economy of the Kartabo Triangle. TPTTI will also support will be invested in the economy of the Kartabu Triangle and support preventative maintenance of the Iteballi-Puruni Road.

1.2 Corporate status of developer

Toolsie Persaud Timber Traders Incorporated (TPTTI), whose registered address is Lots 1-4, Lombard Street, Charlestown, Georgetown, Guyana was incorporated as Company No. 6985 under the provisions of the Companies Act of Guyana on January 20, 2012 (see Annexes II). The ***Directors of TPTTI*** are associated with Toolsie Persaud Limited-an enterprise that has been logging and managing forest concessions in various geographic locations since the early 1950s.

1.3 Engagements with the EPA, Consultants

On October 4, 2013, the company sourced a forest concession from the GFC designated SFEP 2/2013 for an area of 66,873 ha. The SFEP, and an Environmental Authorization are prerequisites for sourcing a State Forest Authorization which formally grants approval to conduct timber harvesting operations. The SFEP provides for exploratory operations so that the developer could examine the feasibility of logging the area. It is imperative too that the company demonstrate to the EPA, a capability for managing the environmental and social concerns of stakeholders. . The GFC will only authorize the issue of a State Forest Authorization (large concession) once the developer acquires an Environmental Authorization, which in the main sets out agreed conditions for managing negative environmental and social impacts. In May 2015, TPTTI formally contacted FTCI to provide technical services generally and to support the development of an environmental and social impact study.

An '*application for environmental authorization'* was submitted to the EPA on March 2, 2016, and two important developments followed:

a) TPTTI, representatives of the EPA, GFC and FTCI did a 'fly-over' reconnaissance trip to the concession area on March 30, 2016.

b) On July 3, 2016, the EPA placed a public notice in the national newspapers, inviting comments from stakeholders on the proposed project by TPTTI as articulated in a project summary attached to the application for the environmental authorization.

There were some challenges with the ESIA process linked to the expiry of the SFEP: however, on August 15, 2017, the GFC approved an extension of the SFEP to August 2018.

The draft ESIA Report was subsequently submitted in July 2018.

1.4 The consultants and their work

On August 15, 2017, FTCI was *formally contracted* to undertake the ESIA study and report, and by September 20, 2017, an updated *application for environmental authorization* with a *revised* project summary was submitted to the EPA.

FTCI in turn recruited the following agency/persons (see CVs for core consultants attached, Annex VIII):

a) EES (represented by a team of three environmental engineers);
b) Eustace Alexander (social scientist);
c) Leon Moore (Wildlife Expert);
d) Phillip Odwin (wildlife technician);
e) FTCI staffs:
    a. Robert Skeete (BSc. Forestry)
    b. Mariea Suegrim (BA, Business management)
    c. Delyon Roberts (Forest technician, Forest surveys)
    d. Rickson Harry (Forest Technician-Inventory)
    e. Bevin Dundas (Botanist, Tree spotter

Godfrey Marshall, consultant/forester, coordinated the work of the team.

Since September 2017, the consulting team undertook thirteen reconnaissance or data collection trips to the concession-eight to the Puruni District and four trips up the right bank Cuyuni River, to Waiamu Landing-for collecting data. Considerable time was spent **analysing various access options to the concessio**n area as well as traversing existing mining roads within and around the concession area. The most recent field exercise was conducted in the northern part of the concession area, in the vicinity of the Biodiversity Reserve, during period September 2021. The trips to the southern part of the concession included a three-week field management level forest inventory. One of the two wildlife censuses was carried out subsequently using the same cut lines (see Annex XII). The other census was carried out in the northern part of the concession area (see Annex XII).

Formal social surveys were conducted at Iteballi, Puruni Landing and at various points along the Kartabu Puruni Road, but very useful information was garnered from informal conversation with many persons.

1.5 Socio-economic activity

Gold mining and the trade in goods, especially fuel, are the primary *economic* activities in the Kartabu Triangle (see Figure 1). There is no logging *currently within* the concession area, only mining. TPTTI estimates that its logging operations will increase the scale of logging within *the Kartabu Triangle* by about 5%.

Figure 1: Typical economic activity-Kartabu-Puruni District

1.6 Challenges

Access to the concession area was the major challenge encountered: the Arimu road network (see Figure 2) which offers the most direct route to the concession area was in a very bad state forcing teams to walk extensive distances or via rentals of ATVs.

Figure 2: Typical Road conditions during the rainy season-Arimu Road

During a field visit in September, the Arimu Road up to Arimu Village was in fact in excellent condition; however, beyond the village, the road is in a very poor state to the extent that it is only being used by ATVs.

Another challenge faced by the consultants was trying to predict the weather patterns: the rainy season leads to degradation of hinterland roads and flooding of low-lying areas. For example, the current rainy season started in late April when the team anticipated that mid- April would have been the peak of the dry season.

1.7 Stakeholder cooperation

Just two (2) mining crews were encamped and doing mining in the *southern p*art of the concession area. There is evidence, based on the numerous 'exploratory pits' encountered, of extensive reconnaissance activity by miners using ATVs. In the northern part of the concession-north of the Arimu Road, there are several land-based mining operations, and many of these are accessed via the Waiamu and Quartzstone Landings respectively on right bank Cuyuni River.

More than 30 persons were formally interviewed (please see Sections 2.3 and 4.0). In the Takutu, Arimu and Puruni Districts, the general stakeholder response to the 'new project' was either *positive* or *disinterest*. Of course, all stakeholders are looking for expanded business opportunities and new road networks, but mining operations appeared to generate more interest than logging. For stakeholders at Iteballi, there were no negative reports, but residents wanted to see TPTTI more involved in community development.

1.8 Report format

Chapter 2 discusses the methodologies used to undertake the ESIA study. Chapter 3 discusses project alternatives. Chapter 4 relates stakeholder analysis and Chapter 5 looks at the regulatory framework for the project. Chapter 6 discusses the nature and scale of the project. Chapters 7 to 10 looks at physical baseline data for the project in terms of: water resources; soils land and geology; air quality; and climate and climate change. Chapter 11 examines baseline data on biological resources, Chapter 12 looks at ecosystem services and Chapter 13 reviews issues related to noise and vibrations. *Landscapes and visual resources* are discussed are discussed in Chapters 14, 15 and 16 looks at *cultural heritage* and *socio-economic and cultural impacts* respectively. Chapter 17 reviews risks and risk assessments while Chapter 18 looks at *cumulative impacts.* An environmental and social management plan is presented in Chapter 19 and an emergency response plan is presented in Chapter 20. Chapter 21 deals with a 'Conceptual Rehabilitation and Closure Plan'.

There has been a major revision of the document with content addressing EPA's comments on the first draft highlighted in red font. Chapters 22 and Annex XXV have been added as a direct consequence of comments on the first draft. Chapter 23 has also been added.

2.0 FIELD WORK METHODOLOGIES USED TO UNDERTAKE THE ESIA STUDY

2.1 Overview

Generally field teams comprised five (5) persons who used a Land Rover or rented bateau type craft and ATVs. The composition of the team depended on the reason for the field exercise. Twelve persons were deployed for the forest inventory exercise.

2.2 First steps

The very first mission of the consultants was detailed discussions with the developer to establish whether they were able to access the concession area and whether they had any assets on the ground the consultants could use.

2.3 Consultations

The consultants benefited immensely from a sector scoping meeting held on January 12, 2018 (Grand coastal Hotel, East Coast Demerara) and a public-sector scoping meeting at Iteballi on January 14, 2018. The sector scoping meeting was particularly useful for the views expressed by representatives of Government Agencies and Environmental NGOs.

In addition, information was garnered from several rounds of consultations, as follows:

a) *Forest Resources Information Unit (FRIU), Guyana Forestry Commission*: this Unit produced three thematic (topographic, soil and vegetation) baseline maps respectively of the concession area at scale 1:50,000 as well as maps of the *Kartabu Triangle* which allowed the team to study access options; the FRIU also produced soil maps and vegetation maps of the area.

b) *GGMC Operatives*: the team visited the field operations department at GGMC HQ, Brickdam to gather information on access options to the concession area via the Arimu Road and the Cuyuni River.

c) *Boat Captains:* consultations were held with boat captains plying the Cuyuni River to garner information on the modalities of travelling up Cuyuni River via regular boat service and/or charters. Consultations were also held with boat captains conducting passenger services along the Upper Puruni River, above Puruni Landing.

d) *General consultations*: the team consulted miners, taxi operators (Iteballi-Puruni L), truck drivers, Brazilians, businessmen and women; in short anyone who may have information on roads in or near the concession area.

2.4 Field trips

Eight field trips were conducted to the south of the concession using Puruni Landing as a base: boats and ATVs were rented as necessary, but most of the reconnaissance and data collection

tasks were accomplished by traversing the concession on foot, frequently covering distances of 15-26km.

Four field trips were made to Waiamu Landing, right bank Cuyuni River. This entailed travelling to Bartica, then travelling from Bartica to Waiamu Landing. These trips on average lasted about five to six days. At Waiamu Landing, an ATV was rented, and this allowed the team to traverse the roads to Quartzstone Landing and other points along the Arimu Road.

2.5 Social surveys

FTCI deployed one of its staff, Ms. Mariea Suegrim to undertake the social surveys from Iteballi to Puruni Landing.

3.0: PROJECT OPTIONS

Some 90% of the concession area has been alienated for mining authorizations and this fact severely limits the ***exclusive*** use of the forest area for protective functions. However, it appears to the company that unless there is a major increase in the price of gold, more than 80% of the area will remain intact due to very low gold recovery prospects versus high operational costs, fuel[4] being the highest cost centre. However, it must be considered that areas with significant gold deposits are *not known,* and that exploratory work goes on all the time.

The expansion of mining activity from mining alluvial soils along waterways to land based operations has led to major forest degradation because the trees must be removed to gain access to the sub-soil (see Figure 3). This activity-removal of forest stands- will go on indefinitely. During social surveys, the miners themselves complained that valuable timber is wasted because miners do not have commercial rights to merchantable timber. (The rights are in fact vested in forest concessionaires who seldom know who the miners are, much less to work with them to retrieve timber; forest concessionaires can only retrieve timber in a timely manner if there is a road network already in place).

Figure 3: Post mining sites devoid of merchantable timber

When miners cut or bulldoze merchantable trees, everyone loses: no timber products for trading, no timber-based taxes or royalties goes to the State, and no employment and ancillary economic linkages develop.

TPTTI recommends logging for the following reasons:

a) Logging would ensure that valuable timber is retrieved from areas that would be mined at some time: the retrieval of the timber would generate employment, taxes for the State and foreign exchange earnings.

[4] There is the cost of fuel itself, and the cost of transporting it to the mining locations.

b) Logging could force miners to put more value on standing trees and consider measures for reducing deforestation.

c) TPTTI will introduce environmental management practices that may encourage the mining community to develop practices of their own.

4.0 STAKEHOLDER ANALYSIS

4.1 Overview

Mining and logging have been the main economic activities in the Kartabu-Triangle since the early 1950s, with their scale increasing significantly after the completion of the UMRP Road in 1976. An observation of persons and vehicles traversing the Iteballi community, indicate that mining and ancillary trading activities are responsible for about 90% of the economic activity. Indeed, mining is directly responsible for the development of Puruni Landing, for a taxi service between Iteballi and Puruni Landing, and a taxi service between Iteballi and points along the Arimu Road.

The GGMC and the Ministry of Public Infrastructure have been maintaining the Kartabu-Puruni Road; and in collaboration with ETK Mining Company, the barge services at Teperu-Iteballi and at Puruni Landing. Loggers, including TPL-which is associated with TPTTI-have been offering substantial support with road maintenance.

4.2 Stakeholder analysis

4.2.1 Stakeholder communities-Kartabo Triangle

Four communities may be recognized within the Kartabo-Triangle: Iteballi, Takutu Community, Tiger Creek Junction and Puruni Landing:

Iteballi, with a current population of about 400 persons**,** developed rather differently from the other communities. Iteballi started out as a log depot, firstly by WWTCL (1950s), followed by GTL, GSM and AMS in the 1970s; AMS subsequently moved its depot to Kartabu Point. Also, the Ministry of Public Works and UMRP developed a barge service between Teperu and Iteballi. The first group of residents initially worked with logging companies, then families, started squatting and setting up businesses to cater for the needs of miners in transit. Eventually, many citizens applied successfully to GLASC for agricultural lands around Iteballi and were successful. The community acquired institutional structure in the form of a CDC. There is a primary school, community centre and health centre there. Residents depend on transiting miners for their livelihoods (see Figure 4) and are desperate to foster the development of their community.

The GFC is the only public agency with facilities at Iteballi, however there is a checkpoint manned jointly by the GPF and the GGMC about 5km west of Iteballi. In the main, Iteballi is one of the *satellite* communities of the Bartica Township –*less than ten minutes away by boat or 30 minutes by road. (Bartica is the main hub for goods, transportation services, banking services and medical attention in the general area).*

Takutu Basin comprises a cluster of mining camps and business places 46-54km, Kartabu-Puruni Road; the general basin lies east of Takutu Mountain and south of the Kartabu-Puruni Road. There have been several gold shouts in the area and the intensity of mining has always been high over

the years. Up to 200[5] persons may occupy the Takutu Basin, depending on the weather and the price of gold. Although the Takutu basin has been mined for more than 30 years, there is no evidence that mining activity is slowing down. Indeed, a gas station is currently being erected there and DIGICEL-which offers cellular phone services- has commenced preparation for erecting a communications mast.

Tiger Creek Junction comprises a cluster of business places and a resident population of about twenty (20) persons that developed after 'shouts' in the Tiger Creek basin. Originally, most of the business places were set up in the Tiger Creek watershed itself, but the businesspersons gradually shifted to the junction of Tiger Creek Road with the Kartabu-Puruni Road where they are exposed to much more business.

Figure 4: Taxis parked at Iteballi Waterfront

Puruni Landing is a masterly model of the creativity of private enterprise. The community developed rapidly after a barge service (see Figure 5) was established there in the late 1970s. It is strictly a mining community, comprising miners and businesses catering for the need of miners. The GGMC is the only public agency with an office at Puruni Landing. (TPTTI will host a GFC forest station on the concession area). Agencies such as the MNR, GPF, the MOPH and the RDC Reg. #7 visit Puruni Landing from time to time. Loggers operating on right bank Puruni River transport logs via Puruni Landing. MNR has indicated that MOPI will build a bridge across the Puruni River, near Puruni Landing.

During social surveys at these points, the overall response is that all stakeholders' welcome development. There are many people seeking economic niches every day, as evidenced, for example, from the diversity of businesses in Puruni Landing. The businessmen trading in food,

[5] Personal communication with residents

fuel and other goods welcome the opportunity to expand their sales. Stakeholders at Takutu and at Iteballi wants to see more community development and employment opportunities. And everyone wants to know where the new road networks are.

Figure 5: Routine economic activity at Puruni Landing

TPTTI's log haul route does not include Puruni Landing, but many residents traverse the Puruni River which forms the southern boundary of the concession. Miners are not currently occupying the concession area on left bank Puruni River, but they have done so in the past.

4.2.2 Other communities

There are several locations within the concession area, on *right bank* Cuyuni River, where a few people live, the two more important locations being *Waiamu Landing* and *Quartzstone Landing*. Miners reported that during the rainy season, the Arimu Road deteriorates to the extent that it cannot be used safely by trucks and therefore the miners set up the two landings on right bank Cuyuni River where regular boat services from Bartica transport goods and personnel. From Waiamu Landing and Quartzstone Landing, there are roads that connect to the Arimu Road network. The number of people at these Landings vary from three to fifteen; the total persons normally depend on the weather (high in the rainy season and low in the dry season). No formal consultations were conducted there.

4.2.3 Other stakeholders

During the sector scoping meeting on January 12, 2018, a large body of stakeholders indicated a strong interest in the project mostly in relation to overarching issues such as climate change and wildlife conservation. Stakeholders at the scoping meeting included representatives of the MNR, DOE, EPA, GFC, GGMC and the Ministry of Communities.

4.3 Stakeholder profiles

Stakeholders at the sector scoping meeting comprised many senior representatives of various public agencies and NGOs with an interest primarily in the natural resources sector. Stakeholders who were at the public-sector scoping meeting were formally interviewed by the consultants. A total of 50 persons were interviewed: 34% at Iteballi, 8% at Takutu Basin, 14% at Tiger Creek Junction and 44% at Puruni Landing. (The consultants believe that Puruni Landing is driving the development of Kartabo Triangle given the amount and diversity of businesses there and therefore their opinions about new developmental projects in the Triangle are important). In conducting surveys, stakeholders were encouraged to complete the questionnaire (see Annex XIV) themselves. Stakeholders formally consulted ranged in age from 20 to 62, with 56% being younger than 40yrs. 26% of the persons interviewed were females and these ranged in ranged in age from 22 to 47 yrs.

4.4 Stakeholder issues

Representatives of public sector agencies were mostly concerned with overarching issues in the natural resources sector such as climate change, forest conservation practices, conservation of fauna and conservation of unique landscapes. There were no specific challenges to the project, however. Based on stakeholders formally interviewed, 78% of those interviewed believed that the project will bring positive benefits to the district, while 8% felt that the project will (also) bring negative benefits to the district. Looking forward, the main issues residents contemplate for the long term are better security & medical attention (30%), community development (14%) and employment opportunities (14%).

4.5 Managing stakeholder issues

TPTTI has prepared stakeholder analysis template (Table 1) and a stakeholder analysis matrix (see Table 2) and to guide its management of stakeholder issues. TPTTI will always be guided by national and/or regional level initiatives which it can support. TPTTI 's forest monitoring officer will be engaging with stakeholders to ensure that concerns or complaints are addressed as quickly as possible.

Table 1: Stakeholder Map: TPTTI's Logging Project

POWER →		
	Disinterested Stakeholders: FMPS, EMPS & APOS available for scrutiny	Very interested stakeholders: their support essential & critical, close attention paid to their requirements)
	• Ministry of Public Infrastructure • Ministry of Public Health • Ministry of Education • Ministry of Public Security • Ministry of Regional Development • GGMC, GGMDA	• Employees • MNR • GFC • DOE and sub-agencies (EPA, PAC, OCC) • Environmental NGOs
	Disinterested parties: their interests and concerns to be monitored closely	Interested stakeholders: support to be nurtured through timely information sharing
	• Business community • Logging community • Timber dealers	• Iteballi Community • Takutu Community • Tiger Creek Community • Puruni Landing • Mining Community
	INTEREST →	

Table 2: Stakeholder Analysis-Toolsie Persaud Timber Traders Inc.

#	Stakeholders	Involvement in Project	Interest in Project	Influence/Power	Impact on Project
1	**Public Agencies (MNR, GFC, EPA)**	**Statutory Regulatory functions; prescribes standards for forest use, environmental management**	**Sustainable forest management Adequate environmental management**	**High power, high influence: determines whether the project goes ahead**	**If project approved, determines the operational framework for the project**
2	Public Agencies -DOE	Compatibility with national forest conservation goals, GSDS; adherence to international treaties & conventions.	Specific forest conservation initiatives, including wildlife management, conservation of biodiversity, ecosystems, and landscapes	High power, high influence determines whether the project goes ahead	Strong interest in forest monitoring mechanisms and environmental management plans.
3	Public Agencies (MPI)	Oversight of Kartabu-Puruni Road	Rural, regional development	High in the long term; the road is critical to the viability of TPTTI's logging project	Approves major road works, overall responsibility for the Kartabu-Puruni Public Road
4	Public Agencies-MPH	Management of critical health issues in the Puruni District (Malaria,	Monitoring of incidences of primarily malaria outbreak	Moderate: TPTTI must address issues of potable water for employees and OSH practices.	Welfare and health of employees of TPTTI.
5	Public Agency-GGMC	Manages mining activity in Mining District # 4.	The development of mineral licences in Region 7	High; the scale of mining is a direct threat to sustainable forest management	Manages miners' forest conservation practices
6	Public Agency -Ministry of Public Security:	Oversight of security issues; occupational safety & health issues	General security and other social issues where large groups of miners and loggers operate	Low, the actions of the agency will have little impact on the project	Support for checkpoints monitoring unlawful activities (for example unlawful wildlife trade)
7	Regional Administration, region #7	Regional development: monitoring development of regional resources. compatibility with regional plans	Economic development of the region;	High power: helps determine which projects are a priority	Determines development priorities in Region 7
8	Logging Community	Shared use of roads infrastructure	Collaboration in environmental management, stakeholder issues	High; as a group, they wield considerable political power.	Generates social and environmental challenges for the project. Their cooperation is essential to help the developer

					mitigate some hazards and environmental impacts associated with road use.
9	Miners, GGMDA	Shared use of the Kartabu-Puruni Road Shared use of concession area & of concession roads.	Full access to their mineral licences	High influence and power due to the high political profile of miners.	They help determine the quality and scale of environmental challenges and the intensity of social impacts.
10	Hunters	Shared use of concession area Shared use of concession roads & the Kartabu-Puruni Road	Full access to the concession	Low, very low political profile	Complicates wildlife management
11	Businesses-Transporters	Associated with miners	Business opportunities	Low	They help determine the quality and scale of environmental challenges and the intensity of social impacts.
12	Businesses-Vendors of goods	Associated with loggers and miners	Business opportunities	Low	They help determine the intensity of indirect and cumulative social impacts.
13	Employees	Execute the project, and the environmental plans	Economic benefits	High	Determines the developer's capability for addressing all impacts arising from the logging project.
14	Regional communities	General support for projects (that yield income for relatives)	Economic benefits	Moderate	Political support
16	Regional & urban timber dealers	Markets for timber, especially for the loggers' associations	Timber	Low	They help determine the intensity of indirect and cumulative social impacts
17	Environmental NGOs	Conservation of biodiversity, the environment	Sustainable forest management Adequate environmental management	High	They ensure a more thorough approach to the assessment of the assets and resources on the concession area.

5.0: POLICY, INSTITUTIONAL AND LEGAL FRAMEWORK

5.1 The natural resources sector

The Natural resources sector has been evolving based on new policy changes and the need to develop and demonstrate the capability for managing international agreements and obligations to which Guyana is a party.

Some of the changes are linked to the emerging petroleum industry: these will be ignored for this report. Many of the changes are linked to the concept of an overarching green economy, which will impact on all sectored strategies and activities. The policy changes have also led to a reorganized institutional framework (see Figure 6), with the Ministry of the Presidency taking direct responsibility for key sectors, such as the Department of Environment. In early 2021, the Department of Environment and the Office of Climate Change were merged 'to ensure a focused approach to tackle climate change'[6]

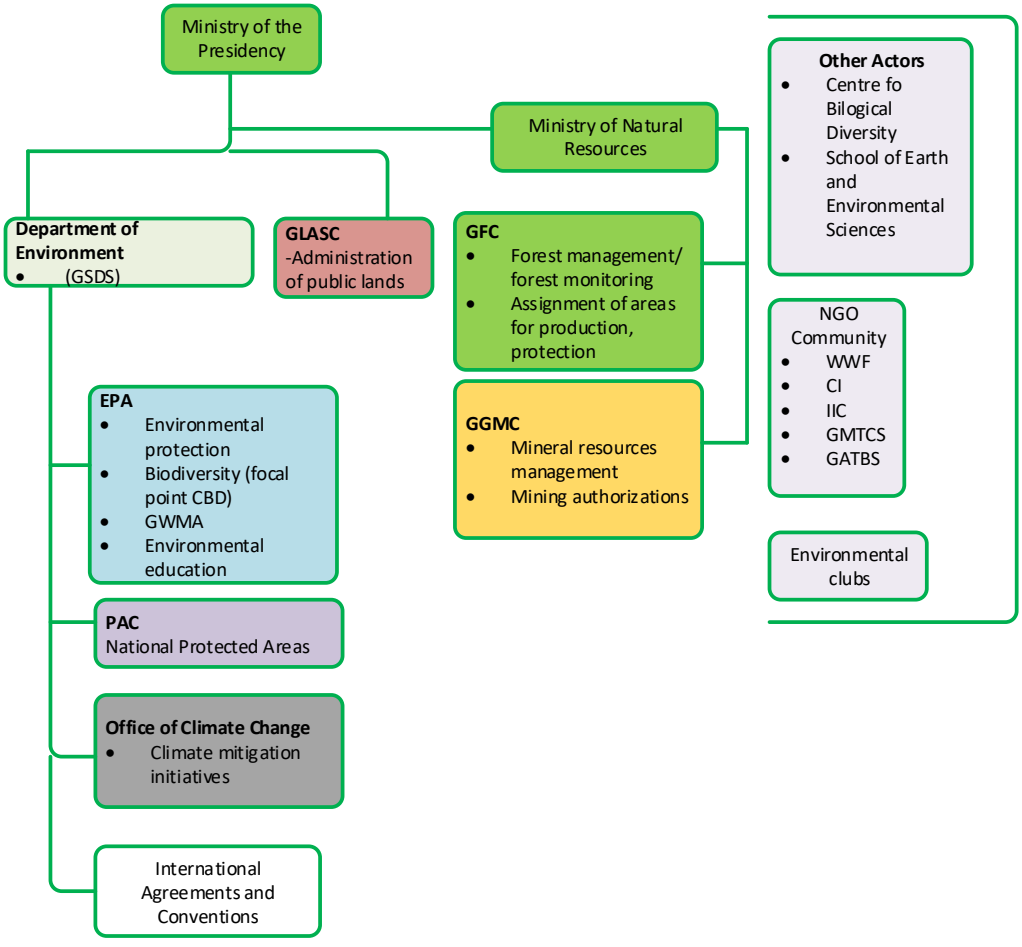


Figure 6: Organization Chart for the Natural Resources Sector[7]

[6] Dept. of Environment, Office of Climate Change to be merged – News Room Guyana

[7] A Department of Environment and Climate Change was created

TPTTI makes sure that its Coordinator keeps abreast of these changes mainly by following websites for the various agencies and information in the print media.

5.2 The Constitution

Article 36 of Guyana's Constitution of 1980 is the basis for the environmental initiatives across the entire natural resources sector by prescribing the following: *'In the interests of the present and future generations, the State will protect and make rational use of its land, mineral and water resources, as well as its fauna and flora, and will take all appropriate measures to conserve and improve the environment'.* In 1996 the Environmental Protection Act and supplementary legislation in 2000 more or less translates the provisions of the Constitution into practical measures.

Guyana is endowed with a considerable diversity of natural resources and this diversity is also reflected in a diversity of policies, legislation, and standards across the sector. Issues of climate change and conservation of biodiversity, for example, are applicable right across the natural resources sector and are addressed as overarching issues before the more specific policy and legislative framework is addressed.

5.3 Overarching frameworks

5.3.1 National Environmental Action Plan (NEAP) 1994

The major objective of the NEAP is to 'identify the major environmental problems (today) and to formulate appropriate policies to address the cause and effect of these problems. A major focal point of the NEAP is sustainably managing the economic potential and conservation of the hinterland forests in the face of massive investments in forest and mineral resources respectively (since the advent of the Economic Recovery Programme which deliberately sought (foreign) investment in these resources to promote economic development.

This ESIA study is consistent with the aims of the NEAP, set out as follows:

a) Assure all people living in the country the fundamental right to an environment adequate for their health and well-being.

b) Achieve a balance between the use and conservation of the nation's resources to meet the needs of economic development and improved standards of living e Institute punitive measures to deter possible violations of environmental norms.

c) Ensure that, where environmental damage occurs, remedial action will be taken with the cost being covered by those responsible for causing the damage.

d) Conserve and use the environment and natural resources of Guyana for the benefit of both present and future generations, based on the principle of the exercise of sovereignty.

e) Maintain ecosystems and ecological processes essential for the functioning of the biosphere to preserve biological diversity and to observe the principle of optimum sustainable yield in the use of renewable natural resources and ecosystems, both on land and the sea;

f) Rehabilitate damaged ecosystems where possible and reverse any degradation of the environment Ensure prior environmental assessments of proposed activities which may significantly affect the environment;

g) Ensure that conservation is treated as an integral part of the planning and implementation of development activities;

h) Promote the pursuance of international co-operation on environmental issues;

i) Raise consciousness of the population on the environmental implications of economic and social activities through comprehensive education and public awareness programmes;

j) Involve the population, including indigenous peoples, women, and youth, in the management of the environment and natural resources.

TPTTI is passionate about the conservation of environmental assets and values and will as a first step ensure its management team is familiar with the contents of the strategy. Specifically, one of the first administrative steps taken by TPTTI was to identify ***a biodiversity reserve***, where no logging will occur.

5.3.2 The National Biodiversity Strategy and Action Plan, 2012-2020

The NBSAP, 2012-2014 was developed by the Ministry of Natural Resources and the EPA in partnership with several international partners and NGOs and aligns Guyana to global and regional initiatives on the conservation of biodiversity.

In the context of this ESIA report, priority areas for action set out in the Plan include:

a) Expansion of protected areas to meet the goal of 17% of terrestrial area in-situ conservation in legal protection by 2020. To ensure that these areas would also be effectively managed, capacity would be built for planning, establishment, and management of protected areas. A National Protected Areas Trust Fund would be established which is expected to contribute significantly to the financial sustainability of these protected areas

b) Reviews of existing legislation and outcomes of Environmental Impact Assessments (EIAs) and their roles in protecting biodiversity.

c) Compilation and consolidation of biodiversity data from local, international, and web-based sources including traditional knowledge and development of a database system for biodiversity which makes data freely available to users.

TPTTI is hoping that any lessons learnt from the management of its biodiversity reserve can support national initiatives.

5.3.3 The National Land Use Plan (GLASC, 2013)

The National Land Use Plan (NLUP) provides 'a strategic framework to guide land development in Guyana' and is distilled from several national policies and strategies that have a direct relevance for land use and land management. The NALP is administered principally by the Guyana Lands & Surveys Commission (see Section 5.6.1.6).

Key operational measures of the NLUP include:

a) effective management of competing land use claims
b) The need for linkages between regional development plans and national development

Mining activities on forest concessions is a major concern of loggers. In the context of this ESIA, the NLUP attempts to *'provide for the co-existence of multiple land uses and provide clear, implementable guidelines for making decisions on multiple land uses and mutually exclusive, competing land uses'.*

TPTTI will recruit a Forest Monitoring Officer whose primary responsibility is to manage competing land use conflicts.

5.3.4 The LCDS, 2013

The Government of Guyana launched a *Low Carbon Development Strategy* on June 8, 2009. The strategy elaborates Guyana's vision for promoting economic development while at the same time combatting climate change. The context for the LCDS lie in two main areas: that Guyana's coastland is vulnerable to flooding from rising sea levels generated by global warming; and that Guyana has abundant resources that could be used to combat climate change; and that with its current development goals, Guyana cannot simply keep all its forest resources intact. The core underlying idea of the strategy is that Guyana is willing to put measures in place to keep its forests intact providing that it can realize alternative options for meeting development needs. As a policy instrument, the LCDS will provide the framework in which all interventions in local forest resources occur.

In November 2009, the Governments of Guyana and of Norway signed an MOU that would witness Norway providing the Government of Guyana with a sum of US$ 250 million provided that the avoided deforestation rate can be kept within prescribed values. After a series of consultations, revised versions of the document were published on May 24, 2010 and March 2013.

TPTTI has been studying the LCDS[8], the GSDS and other policy guidelines in the public domain to inform its business development goals.

[8] The LCDS may have been subsumed by the GSDS

5.3.5 National Development Strategy, 2001-2010

The National Development Strategy, 2001-2010 attempted to identify the entire array of political and socio-economic factors issues that stymy the development of Guyana. The strategy collated basic statistics on each sector and presented detailed and objective policy measures to achieve national economic development.

The core thematic areas addressed in the NDS, 2001-2010 are a macro-economic strategy, the social sectors, the productive sectors, the infrastructure sectors and an investment programme and legislative requirements. Within the thematic area '*the productive sectors'*, Chapter 30 deals with Forest Management

The Ministry of Finance has responsibility for the NDS. Many of the ideas articulated in the NDS has been the basis for other developments such as the NLUP, 2013 and the NEAP, 1994.

5.3.6 Environmental Protection Act, 1996

(Cap. 20:05), The Environmental Protection Act, 11 of 1996 revised by Act 17 of 2005 prescribes the basic institutional and regulatory framework within which all activities that impact on the natural, social, and cultural environments are assessed. The Environmental Protection Agency (EPA) is mandated under the Act to make assessments and to issue environmental permits prescribing conditions for developmental activity. The EPA has established guidelines for conducting and reviewing environmental impact assessments; the guidelines explain provisions of the Act in relation to the environmental impact assessment procedure and outline the level of detail required in the environmental baseline study, impact assessment and the environmental impact statement.

5.3.7 Green State Development Strategy (GSDS), 2016[9]

In April 2017, the Government of Guyana, with support from UNEP, launched the Green State Development Strategy (GSDS) to pilot the development of a green economy. The GSDS is intended to provide the framework for the **transition** of Guyana's economy to a green economy 'by opening new sustainable income and investment opportunities in higher value adding and higher growth sectors'.

The GSDS is intended to, inter alia, balance economic growth with preservation of the country's natural resources for generations to come, provide a roadmap for sustainable development targets, and integrate Guyana's relevant commitments to International Agreements (see Annex VII) including alignment with the UN's Agenda 2030 for Sustainable Development and the

[9] This document has been replaced by the Draft Low Carbon Development Strategy, 2030. *The LCDS 2030 will be aimed at creating a new low carbon economy in Guyana by establishing incentives that value the world's ecosystem services and promotes these as an essential component of a new model of global development. According to Guyana's President Dr. Irfaan Ali, the draft LCDS 2030 attempts to answer two questions: how can Guyana harness the opportunities of low carbon development to prosper at home?, and how can Guyana lead the way to globally relevant solutions to the biggest challenges of our time, including energy security and climate change?*

corresponding **SDGs.** One of the seven pillars identified for the creation of a green state is the sustainable management of natural resources and the expansion of environmental services.

5.4 Environmental Protection Regulations

In 2000, under the EPA Act, regulations on Water Quality, Air Quality and Noise Management (among others) were established. These pollution management regulations were developed to prescribe standards for developmental projects during construction and operation.

5.4.1 Environmental Protection (Water Quality) Regulations 2000

These regulations require, among other matters the registration and environmental authorization by any person whose construction, installation, operation, modification, or extension of any facility cause the discharge of effluents. Guidelines on the discharge of effluents and disposal of waste are detailed in these regulations. A Standard for water quality has been developed by the Guyana National Bureau of Standards[10]. The provisions of these regulations have been considered during baseline studies conducted by TPTTI.

TPTTI will take measures to monitor water quality at the five *permanent monitoring stations* it will operate.

5.4.2 Environmental Protection (Air Quality) Regulations 2000.

The requirements for registration and environmental authorization by persons with facilities that emit air pollutants from any process into the atmosphere are outlined in these regulations. Elements related to parameter limits on air contaminants and emission samplings are also stated in the regulations. *The EPA and the GNBS are currently developing air quality standards.* TPTTI will use RIL practices which emphasize planned interventions in the forest environment and will use fully functional mechanical equipment to manage air quality in the forest environment.

5.4.3 Environmental Protection (Noise Management) Regulations 2000.

The EPA is responsible for the establishment of standards for permissible noise levels in industry, construction, and other areas. The categories for which permissible noise levels are to be fixed by the EPA were identified as follows: Residential, Institutional, Educational, Industrial, Commercial, Construction, Transportation and Recreational

The GNBS, in collaboration with the EPA, has published interim guidelines as follows:

TPTTI will ensure that all its machines are maintained properly to keep noise levels within the manufacturers' standards and the local standards (Table 2). Normally, no work will take place after 18:00 hrs. However at least one generator will be used at night at the base camp on the concession.

[10] See GNBS GYS 262: 2004: Specification for drinking water

Table 3: Noise Guidelines (Source GNBS: GYS263: 2010)

Categories	Daytime (06:00h-18:00h) Limits in dB (A)	Night-time (18:00h-06:00h Limits in dB (A)
Residential	75	60
Institutional	75	60
Educational	75	60
Industrial	100	80
Commercial	80	65
Construction	90	75
Transportation	100	80
Recreational	100	70

5.4.4 Environmental Protection (Authorization) Regulations 2000, 2005

These regulations cover the legal basis and modalities for the application and receipt of an Environmental Authorization, the management of the conditions under which the Authorization is granted, and the conditions under which the Authorization may be renewed.

This ESIA Report is a direct consequence of Section 3 'Environmental Impact assessment' of the Environmental Protection (Authorization) Regulations 2000, 2005.

5.4.5 Environmental Protection (Hazardous Waste Management) Regulations, 2005

These regulations cover the management of substances that may modify the environment in a negative way. For example, in logging operations there may be spillage of oil, or accelerated erosion leading to pollution of waterways.

TPTTI will take due care to avoid any form of potential contaminant within the forest environment. Specifically, only petroleum products (fuel, oil, grease) and OTC drugs for the combat of mosquitoes at the base camp and at forward camps.

5.5 Forestry Policy & Forestry Legislation

5.5.1 Forest Policy

5.5.1.1 The National Forest Policy Statement (NFPS) (2018), National Forest Plan (NFP) 2018

A new National Forest Policy Statement 2018 has been published after extensive country wide consultations. The overall objective of the NFPS (and the NFP) "is the conservation, protection and utilization of the State forests by ensuring its social, economic and environmental attributes and benefits are sustained and enhanced for the benefits of current and future generations of Guyanese, whilst fulfilling Guyana's commitments under international agreements and conventions". The new policy responds to the recent and emerging changes in Guyana's economic, social, and political environment. While former forest policies emphasized timber products, the new policy ensures consideration of all tangible and intangible values of forest. For example, the conservation of biodiversity, ecotourism and wildlife management have been given due consideration in the new policy. In addition, the need for more stakeholder inputs into the implementation of the NFPS has been recognized and assured.

TPTTI's Forest Monitoring Officer will keep examining opportunities where the company can support national level initiatives in support of the NFPS.

The *National Forest Plan 2018* which sets out the way core policy statements will be implemented was developed at the same time as the NFPS. TPTTI duly participates in consultations designed to develop forest policies.

5.5.1.2 Forestry Management Plan Guidelines, 1999

The Forestry Management Plan Guidelines, 1999 elaborates the basis for strategic and operational planning. Guidelines for annual plans of operational (APO) have also been published. TPTTI has used the guidelines to develop a FMP and an APO for the SFEP.

5.5.1.3 Code of Practice for Forest Operations 3rd Ed, 2013 for Timber Sales Agreements and Woodcutting License Holders[11].

The **original** Code of Practice for Timber Harvesting, 2nd Ed. based on FAO's Model Code of Forest Harvesting Practice, 1996 provides guidance on applicable standards for local forest conditions. It is designed essentially to balance commercial considerations with the conservation of the natural environment and issues of occupational safety and health.

Over the years the Code has been reviewed and developed to target specific operators at the various concession levels. TPTTI has copies of the Code of Practice for Forest Operations 3rd Ed, 2013 available for consultation by its field operatives.

[11] This document has been subsumed by the Code of Practice for Forest Operations,2018 and Guidelines for State Forest Authorizations (Large Concessions), 2018.

5.5.1.4 Environmental Impact Assessment Guidelines: Volume 5 – Forestry, 2000

These guidelines produced by the EPA and the EAB and in consultation with the GFC, provide a framework for conducting and reviewing EIAs for forestry projects in Guyana. TPTTI endeavours to keep track of these requirements and all changes made from time to time.

5.5.2 Forestry Legislation

5.5.2.1 Forests Act 2009

This Forests Act 2009 authorizes the GFC to, among other things:

(a) Grant forest concession agreements to individuals and companies to harvest timber or non-timber products or to undertake research or to carry out approved community-based activities or to generate approved forest services (including ecotourism) from defined tracts of State forests;

(b) Regulate the conveyance of timber along public roads, and timber exports;

(c) Regulate the rights and privileges of Amerindians in relation to State Forests

The Act also outlines the ownership of forest produce, offences and legal proceeding under the Act, and penalties that may arise as a result.

TPTTI contributes to discussions on forest policy and forest legislation as often as the opportunities to do so present themselves.

5.5.2.2 Guyana Forestry Commission Act, 2007

The Guyana Forestry Commission Act No. 20 of 2007 provides specifically for the establishment, organization, mandate and functions and responsibilities of the Guyana Forestry Commission.

The object of the Commission is to encourage the development and growth of forestry in Guyana on a sustainable basis.

The primary functions of the Commission include:

a) Develop, advise the Minister, and carry out Forestry Policy

b) Research, collate, analyse, and prepare and disseminate data, statistics, and other information about forests and all aspects of forestry and forestry related jobs; and
c) To administer the Forests Act, 2009

5.5.3 Other Relevant Laws

5.5.3.1 The Protected Areas Act of 2011

The Protected Areas Act of 2011 provides for (a) the protection and conservation of Guyana's natural heritage and natural capital, (b) the creation, management and financing of a national system of protected areas; (c) the maintenance of ecosystem services of national and global importance including climate regulation; (d) the establishment of a protected areas commission;

(e) the establishment and management of a protected areas trust fund; (f) the fulfilment of Guyana's international environmental responsibilities; (g) participation in protected areas and conservation; and (h) related purposes.

The Act aims to provide for the conservation of biological diversity, natural landscapes, seascapes and wetlands and to safeguard ecosystem services. TPTTI's conservation practices will have to be aligned with the objectives of this Act.

5.5.3.2 The Environmental Protection (Wildlife Management and Conservation) Regulations 2009

The Environmental Protection (Wildlife Management and Conservation) Regulations 2009 provides generally for the conservation of wildlife. More importantly, the Regulations define the term 'wildlife' as including any *'non-cultivated or non-domestic organism in the kingdoms of animals and plants, Protista, prokaryota and fungi or any parts or derivatives thereof*'.

The Regulations also defines the following:

a. *biodiversity*- the variability among living things including inter alia terrestrial, marine and other aquatic systems and ecological complexes of which they are a part, and including diversity within species, between species and of ecosystems.

b. *endangered species*- species facing extremely high risk of extinction in the wild
c. *hun*t - includes pursue, worry, stalk, mutilate, call, follow, kill or capture any animal or attempt to do so.

TPTTI will not allow its employees and contractors to hunt or fish on the concession area.

5.5.3.3 The Wildlife Conservation and Management Act 2016

This 'ACT' provides for the protection, conservation, management, sustainable use, and internal and external trade of Guyana's wildlife.

TPTTI will do its utmost to conserve Guyana's wildlife; the company's employees and contractors will not be allowed to hunt or fish on the concession area.

5.6 Regulatory Agencies/Departments

5.6.1 Ministry of the Presidency

5.6.1.1 Office of Climate Change (OCC)[12]

The Office of Climate Change has direct responsibility for managing consultations and other liaison responsibilities for the LCDS. The OCC manages GOG's engagements with the Forest Carbon Partnership Facility (FCPF), the Forestry Investment Programme, and UN-REDD.

TPTTI's forest monitoring officer will scan the OCC's website regularly.

[12] The Office of Climate Change and the Department of Environment were merged in 2020

5.6.1.2 Department for the Environment (DOE)

The Department for The Environment has oversight and policy coordination functions over the Environmental Protection Agency, the Protected Areas Commission and the Wildlife Commission (see Figure 1). The DOE is the lead agency for the GSDS and International Agreements and Conventions.

5.6.1.3 Environmental Protection Agency

The Environmental Protection Act provides for the establishment of the (Guyana) Environmental Protection Agency (EPA) as the principal authority for environmental management in Guyana. In Sec. 4 (1) (a), the EPA is given the mandate to "take such steps as are necessary for the effective management of the natural environment so as to ensure conservation, protection and sustainable use of its natural resources" In addition the Agency is given the overall responsibility to "coordinate the environmental activities of all persons, organizations and agencies" [Sec. 4(1) (c)]; and is mandated "to play a coordinating role in the preparation and implementation of cross sectored programmes of environmental contents" [Sec. 4(1) (1)]. The mandate to serve as the highest authority for granting Environmental Authorizations, where they are required, is supported by Sec. 5 which states that "any person or authority under any other written law, vested with power in relation to the environment shall defer to the authority of the Agency…."

5.6.1.4 The Protected Areas Commission

This Commission enforces the Protected Areas Act, 2011.

5.6.1.5 The Guyana Wildlife Conservation and Management Commission

This agency inter alia is the designated CITES management authority for Guyana. TPTTI looks forward to liaising with this Commission to contribute to the management of fauna generally, and its biodiversity reserve.

5.6.1.6 Guyana Lands and Surveys Commission

The core function of the Guyana Lands and Surveys Commission is to survey and map the land and water resources of Guyana, to be custodians of all public lands, to administer these effectively in the national interest, and to provide land-based information to a broad range of public and private sector entities and interests.

The GFC consults with the Guyana Lands and Surveys Commission before issuing forest concession agreements.

5.6.2 Ministry of Natural Resources (MNR)

The Ministry manages the overarching initiatives to coordinate policy development for the following agencies in the natural resources sector: the GFC, the GGMC and the GGB. The MNR is

expected to oversee the multiple use approach to natural resources generally and the resolution of emerging conflicts.

5.6.2.1 Guyana Forestry Commission

Of the 214,970 km2 of which nearly seventy-five percent is covered with natural vegetation, approximately four fifths is classified as State Forests under the jurisdiction of the GFC. The GFC is responsible for advising the subject Minister on issues relating to forest policy, forestry laws and regulations and forestry practices. The Commission is also responsible for the administration and management of all State forests. The work of the Commission is guided by a Draft National Forest Plan that has been developed to implement the forest policy. The Commission develops and monitors standards for forest sector operations, develops and implements forest protection and conservation strategies, oversees forest research, and provides support and guidance for forest education and training. The functions and responsibilities of the GFC are assigned under the Guyana Forestry Commission Act. The GFC is the institution responsible for prescribing conditions for the use of forest resources and implementing forest monitoring programmes.

FAO, UNDP, ITTO and ACTO are international agencies providing technical assistance to the forestry sector.

TPTTI keeps track of all developments at the GFC to inform its own operations.

5.6.2.2 Guyana Geology & Mines Commission

The Guyana Geology and Mines Commission (GGMC) was created in 1979 from the Department of Geological Surveys and Mines which itself was the successor to the Geological Survey of British Guiana.

Objectives of the GGMC, include:

Reduce the occurrences of identified pollution violation levels associated with mines and production processing facilities from year end 2014 levels by *identifying and correcting existing environmental threats* and by working with and using the financial and other resources of the property owners, the government and GGMC.

The functions of the Commission include:

a) Promotion of mineral development; b) Mineral exploration; research in exploration, mining, and utilization of minerals and mineral products; and c) Enforcement of the conditions of Mining Licenses, Mining Permits, Mining Concessions, Prospecting Licenses (for Large Scale Operations), Prospecting Permits (for Medium and Small-Scale operations) and Quarry Licenses.

GGMC, in association with the GMSTCI and partners (WWF and CI, see Section 5.8) are engaged in several initiatives to manage mining practices. These are expected to bear fruit countrywide in another two to five years. TPTTI will support 'greener mining'[13] piloted by the GGMC and the GMSTCI.

[13] http://dpi.gov.gy/small-and-artisanal-miners-are-learning-how-to-mine-greener/

5.7 Treaties & Conventions

Guyana has signed on to several international and regional treaties and conventions (see Table 3) to ensure that forest-based developments in Guyana are consistent with global and regional approaches to such development.

5.8 Environmental NGOs & International Agencies

WWF-Guyana and Conservation International (Guyana) Inc. are two very proactive environmental NGOs[14] in the natural resources sector. For example, since 2013, a grant agreement was signed between WWF and GGMC which provides financial and technical support for national capacity building through education and awareness activities, baseline studies and training of stakeholders within the gold mining sector. Also, CI in partnership with the GGDMA and GGMC, is implementing a programme to advance green development of the mining sector by enhancing efficiency, reducing pressure on the environment, and improving livelihoods; the programme will focus on (i) promotion of low-impact prospecting and efficient technologies and practices,

(ii) integrated natural resource management planning for mining areas, and

(iii) phasing out mercury use by engaging businesses and other actors within the gold mining supply chain.

[14] https://www.nre.gov.gy/environmental-management-in-the-mining-sector-wwf/

Table 4: Conventions/International Agreements to which Guyana is a party

No.	Conventions	Ratification/Accession
	A. Biodiversity	
1	+United Nations Convention on Biological Diversity +Cartagena Protocol on Biosafety +Nagoya protocol on Access to genetic Resources and the fair and equitable sharing of benefits arising from their utilization.	+Signatory in 1992, ratified in 1994 +Acceded to in 2008 +Acceded to in 2014
2	+Convention on International Trade in endangered species of wild fauna and flora (1973)	+Ratified in 1977
3	+Cartagena Convention or the Protection and development of the Marine environment of the wider Caribbean region (1983). +Specially protected Areas and Wildlife (SPAW) Protocol (1990)	+Ratified in 2010 +Ratified in 2010
4	+International plant protection convention (1952)	+Acceded to 1970
5	+Convention on the Protection of the World Cultural and the Natural.	+Acceded to in 1977
6	+Ramsar Convention on Wetlands (1971)	+Party
7	+Convention on the Protection of the World Cultural and Natural Heritage (1972)	+Signatory 1977
8	+International Tropical Timber Agreement 1994, 2006	+Signatory 2006
	B. Environmental conventions to which Guyana is a party	
	+United Nations Framework Convention on Climate Change +Montreal Protocol +Kyoto Protocol +Paris Agreement	+Signatory in 1992, ratified in 1994 +Acceded to in 1993 +Acceded to in 2003 +Acceded to in 2016
10	+Vienna Convention on the protection of the Ozone Layer	Acceded to in 1993
11	+United Nations Convention to Combat Desertification	+Signatory in 1996, ratified in 1997
12	+International Convention for the Prevention of pollution (MARPOL 73/78)	+Acceded to 1997
13	+Basel Convention on the Control of Trans-boundary Movement of Hazardous Waste and their Disposal	+Acceded to in 2001
14	+Stockholm Convention on Persistent Organic Pollutants	+Acceded to in 2007
15	+Rotterdam Convention on Prior Informed Consent for Certain Chemicals and pesticides in International Trade	+Accede to in 2007
	+International Plant protection Convention (IPPC), 1951	+Adherence 1970
16	+Minamata Convention on Mercury	+Signatory in 2013
	C. Other relevant items	
17	+Caribbean Planning for the Adaptation to Climate Change CPACC (and its sequel Mainstreaming Adaptation for Climate Change in the Caribbean (ACCC)	+Signatory 1997
18	+Caribbean Regional Environmental Programme (CREP)	+Signatory 2001
19	+Caribbean Environmental Programme and its Specially Protected Areas and Wildlife (SPAW Protocol)	+Signatory 1990
20	+Treaty for Amazonian Cooperation	+Signatory 1978
21	+Guiana Shield Initiative (and Guiana Shield Facility)	+Signatory 1993

6.0 THE LOGGING PROJECT

6.1 Introduction-Corporate Profile

The TIN Certificate for the company is shown in Annex III. TPTTI is *associated* with TPL, which itself conducts a logging operation within TSA 4/85, situate southern side Kartabu-Puruni Road, between left bank Puruni River and right bank Puriari River, left bank Mazaruni River. (TPL has been in logging and sawmilling since the late 1950s) This business association affords TPTTI full knowledge of the forest management framework- the suite of forest management standards and practices-prescribed by the GFC.

TPTTI has a board of directors with the capability for managing the suite of variables that characterize timber harvesting and timber processing operations. The Directors of TPTTI **and** core managerial staffs for TPTTI are shown in Table 4, while the organization chart for the company is shown in Figure 8. Table 5 sets out the list of staffs to be recruited and trained for work related to the TSA; these will be recruited over a twelve-month period.

Table 5: Directors and senior operatives of TPTTI

#	Name	Designation	Core responsibilities	Logging experience (yrs.)
1	PERSAUD, Toolsie	Chairman	Policy, Financial matters Partnerships, Budgets	60
2	PERSAUD, Avinash	Director/Chief Executive Officer	Strategic policy, financial, marketing and overarching operational decisions, business goals	30
3	PERSAUD, Vinode	Director	Strategic policy, financial and marketing decisions	30
4	PERSAUD, Rajesh	Director	Strategic policy, financial and marketing decisions	30
5	PERSAUD, Muneshwar	Forest Operations Coordinator	Planning of field operations; ensuring compliance with legal framework	20
6	MOHAMED, Shaheed	Production Supervisor	Direct responsibility for day-to-day field operations	25
7	SMITH, Dornellas	Log pond clerk	Field & production records	18

The senior managerial staff (see Table 1) have all acquired extensive logging experience working in similar positions at Toolsie Persaud Limited (TPL) - a company that has been engaged in logging in Guyana for more than *60 years.* The management team and directors will be supported with some sixty (60) field operatives when timber harvesting operations commence.

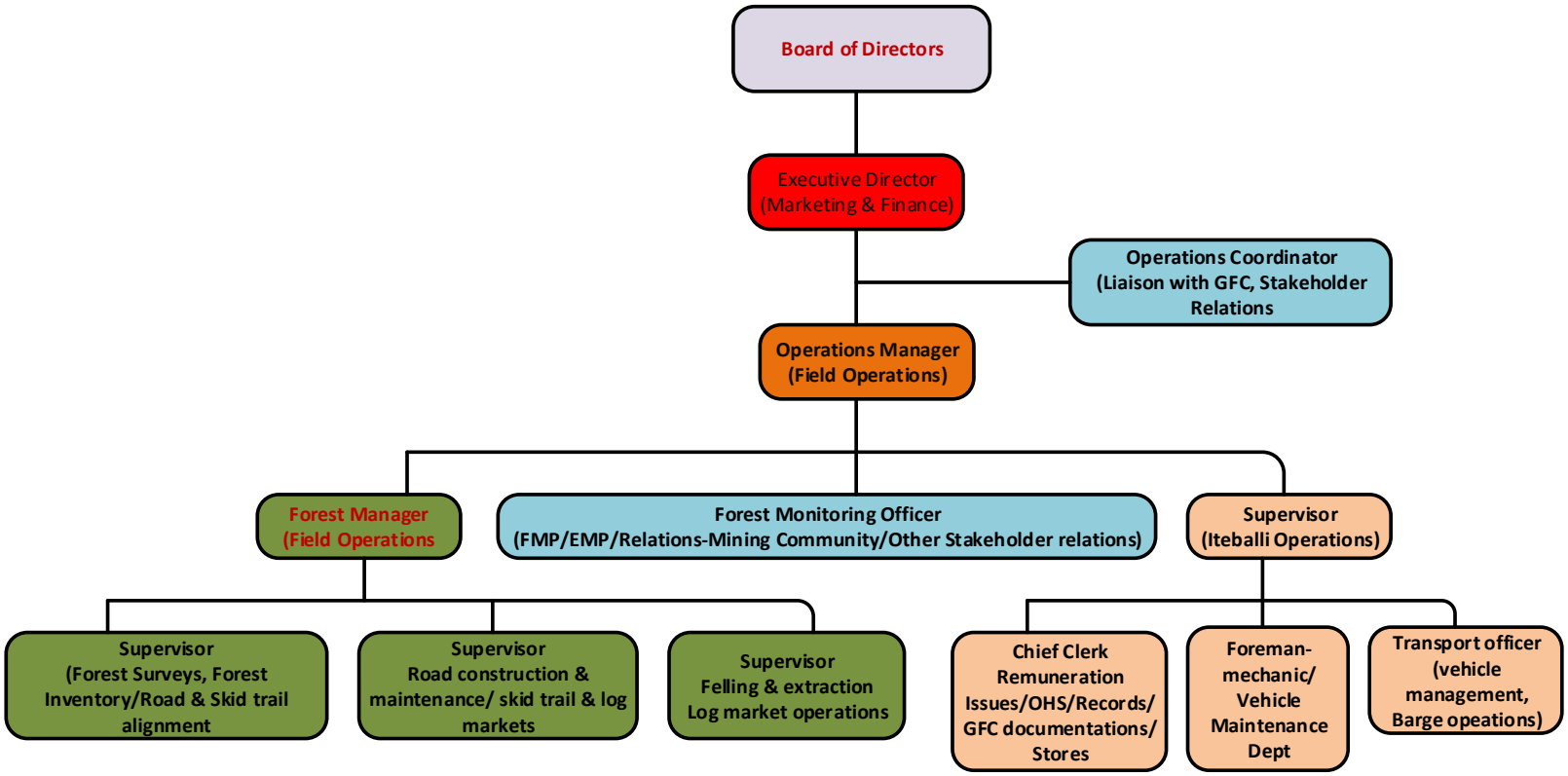


Figure 7: Organizational Chart: TPTTI

Table 6: Field Operatives to be recruited on receipt of the forest authorization

No.	Designation	No of Persons	Base station	
			Ekabago?	Iteballi
1	Forester	1	+	
2	Supervisor	2	+	+
3	Community Liaison Officer	1		+
4	Truck Drivers (Logging trucks)	2	+	
5	Drivers-Utility trucks	2	+	
5	Chainsaw Operators	2	+	
6	Skidder Operators	2	+	
7	Bulldozer Operator	1	+	
8	Log Loader Operator	2	+	+
9	Mechanics	4	+	
10	Logging Clerks	5	+	+
11	Crane Operator	1		+
12	Field Technicians	20	+	
13	Camp Attendant	1	+	
14	Choker-men	14	+	+
TOTAL		60		

TPTTI has developed a human resources policy (see Annex XX) which sets out the main elements of its human resources management practices.

6.2 Business Objectives

The business objectives of TPTTI include the following:

a) To conduct sustainable logging operations fully compliant with local standards;

b) To promote forest conservation generally, including supporting initiatives targeting the conservation of biodiversity, fauna and the protection of unique landscapes;

c) To support initiatives linked to mitigation of climate change generally;

d) To support the enhancement of a green economy in Guyana, including initiatives emerging under the GSDS; and

e) To promote the development of the forestry sector.

The primary business of TPTTI is therefore logging and it is for this reason that TPTTI acquired SFEP 2/2013 over an area of 66,873 hectares of forest resources under the provisions of the Forests Act 2009.

The SFEP affords TPTTI the opportunity to gather baseline data on the concession area, evaluate the variables impacting on timber production from the area and determine whether logging the area would be feasible.

TPTTI will invest some US$1.5 million on exploratory operations by October 2018. Initial studies have given the company much optimism and the company will spend about US$2 million to conduct several operations including management level

inventories, identifying and demarcating a biodiversity reserve, organizing the entire concession area into compartments and blocks, conduct forest 100% forest inventories initially for blocks in Compartment Ekabago, and conduct field surveys leading to the alignment of primary roads within the concession area. Meanwhile, TPTTI will also inject some U$600,000 per year into the *economy* of the Kartabu Triangle, including *supporting* road maintenance works along the Iteballi-Puruni Road and small projects at Iteballi.

6.3. Current asset base

TPTTI has *at hand* many critical production assets (see Table 7) to conduct a state-of-the-art logging operation based on RIL principles and practices. Once the desired TSA is issued, and TPTTI collects additional data on forest stocking, terrain conditions and the spatial impact of mining operations, the purchase of additional heavy-duty assets will be considered

Table 7: List of Machinery Assets at hand

#	Machine	No.	Application
1	Tracked Skidders	2	Skidding Operations
2	Logging Trucks	2	Hauling logs from the TSA to Iteballi
3	Utility vehicle	1	Various tasks
4	Log Loaders	2	Loading/Off -loading trucks Concession area & Iteballi
5	Crane	1	Barge loading operations at Iteballi
6	Bulldozer	1	Earthworks linked to roads, skid trails and log markets
TOTAL PIECES		9	

6.4 The Forest Concession

SFEP 2/2013 is situate generally between the right bank Cuyuni River in the north and the Puruni River to the south; and between the Mara-Mara River to the east and the Ekabago River to the west (see description in Annex VI).

The SFEP shares common boundaries with three forest concessions on the eastern side and with one SFEP on the western side. In extracting logs, TPTTI will obtain a timber path for an existing *(mining)* road designated Tiger Creek Road which is situate within TSA 1/90 held by WTTCL and which will be used by TPTTI to access the new forest concession.

The area of the forest concession is covered with mixed forests on undulating or hilly terrain save for those gaps that have been cleared for mining activity.

Data based on GFC's vegetation maps indicate that Mixed forests on undulating to hilly terrain is the dominant forest type within the concession area.

The forest resources in the area are typical of that within the Kartabu Triangle, which Ter Steege (2000) described as Central Guyana Wet Forests: forests characterized by a high abundance of commercial species including Wamara (*Swartzia leiocalycina)*, Greenheart (*Chlorocardium rodiei*), Mora *(Mora excelsa)*, Morabukea (*Mora gonggrijpii*), Haiariballi *(Alexa imperatricis)* and Aromata *(Clathrotropis spp).*

Ground surveys reveal patches of degraded forests on ex-mining sites as well as several pits where exploratory sampling was carried out by miners.

The northern part of the forest concession-areas north of the ARIMU Road, has been impacted to a much greater extent by mining activity, probably due not only to the ARIMU Road, but also its proximity to the Cuyuni River.

The forest resources are described in more detail in Section 11.0

6.5 The project

6.5.1 Introduction

The intended project involves logging on the concession area, transporting the logs from the concession area via the Kartabu-Puruni Road to Iteballi, left bank Mazaruni River; from Iteballi, the logs will be transported by barge to points of processing or sale on the coastal belt.

Forest production will be based on RIL principles and other practices that have been used successfully by *TPL*.

The provisional planning parameters for the concession area as follows:

I.	Total concession area:	66,873.36	(A)
II.	Total area of merchantable forest:	66,873.36	(B)
III.	Biodiversity Reserve (4.5% of (B)):	3,009.30	(C)
IV.	Available merchantable forest (+ buffer zones) (B-C):	63,864.06	(D)
V.	Net production forest (-inoperable areas, est. 20%): (D*0.8)	51,091.25	(E)
VI.	Felling cycle:	60 years	(F)
VII.	Allowable yield for a 60-year cycle:	20m^3	(G)
VIII.	Total production: (E*G (m^3)):	1,021,825m^3	(H)
IX.	Annual Allowable Cut (60-year cycle): (H/F)	17,031.42m^3	(I)
X.	Annual Allowable Area: (E/F):	851.52ha (~900ha blocks)	(J)

TPTTI's projections are that it would harvest an area of 900 ha per annum for a projected yield of 17,031.42m^3 covering a minimum of fifteen species.

The operational phases involved in this project are *summarized* in Figure 8, Table 8.

6.5.2 Standard Operational Procedures

6.5.2.1 Legal framework

TPTTI will abide with the suite of forest management prescriptions developed by the GFC. Specifically, TPTTI will prepare a forest management plan setting out the nature and scope of all activities to be carried out on the forest concession. In addition, the FMP will be translated into Annual Operational Plans. Activities will only proceed when the FMP and APO are approved by the GFC.

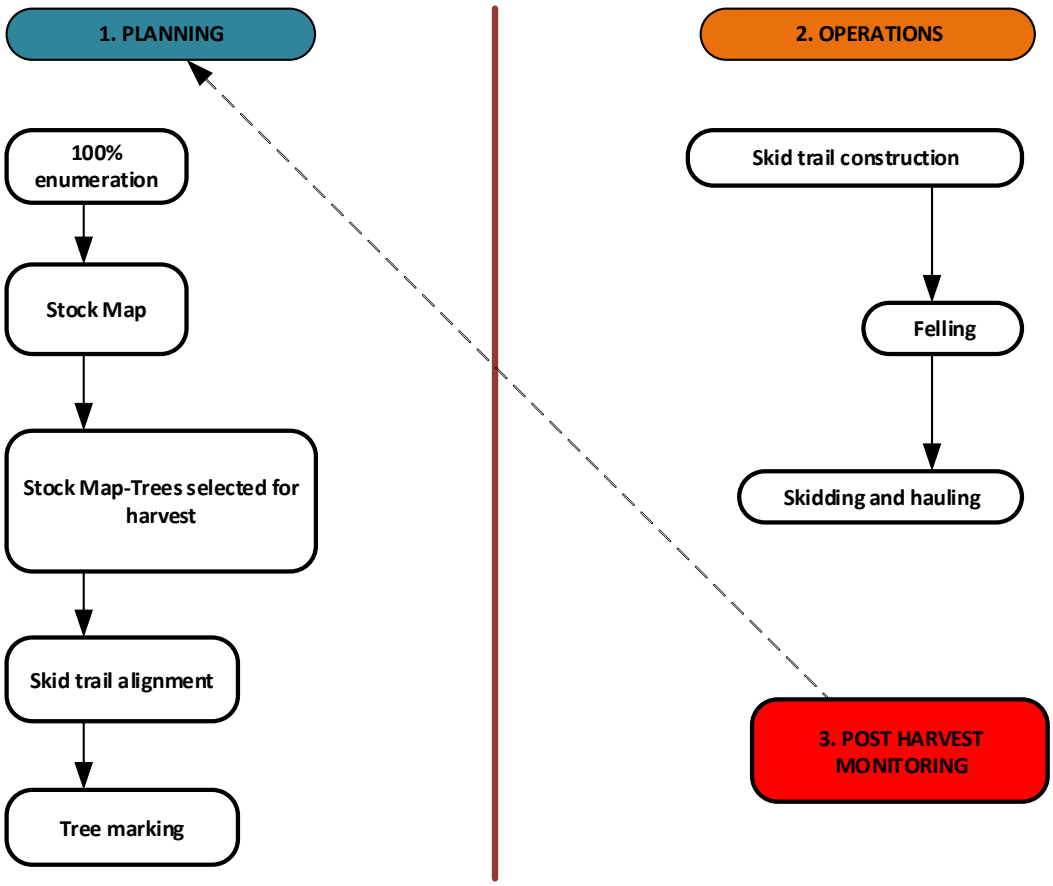


Figure 8: Summary of Operations

Generally, the nature of all operations will be in line with GFC's COP and with prescriptions set out in the environmental management plan.

TPTTI will also abide by other statutory legislation including those concerned with general employee welfare and remuneration packages and issues of occupational safety and health.

6.5.2.2 Boundary Demarcation

The perimeter of the forest concession has a length of about 198km: waterways comprise 168.5km (85%) while cut lines represent a total of 29.5km (15%) representing nine (9) segments with lengths varying between 0.7km and 9.9km. The lines will be demarcated on the ground on receipt of the TSA.

A total of 22 signposts will be positioned along the perimeter of the concession area. The signboard will simply state the name of the company and the designation of the concession.

Table 8: Summary of key phases of TPTTI's logging project

#	OBJECTIVE	ACTIVITIES	STATUS AT MAY 31, 2018
1.0	**PREPARATORY TASKS**		
1.1	Establish concession boundaries: Determine/demarcate borders	Line cutting activities, posting of signboards	90% of the boundary is formed by waterways. Line cutting awaiting issue of TSA
1.2	Determine existing land use	Traverse of the forest area on foot/boat/ATV	90% of area traversed to date by Company & Consultants
1.3	Determine Productive vs. non-productive forests	Map based activity + recce information.	Completed, but the expansion of mining activities require that this exercise be repeated on receipt of the TSA
1.4	Identify primary biodiversity reserve	Traverse of area identified, posting of sign boards, line cutting activities.	Completed
1.5	Identify compartment boundaries	Surveying/Line cutting activities	Completed
1.6	Identify primary road layout	Map based or if an existing road, an extended traverse on foot or ATV along the entire length of the road	40% complete- southern part of the concession prioritized.
1.7	Identify possible sites for forward camps	Map based, or if an existing road, an extended traverse on foot	Area for primary base camp for 10yr period identified
2.0	**PLANNING OPERATIONS**		
2.1	Alignment of Primary Road	Surveying works; traverse of road alignment, identification of points for bridges, culverts, mining pits, earth works	Completed for Compartment Ekabago
2.2	Selection of area for setting up base camp, forward camps	Surveying works, site assessment (soil, vegetation, and drainage conditions, etc.).	Completed
2.3	Secondary road alignment	Surveying works (including grades and angle of curvature for road alignment, identification of points for bridges, culverts, mining pits, earth works	30% completed for Compartment Ekabago
2.4	Setting up of temporary camps for road crews, inventory crews	Minimal clearing for tarpaulin covered camps, vehicle park, etc.	Ongoing in Compartment Ekabago
2.5	Block Demarcation	Surveying, line cutting	15% completed; Compartment Ekabago prioritized

#	OBJECTIVE	ACTIVITIES	STATUS AT MAY 31, 2018
2.6	Forest Inventory	Forest enumeration	In progress, southern part of concession prioritized
2.7	Stock map preparation	Desk task	Completed for 15 blocks, Compartment Ekabago
2.8	Selection of merchantable stock to be harvested	Desk task	Completed for 15 blocks, Compartment Ekabago
2.9	Skid trail alignment	Surveying, line cutting, cutting of trees, and takubas along skid trails	Not started
2.10	Log market location	Site assessment and site surveys	Not started
3.0	**FIELD OPERATIONS-FOREST CONCESSION**		
3.1	Deployment of machinery	Transporting all equipment to the project site	Not started
3.2	Primary, secondary road construction.	Tree removal, earthworks	Not started
3.3	Log market construction.	Tree removal, earthworks	Not started
3.4	Skid trail construction	Tree removal, earthworks	Not started
3.5	Felling & bucking of trees.	Mechanical felling, bucking of trees	Not started
3.6	Skidding logs to log markets.	Dragging/hauling logs along skid trails	Not started
3.7	Log market operations (sorting and grading of logs).	Sorting, stacking logs, loading logs onto lorries	Not started
3.8	Hauling logs	Transporting 35-40m^3 logs via heavy duty trucks	Not started
4.0	**FIELD OPERATIONS-THE KARTABO-PURUNI ROAD**		
4.1	Logs transiting the Kartabu-Puruni Road	Transporting 35-40m^3 logs via heavy duty trucks	Not started
4.2	Managing stakeholder issues	Engagement with stakeholders to address complaints	Not started
5.0	**FIELD OPERATIONS: THE ITEBALLI COMMUNITY**		
5.1	Logs transiting the Iteballi Community	Transporting 35-40m^3 logs via heavy duty trucks	Not started
5.2	Riverside log depot operations	Transferring logs to a barge at Iteballi waterfront	Not started
6.0	**CORPORATE SOCIAL RESPONSIBILITY**		
6.1	Support preventive maintenance of Kartabu-Puruni Road	Deploy machines for earth fills, road grading, road compaction and drainage works	Not started
6.2	Support the development of Iteballi Community	Support simple community events as requested by NDC.	Not started
6.3	Manage stakeholder issues	Engagement with community representatives to address complaints.	Not started

6.5.2.3 Logging protocols

(a) Road works

There is a network of existing roads within the concession area: based on reconnaissance surveys conducted by consultants, the road density within the northern part of the concession is much higher than in the southern part. These roads were built long ago by big mining companies but degraded over time to a stage where 4x 4 and 6 x 6 lorries can only use them in the *dry season*. These roads are traversed on a regular basis by ATVs. It appears however, that considerable effort was put into the alignment of the roads and TPTTI will be upgrading those that it plans to use. TPTTI roads network and design will be guided by the need to be used in the dry as well as wet season. TPTTI will build up a network of roads to a standard to enable loaded trucks to travel at about 50 km/hour with a payload of about 42 m^3 of logs. As far as practicable, a bearing surface of lateritic soils will be used to ensure year-round use of the road.

Roads will be planned based on the following considerations:

a. Firstly, the terrain is very hilly, and the company will be forced to seek out grades that are amenable to fully loaded trucks in any weather; due to environmental implications, the company will avoid scenarios where 'cut and fill' works would be necessary.

b. Road design will ensure road curvatures and elevations that allow loaded trucks to traverse them with logs up to 18m in length.

c. Exceptional care will be taken in undertaking earthworks linked to bridges and culverts.

d. Road width is based primarily on economic and safety considerations, soil and terrain conditions and the engineering requirements for double-tandem logging trucks with pole trailers capable of carrying up to 42 m^3 of full-length logs per trip at speeds of about 50 km/hr. The central and north-eastern parts of the concession are quite hilly, even mountainous; hence the company works with specifications that are different from those recommended in the COP.

Tables 9 and 10 sets out the road specifications used by the company.

(b) Culverts

The concession area has a high drainage density and culverts are inevitable. However, considerable attention to road planning seeks to minimize the number of culverts necessary. All culverts (and bridges) are constructed with the use of timber, with a preference for '*Chinese culverts'*, rather than the hollow log culvert type that has proven inefficient in the sandy areas. The prescriptions of the Code of Practice for Timber Harvesting regarding selection of crossing points, earthworks, and gradient are followed to the maximum extent possible.

Table 9: TPTTI's road specification guidelines

Type of Road	Description	Recommended specifications (m)	Actual specifications (m)
Main Road	Formation width-ditch to ditch	12	10
	Running surface-cambered	10	6-8
	Cleared vegetation-total (max)	36	20
Secondary and Feeder Road.	Formation width-ditch to ditch	10	8
	Running surface-cambered	8	6
	Cleared vegetation-total (max)	30	16

Table 10: Specifications of selected road features

ITEM	DESIGN AND SPECIFICATIONS
Slope at Side cut	Preferably < 16%;
Corduroy	Durable logs with tip diameter >25 cm are placed perpendicular to the road alignment.
Bridges	• Durable logs used always • Straight road sections of at least 20 m, aligned with the centre of the bridge, will occur at each end of the bridge. • Bridge height will be 2.5 meters above the high-water level • Earth and other debris falling into the creek or River during bridge construction will be removed after completion of the bridge • Road maintenance crews will monitor the use of the bridge
Road camber	The centreline of the road will be cambered to prevent water lodging on the surface of the road.
Super elevation	Due attention will be paid to super elevation on the road curves relative to the soil type, and the curve radius.
Drains	Due care will be taken to trap sludge and otherwise prevent slurry from the road from entering directly into natural waterways.
Borrow pits and quarries	These will have only one sloping side.

(c) Bridges

The nature of the bridges built depends on the nature of the terrain and the size of the creek to be crossed. All bridges are constructed from durable hardwoods (*Mora excelsa*, *Eschweilera spp.* etc.). Normally a stable log bearer cradle is constructed (log cribbing is set into earth works on each side of the creek or River then stringers are laid across them). The stringers are then covered with compacted earth and shaped to accommodate trucks, and *super elevated* to facilitate run-off. Here again the

prescriptions of the Code of Practice for Timber Harvesting are followed to the maximum extent possible.

Other road features and their specifications are based on the company's experiences in road construction and maintenance, cost considerations and the fact that there is **public** use of TPTTI's primary roads.

(d) Forward Planning of Roads

Some 40 km of roads, mostly within the eastern part of the SFEP has already been constructed by miners. The company prefers to use existing roads; however, the existing roads have not been designed for logging trucks (with pole trailers) conveying logs up to 20m in length. Therefore, considerable upgrade is required wherever the company opts to use the existing road.

Table 11 below shows projected road construction over the next five years within the concession area.

Table 11: Projected Road construction schedule: Ekabago & Access Road

Year	Compartment(s)	Maintenance of Access Road (Km): Tiger Ck. To M/Mara	Primary Road (Km)	Secondary Road (Km)	Total (Km)
2018		10	10	10	20
2018	Ekabago		15	12	27
2019	Ekabago		29	7	36
2019	Ekabago		25	6	31
2019	Ekabago		27	5	32
Total			**106**	**40**	**146**

In view of ongoing mining operations in the northern part of the forest concession, the planning of roads requires further study. In any event, the company is unlikely to operate in that area before 2025.

(e) Biodiversity reserve

One of the first acts of the company was to set out a forest reserve of 3,015ha. A vegetation map of the area indicates that there is more diversity of forest types at the northern extremity of the concession. It also contains a diversity of site conditions based on altitudinal gradients and its proximity to the Cuyuni River. The position of the reserve (see Figure 9) at the northern tip of the concession area allows for easy monitoring.

The consultants traversed the area and confirmed that the area is mostly intact and that the species composition is by and large very similar to the other parts of the concession area.

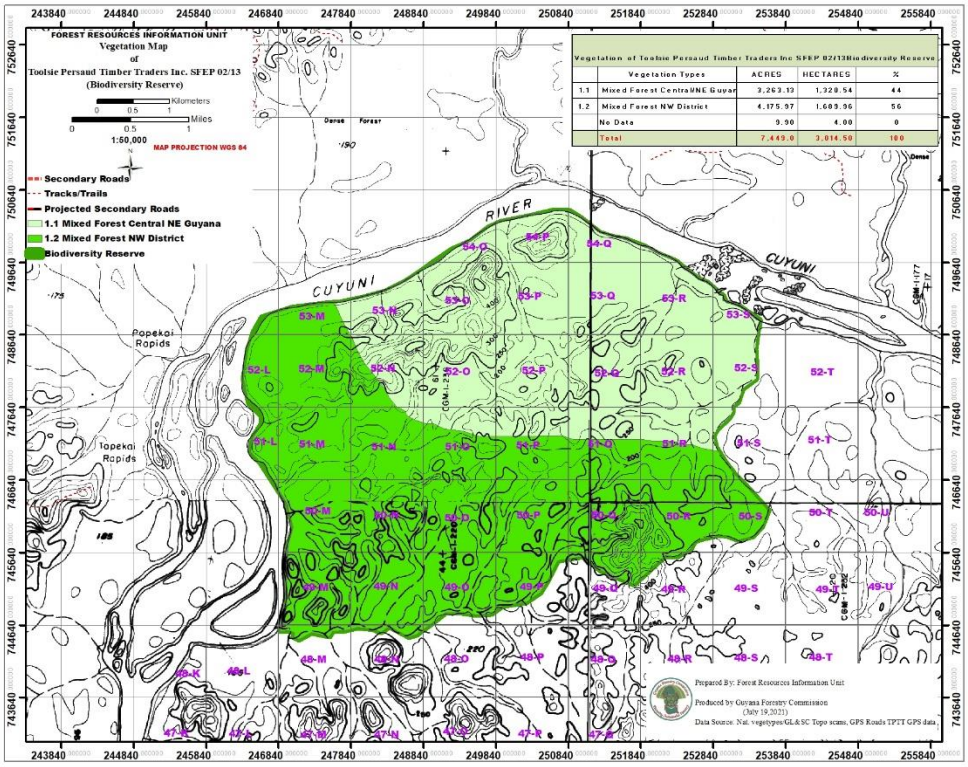


Figure 9: Map of TPTTI's Biodiversity Reserve

(f) Compartments

Apart from the biodiversity reserve, the concession area has been divided into four compartments (see Table 12, Annex VII). Each compartment corresponds roughly to a 10-year management period.

Table 12: List of Compartments-SFEP 2/2013

#	Compartment Name	Area (ha)	% of area	Remarks
1	Ekabago	18,658.28	27.9	Southern part of the concession area, between right bank Mara-Mara River and left bank Ekabago River
2	Arimu	17,630.18	26.4	Between Arimu Road and Ekabago compartment
3	Cuyuni	12,500.47	18.7	Immediately north of Arimu Road
4	Quartzstone	15,069.89	22.5	Northern extremity of the concession area
	Bio Reserve	3,015.00	4.5	At the northern extremity of the concession area, more diverse forest types.
		66,873.82	100	

(g) Blocks

The entire concession area has been organized into 1000m x 1000m (100ha) blocks and each block has been assigned a unique alpha-*numerical code*. These blocks are very convenient for planning timber yields and managing prescriptions of the COP especially in relation to buffer zones. The concession area has already been divided into blocks, however only 6% of these have been demarcated to date on the ground.

(h) Forest inventory

Given the nature of local forests, especially in terms of the diversity and spatial distribution of merchantable species, the distribution of diameter classes for each species of interest and the diversity of site conditions, a 100% forest inventory is necessary for efficient timber harvesting practices. A 100% inventory allows for the merchantable volume to be removed, the skidding distances required, the alignment of access roads and the location of log markets to be constructed.

100% enumeration may be conducted up to one year prior to felling.

(i) Stock maps

Data collected during the 100% inventory for each 100 ha will used to produce stock maps. These maps will show the position (x, y value) of each tree enumerated and an estimate of its dbh[15], the species, the configuration of the terrain and the stream network. Existing roads passing through the block and every other feature of operational interest are also recorded on stock maps. Stock maps are normally prepared with the aid of GIS technology.

Based on the trees placed on the stock map, the prescribed allowable cut and prevailing market demand, the target trees to be felled (felling stock) is determined. Based on this determination skid trails representing the most feasible route to extract the logs and log markets are put on the stock map.

(j) Skid trail alignment

Skid trail alignments marked on the map are duly aligned in the field subject to features of the terrain not captured in sufficient detail during the forest inventory exercise. Skid trail alignments are normally done soon after the forest inventory exercise.

(k) Tree marking operations

The tree marking exercise involves four steps:

a. Validation of the species name, diameter at breast height (dbh) and form to ensure the log produced meet market requirements

b. Checking the trees site condition, relative to the nearness to other merchantable trees (proximity rule) and slope conditions

[15] Diameter at breast height

c. The cutting of lianas attached to the target trees

d. Marking the direction of fall of the tree relative to the skid trail. This involves painting an indicative mark on the tree.

Tree marking will be conducted about three-four weeks before actual felling of the tree.

(l) Felling & Bucking trees

Each feller has an assigned felling area delineated by the skid trails, block boundary lines or natural features. Logs are felled in predefined sequences and angled to the skid trails to ensure the least disturbance to the forest floor. To improve efficiency, each feller is issued with a piece of cord so that he makes sure that trees below the prescribed dbh (50cms over-bark for mill logs and 35cm for piles) are not felled and to fell logs as inventoried. The feller only cuts trees on the current TPTTI species list, which is regularly upgraded in line with market requirements.

The fellers are instructed that it is a mandatory requirement of the GFC Code of Practice that trees within a minimum of 50 meters of waterways are not to be felled. The Fellers will first cut lianas, vines and underbrush near the trees to be felled to ensure safety and reduce the incidences of trees being pulled or pushed over in the felling process. The Feller is issued with flagging tapes so that he can mark a trail from the felled tree to the nearest skid trail

All trees must be felled using an undercut, either the Humboldt or conventional method. Every feller must carry felling wedges. For every tree felled, there must be a defined and where necessary cleared safety routes, at 45° to a line or direction opposite the direction of fall of the tree. Front and back cuts should be aligned so that there is an adequate hinge to control the direction of fall of the tree fall. The legal limit for stump heights is not more than 3ft. (=90cms) for trees without buttresses and not more than 3 inches (=7.5cm) above the buttresses for those trees with buttresses (Forests Act, Cap. 67:01). Trees must be felled and bucked at first branch unless there is a major defect. The Feller will ensure that the stem is cut completely through or there will be a difficulty in extraction. There will be no felling where slopes of more than 58% extend for more than 50 meters. The company has already solicited technical assistance from the Forestry Training Centre Incorporated to train fellers (among others) to improve felling practices. In addition is there is ongoing monitoring of the fellers by the operations manager and other supervisors.

A tag is placed on the tree stump.

(m) Extraction / skidding operations

The skidder operator is responsible for stumping/positioning a log so that it can be easily pick-up by the Skidder Operator. The butt end of the log is placed clear of the ground so that a choker strap can be easily placed round the log. Efforts are being

made to identify ways and means to reduce or eliminate the need for the logs to be "stumped" by tractors. Logs should only be moved the minimum required to allow the choker to be set. (The crawler tractor moves logs from the stump, whereas the rubber-tired Skidder conveys logs along the skid trails to the log market on road sides.

(n) Log market operations

Each log skidded to log market is scaled, graded and tagged at the log markets, each log being identified by a serial number on plastic tags.

(o) Hauling operations

Log loading in the forest is done at the log markets with log loaders and up to four MACK Logging trucks will be used to haul logs from log markets to Iteballi at an average of load of 40-42 m^3 per trip for distances of 100+km.

(p) Marine transport

Tugs and Barges will be used to transport timber (logs and lumber) from Iteballi to Georgetown via the Mazaruni, Essequibo and Demerara Rivers, a 24-hr. trip.

(q) Forest monitoring

TPTTI will set up a monitoring team whose primary function is to ensure that production systems work efficiently and that post-harvest conditions remain amenable to forest stand growth and wildlife habitats. For example, the forest monitoring team will check that all stumps are properly tagged, logs on the forest floor are duly removed, and that debris or litter from products introduced by field operatives –batteries, plastic bags, drinks bottles, etc., are removed from the forest floor.

(r) Environmental monitoring

Environmental monitoring here refers specifically to permanent monitoring of targeted locations on the concession area where environmental parameters such as 'water quality', 'ph.' and 'turbidity levels are recorded regularly and in line with the rainy season and the dry season respectively. Three such points have been identified to date in the southern part of the concession. All other commitments set out in the EMP will be monitored by the team.

The flux of miners in the northern part of the concession observed to date dictates that more care be taken with the selection of monitoring points. It is the case though that TPTTI will probably not conduct logging north of the 'Arimu Road' before 2023.

6.5.3 Records

Records are vital to the performance of the company and its capability for reporting on any matter to stakeholders.

The records to be kept may be, for convenience, put into five categories:

a. Personnel records, including remuneration packages

b. Production records: including records related to road construction and maintenance, block opening and block closure, timber production reports, machine use

c. OSH reports

d. Concession administration records (relating to for example, permits, tags, and GFC monitoring requirements'

e. Records related to compliance with the company's EMP, including new baseline data and data linked to environmental monitoring and reporting, registers of large animal sightings.

f. Stakeholder engagements

7. O WATER RESOURCES

7.1 Introduction

It is likely that when one says *'Guiana'* means *'land of many waters'* that the link between the mass of fresh water and the mass of forests is not always recognized. Forests contribute freshwater resources by minimizing soil erosion, reducing sediment levels in water bodies, and trapping or filtering water pollutants and therefore the most effective land use for keeping water as sediment-free as possible is good forest cover, with its under-storey, surface litter, debris, and organically enriched soil[16]. Fresh water resources and their conservation are of major environmental significance and concern.

The concession area is within the **Physiographic Area Zone 2, Interior Plains** which is characterised by enormous quantities of fresh water from April through August and from November through January; large to very large quantities of fresh water are available for the remainder of the year (GLUS, 2013)[17].

7.2 Definitions and scope (GLASC, 2013)

(a) Quantitative terms (GLASC, 2013)
Enormous quantities of water refer to discharge rates of >400,000 Litres /min.
Very large quantities refer to discharge rates of 40,000 to 400,000 l/m
Large quantities: refer to rates of 10,000-40,000 l/m.

(b) Qualitative terms (GLASC, 2013)
Fresh water: maximum of totally dissolved solids <1,000 mg/l
Brackish water: maximum >1,000mg/l but less than 15000mg/l
Saline water: TDS>15,000 mg/l

(c) Water hardness (GLASC, 2013)
Soft water: 0-60mg/l
Moderately hard: 61-120mg/l
Hard: 121-180mg/l
Very hard: >180mg/l C

(e) 'Soil Water balance' refers to *the amount of water available at any given time in the soil: it is a function of primarily of precipitation, evapotranspiration, soil water storage and water surplus* (Strahler & Strahler, 1997).

7.3 Legislation

The Water and Sewerage Act, 2002 *provides the following definitions:*

i. *'Surface water systems' includes creeks and rivers.*

ii. *'Waste' includes any solid material or material that is suspended, dissolved, or transported in water (including sediment) and which is spilled or deposited*

[16] http://www.fao.org/docrep/011/i0410e/i0410e04.pdf
[17] **This document was supported by the United States Army Corps of Engineers' study in 1998 "Water Resources Assessment of Guyana**.

on land or into a water resource in such volume, composition, or manner as to cause, or to be reasonably likely to cause, the water resource to be polluted

iii. *'water resources' mean water systems, conservancies, canals and all other water arising from rainfall or run off from the land that has been stored or captured within Guyana.*

The Water and Sewerage Act, 2002 provides for the setting up of the ***Hydrometeorological Department*** whose functions include '*to establish, manage, and operate national systems to monitor the availability, quality and use of surface water and ground water'.*

The Environmental Protection (Water Quality) Regulations 2000 (see Section 5.4.1) made under the provisions of the EPA Act require, among other matters the registration and environmental authorization by any person whose construction, installation, operation, modification, or extension of any facility cause the discharge of effluents. Guidelines on the discharge of effluents and disposal of waste are detailed in these regulations.

7.4. The Concession Area

Location

The concession area is bounded generally by the Cuyuni River in the north, the Puruni River in the south, the Ekabago River to the west and the Mara-Mara River to the east. It is situated well away from any communities.

The concession area varies from undulating to very hilly, with areas north of Arimu Road much hillier than the rest of the concession. Elevations of up to 700ft have been noted and several peaks of 400ft+ are quite common.

Five rivers dominate the concession area (see Figure 10): two large unnamed tributaries on the right bank Cuyuni River to the north western end of the concession area, the Quartzstone River, right bank Cuyuni River at the north eastern part of the concession area; the upper Arimu River on the central eastern part of the concession area; the Mara-Mara River, left bank Puruni River on the south-eastern boundary of the concession area; and the Ekabago River, right bank Cuyuni River on the western side of the concession area. The prevailing stream pattern is dendritic, and the drainage density is estimated at 12m/ha.

The concession area is situated within the Kartabu Triangle and is surrounded by many other forest concessions (see Figure 11).

Mining authorizations have been granted *throughou*t the concession area but most of these remain undeveloped. There are signs of exploratory pits everywhere, however 98% of the active mining within the concession area occur in the areas north of Arimu Road.

There are about 48 km of mining roads already existing with the concession area; most of these may only be used by heavy 4x 4 vehicles in the dry season. The ATV is the primary means of traversing the existing roads in the concession area.

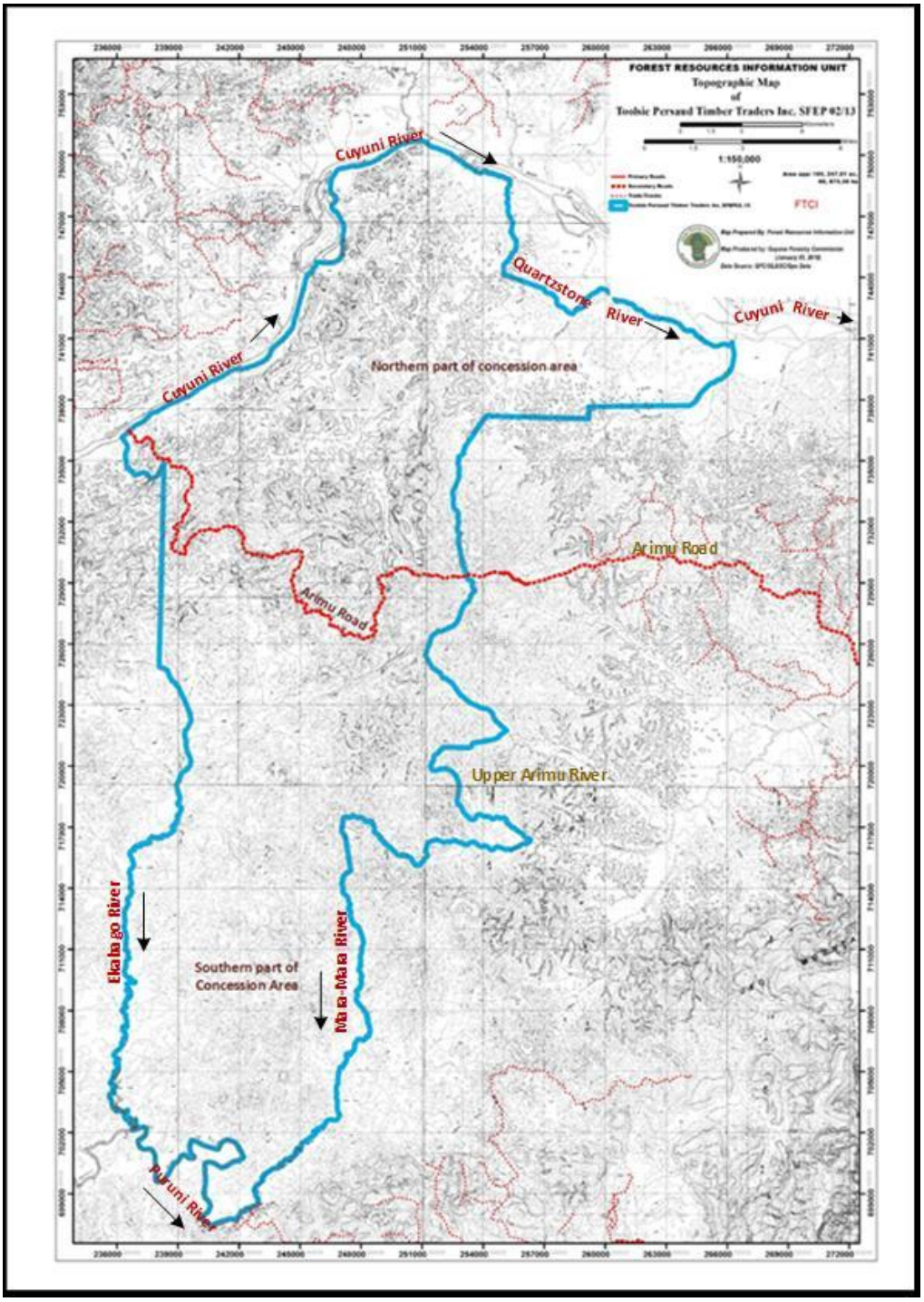


Figure 10: map of SFEP 2-13 showing the main rivers draining the area

Access

TPTTI evaluated the Arimu Road and the Kartabu-Puruni Road and decided that it will access the concession via the Kartabu-Puruni Road: At the point where the company will set up its field base (see Figure 12), it is about 106 km from Iteballi, 65 km from Takutu Community, 17 km from Tiger Creek Junction, and 34 km from Puruni Landing.

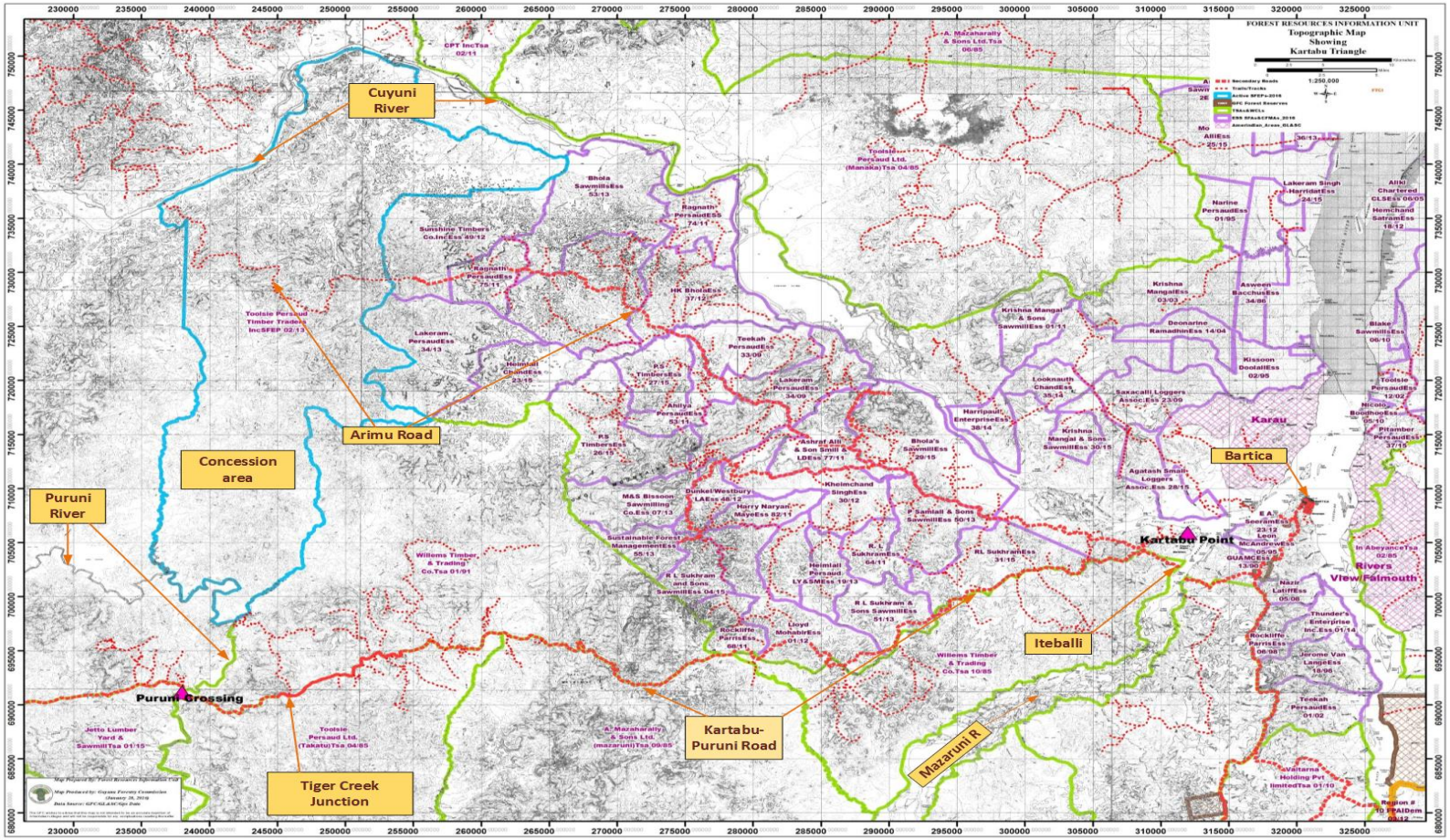


Figure 11: Indicative map showing forest concessions within the Kartabu Triangle

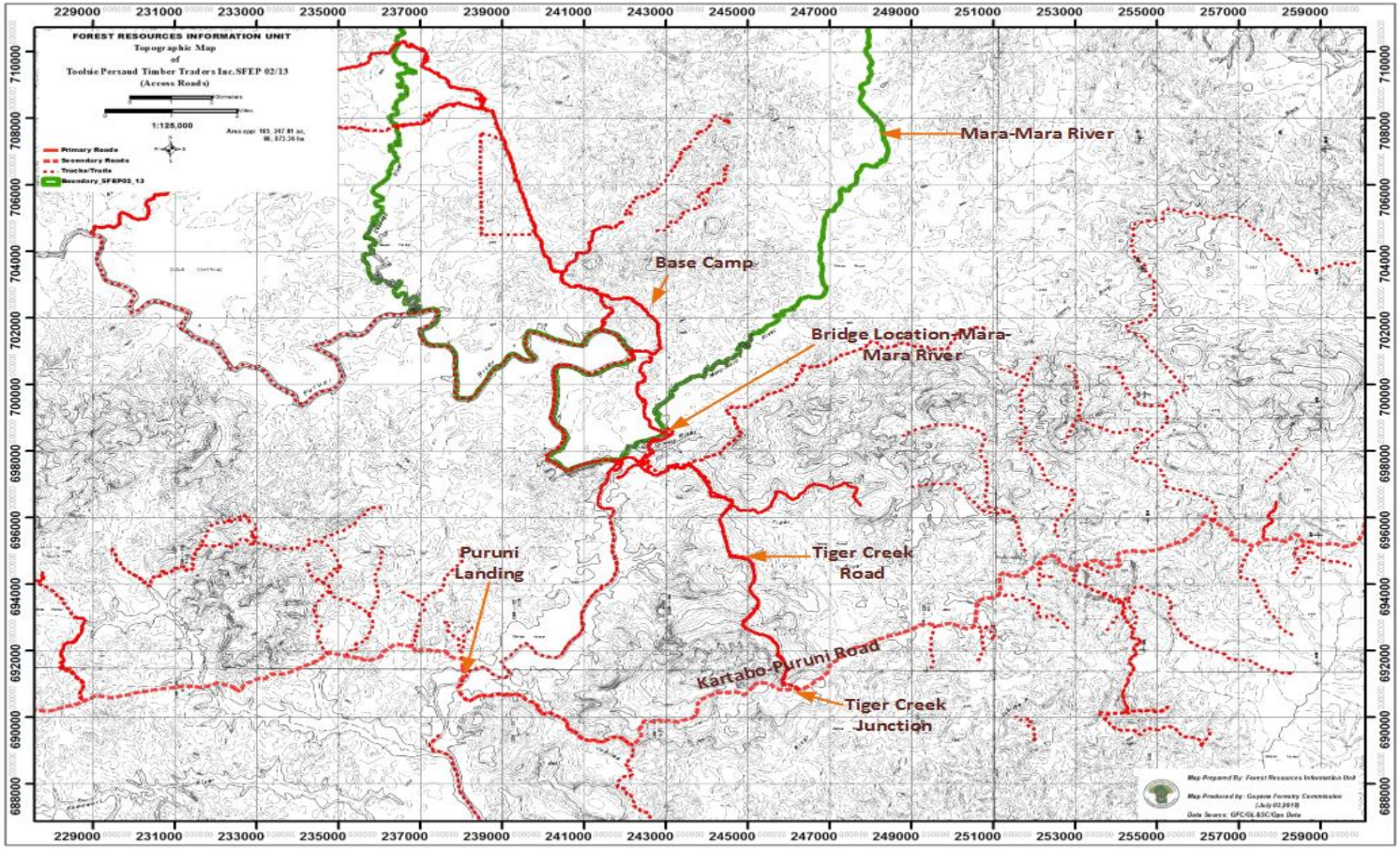


Figure 12: Map showing access options for SFEP 2/13.

There has been at least a 40-year history of mining in the area, much of it concentrated in the upper Arimu District. Access to the concession used to be challenging (see Figure 13).

Figure 13: Deplorable Road conditions in the Arimu District

Major concerns from an operational point of view include the existence of ponds generated by mining activity (see Figure 14) which appear to support masses of weeds and lianas and stymy seedling growth, and occasionally caimans and boa-constrictors, and consequent challenges in traversing the forest floor.

Figure 14: Ponds generated by mining activity

7.5 Methodology for base line studies undertaken by TPTTI

At the outset, the consultants tried to ensure the broadest possible geographic spread for water samples. To this end, the major waterways were identified, Mara-Mara River on the eastern boundary and the Ekabago River on the western boundary. Access to the area was the main determinant of the location of the samples. Waterways showing indications of active mining were ignored. Also, waterways that did not appear to be perennial streams were ignored.

A major challenge with choosing sample sites is the drastic difference in site conditions during the wet and dry seasons respectively. Many sites chosen in the wet season, when it is possible to traverse creeks, would not be available in the dry season due to challenges traversing the creeks. Many miners address this problem by constructing trails which they use in the dry season. As soon as TPTTI starts field operations and sets up a road network, this particular challenge will be resolved.

TPTTI intends to set up Permanent Monitoring Stations. The main criterion for setting up the PMS is TPTTI's capability for safeguarding those stations in the face of competing land use on the concession area. Other criteria include easily accessible sites in the vicinity of perennial streams and the absence of mining within a 5oom radius of the site.

Special bottles, sourced from Gaffoors', were used to collect water samples (see Figure 15). New bottles were used for each sample, and bottles were discarded after the water content was analysed; in other words, bottles are never recycled or re-use.

Two bottles of sample water were collected at each sample point: one was used by the technician the same evening (see Figure 16), while the second sample per point was brought to Georgetown for analysis at Kaizen Laboratory.

Figure 15: Illustration of water sample collection

Figure 16: Illustration of devices for 'inhouse' analysis of water samples

The consultants stored water bottles in a cooler with ice pending the trip to Georgetown. The consultants set a maximum period of four (4) days between the collection of the samples their delivery to the laboratory for analysis. (This rule guaranteed that there was no detectable difference in water quality between the date of collection and the date on which analysis starts.

Water samples were analysed to determine the quality of surface water within the TPTTI's forest concession. During the dry season four (4) water samples were collected and analysed on October 14, 15 and 17, 2017, while during the wet season eight surface water samples were collected and analysed on April 24 - 27, 2018, and May 11 and 12, 2018 within the concession. These samples were collected from several creeks and rivers within the concession. Surface water samples were analysed to have a representative value of the water quality in the concession. The sample locations were selected at strategic points of the forest concession to provide an indication of the baseline surface water quality.

The locations where the samples were collected are identified on the maps at Figures 17 and 18 as the WQ locations and described in the Table 13 below. (Many of these will become permanent monitoring stations, since, if there are any impacts on water quality by the operation, the impacts can be detected by testing water quality at these locations). (Another set of samples were collected during period September 9, 2021 at the northern end of the concession (see Figure 19).

Some analyses were conducted in the field almost immediately while other samples were taken to the laboratory of Kaizen Environmental Services (Guyana) Inc. (see Annexe XXI) the list of water samples by location is set out in Table 13.

The samples collected were analysed for several parameters which are important and generally used to determine the quality of water, i.e. measurements of pH, Temperature,

Biological Oxygen Demand (BOD), Total Suspended Solids (TSS), Chemical Oxygen Demand (COD), Oil and Grease, Turbidity, Electrical Conductivity, Total Nitrogen, Nitrate and Phosphate Ions were taken to assess the spatial changes of the quality of water (see Table 14).

In the absence of a specific national standard on surface water quality, comparison was made with the Guyana National Bureau of Standards (GNBS) for Industrial Effluent Discharge (Table 15) as well as internationally acceptable limits from the US-EPA, 1986 standards for Recreation, Propagation and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife, the World Bank Group International Finance Corporation (IFC) Environmental, Health and Safety (EHS) Guidelines for Wastewater and Ambient Water Quality, and European Union (EU) 1998 Drinking Water Standards (Table 15).

Table 13: Surface Water Sample Locations within and around the TPTTI Forest Concession

No.	Sample ID	Sample Location	Date of Sample Collection*	Time of Sample Collection (h)	Weather Conditions	GPS Readings (UTM, 21N)
Dry Season						
1	WQ1	Creek	Oct 14, 2017.	12:22	Sunny	0241321, **0704664**
2	WQ2	Creek	Oct 14, 2017.	14:24	Sunny	0242518, 0702209
3	WQ3	Mara-Mara Creek	Oct 15, 2017.	15:38	Sunny	0241839, 0697731
4	WQ4	Ekabago River	Oct 17, 2017	11:49	Sunny	0242470, 0700281
Wet Season						
1	WQ1	Ekabago River	Apr 24, 2018	13:25	Overcast	0236426, 0707750
2	WQ2	Creek	Apr 25, 2018	10:08	Overcast	0242556, **0702151**
3	WQ3	Creek	Apr 25, 2018	14:45	Overcast	0244534, 0607435
4	WQ4	Creek	Apr 26, 2018	12:35	Rainy	0238472, **0706203**
5	WQ5	Mara-Mara Creek	Apr 27, 2018	10:15	Rainy	0242910, 0698559
6	WQ6	Creek	May 11, 2018	11:21	Rainy	0245984, 0735997
7	WQ7	Creek	May 12, 2018	07:35	Overcast	0252344, **0723997**
8	WQ8	Creek	May 12, 2018	09:40	Overcast	0238307, 0729594

***Samples collected by: Mr. Osbert Ellis**

Figure 12: Testing Water Samples in the Field (Source: Ellis, 2018)

Since all water samples to date have been collected along creeks, generally all samples were taken in riparian forests, characterised by Mora forests or Marsh forests. Mora forests are characterised Mora (Mora excelsa), Crabwood (Carapa guianensis), Trysil Dalli (Virola surinamensis). In the Marsh forests, common species include Crabwood (*Carapa guianensis*), Aromata, Baromalli, (Catostemma spp.), Fukadi (Terminalia spp.), Manni (*Symphonia globulifera*), Ite Palm (and Mauritia flexuosa) and Manicole Palm (*Euterpe edulis*).

In open, ex mining areas various grasses Including Scleria spp. and a broad range of vines and lianas.

For TPTTI, the dominant soil type is Kanhapludults (89%), characterised by red, yellow podzolic soils and red latosols, with high erosion potential. Soils near creeks usually carry a higher organic matter content and are darker in colour.

Environmental Engineering Solutions, that supports this project, is developing the capability to conduct all the environmental analysis required for forestry projects. The company normally uses Kaizen Environmental Services (KES) but more recently it has been using the Institute of Applied Science & Technology (IAST).

All analysis related to Oil & Grease, Biological Oxygen Demand, Chemical Oxygen Demand, Total N and Phosphate are routinely sent to a Laboratory, IAST or KES.

7.5 Results and Discussion

For the results of the surface water quality analysis conducted for Toolsie Persaud Timber Traders Inc. Forest Concession, most of the parameters analysed were within the acceptable range. For the parameters that were analysed the results were as follows:

7.5.1 Dry Season

- ***PH*** - The pH analysis of the surface water samples collected within the Forest Concession ranged from 4.91 to 6.50 pH, indicating that water in the area is acidic. The pH parameter of Sample WQ4 (4.91 pH) was below the GNBS Interim Guidelines for Industrial effluent into the Environment i.e. pH limits (5.0 - 9.0 pH). However, the pH parameters for the other three (3) sample locations i.e. WQ1 (6.50 pH), WQ2 (5.20 pH), WQ3 (5.45 pH) were within the limits (5.0 - 9.0 pH) GNBS Interim Guidelines for Industrial effluent into the Environment as well as the US-EPA and World Bank Group IFC EHS Guidelines.

- ***Water Temperature*** - The surface water temperature reading ranged from 26.1 ^{0}C to 28.7 ^{0}C during time of collection in the field, this was within the GNBS accepted range of <40 ^{0}C, which is considered healthy for living organisms. It is expected that activities within the area should not change water temperatures beyond natural seasonal fluctuations.

- ***BOD (Biochemical Oxygen Demand)*** - BOD levels of the surface water samples were all <1.78 mg/l and were all within the GNBS accepted range of <50 mg/l as well as the World Bank Group IFC EHS Guidelines of 30 mg/l.

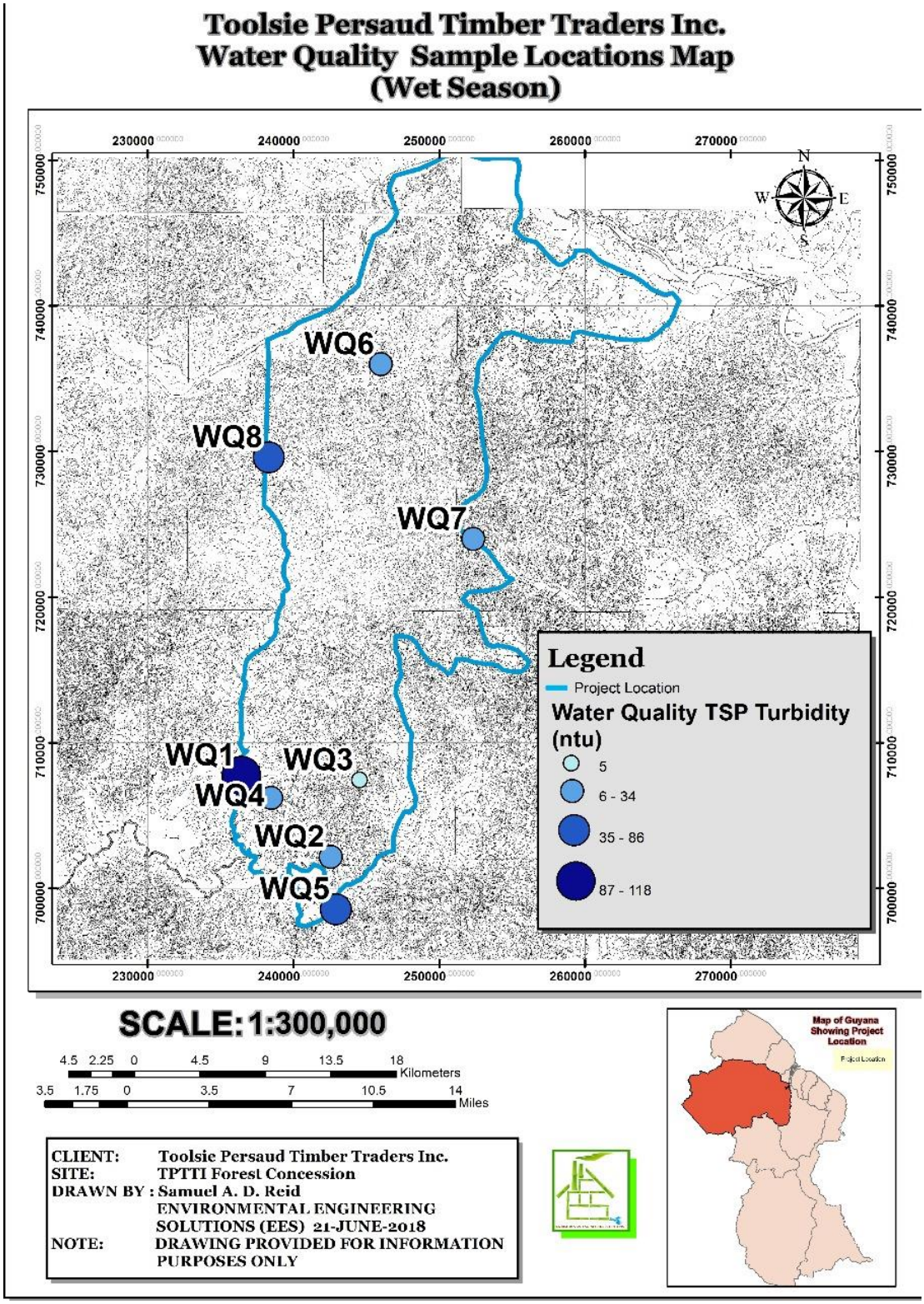


Figure 17: Map showing the locations of water samples, dry season.

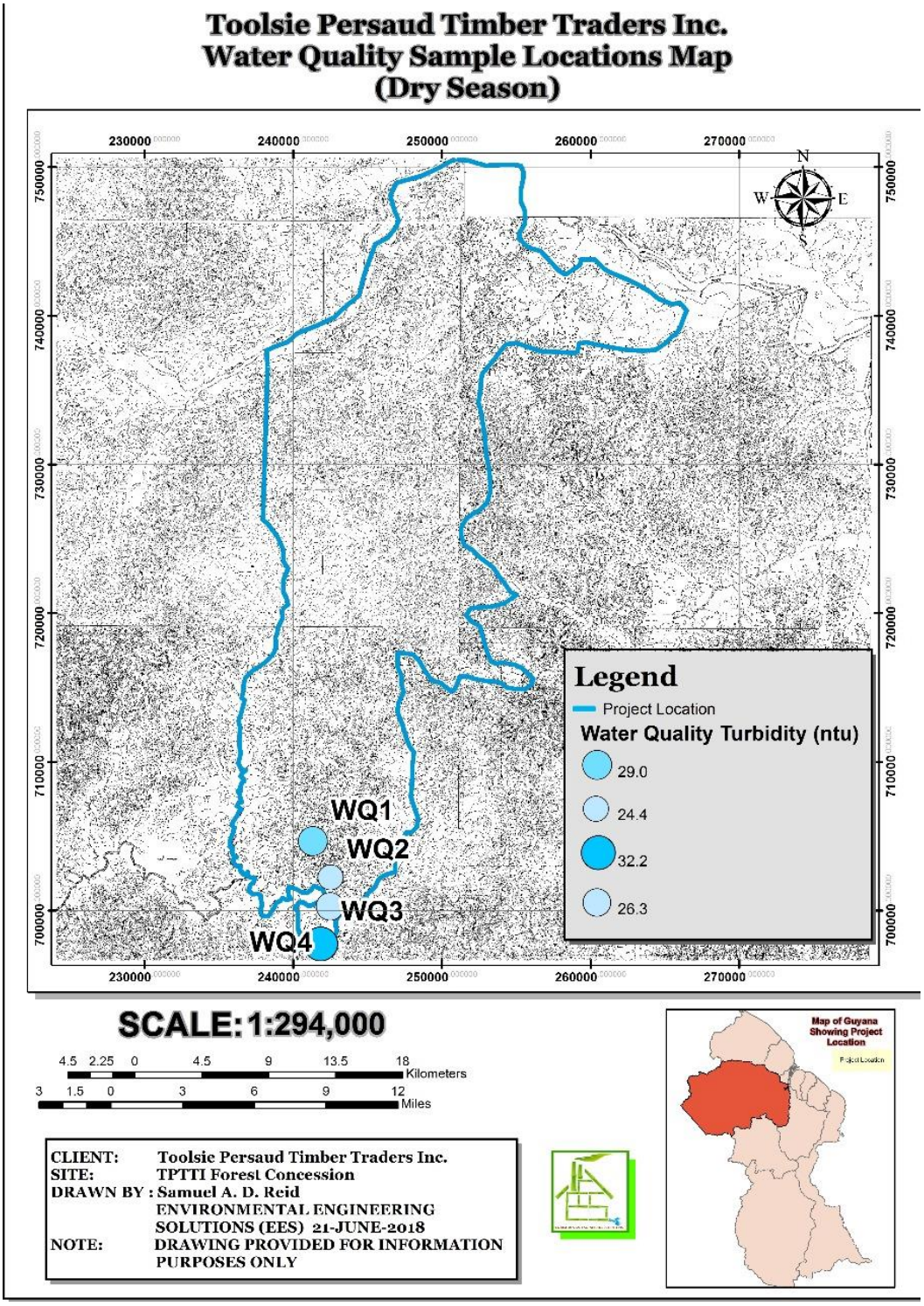


Figure 18: Map showing the locations of water samples, wet season

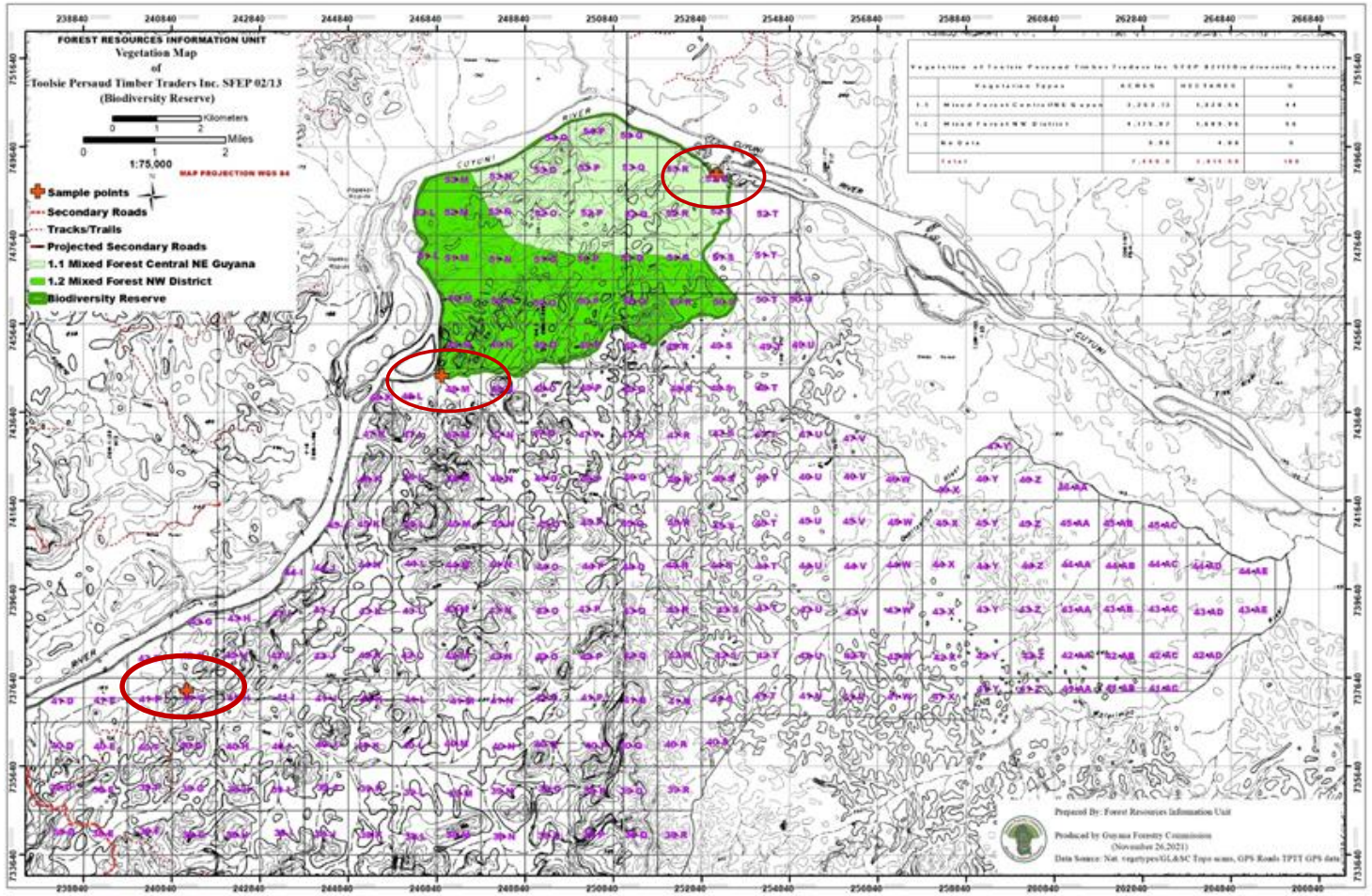


Figure 19: Map of northern part of the concession showing sample points[18]

[18] These formed part of the search for locations for permanent forest stations, but the sites can only be accessed in the rainy season. The data garnered from these plots have been used to describe general features of the area, but the data is not included in this report.

Table 14: Results for Surface Water Samples from TPTTI's Forest Concession

Sample ID	Coordinates UTM, 21N	Parameters											
		pH 5.0-9.0	**Temp (°C) <40**	**BOD (mg/l) <50**	**TSS (mg/l) <50**	**COD (mg/l) <250**	**Oil & Grease (mg/l) <10**	**Turbidity (ntu) 10**	**Electrical Conductivity (µS/cm) *0-1500***	**Total N (mg/l) 10**	**NO_3^- (mg/l) 10**	**PO_4^{3-} (mg/l) ≤0.1**	**TDS (ppm) 500**
Dry Season													
WQ1	0241321, 0704664	6.50	26.2	<1.78	----	9	2.84	29.0	66	----	0.7	----	15
WQ2	0242518, 0702209	5.20	28.7	<1.78	----	22	6.40	24.4	36	----	0.8	----	11
WQ3	0241839' 0697731	5.45	26.7	<1.78	----	26	17.1	32.2	38	----	1.4	----	13
WQ4	0242470, 0700281	4.91	26.1	<1.78	----	19	5.20	26.3	62	----	1.6	----	23
Wet Season													
WQ1	0236426, 0707750	6.44	19.2	ND	4.16	43	13.0	117.5	46	1.4	0.8	<0.54	19
WQ2	0242556, 0702151	6.17	16.3	ND	19.5	30	9.80	27.9	35	1.1	0.7	<0.54	13
WQ3	0244534, 0607435	4.38	17.2	12.4	2.00	65	13.0	4.6	49	1.9	0.2	<0.54	19
WQ4	0238472, 0706203	6.17	20.7	15.4	20.0	39	10.6	33.3	46	1.5	1.2	<0.54	17
WQ5	0242910, 0698559	6.39	27.9	ND	40.0	47	9.00	79.3	38	1.5	1.1	<0.54	14
WQ6	0245984, 0735997	6.28	25.8	ND	30.0	42	7.80	33.8	58	ND	0.5	<0.54	22
WQ7	0252344, 0723997	6.08	25.7	ND	27.7	51	10.0	32.2	32	ND	0.4	<0.54	13
WQ8	0238307, 0729594	6.27	25.7	18.45	69.3	53	8.80	85.5	30	ND	0.3	<0.54	12

***Sample testing by: Osbert Ellis (October 14, 15 and 17, April 24 - 27, 2018, May 11, 12, 2018) and Kaizen Environmental Services (Guyana) Inc. (October 19, 2018, May 02, 2018, and May 14, 2018)**

Key

BOD - Biochemical Oxygen Demand COD - Chemical Oxygen Demand NO_3^- - Nitrates PO_4^{3-} - Phosphates TSS - Total Suspended Solids ND - Not Detected

- ***Total Suspended Solids*** **-** TSS of the surface water samples were not analysed during the dry season.
- ***COD (Chemical Oxygen Demand)*** **-** COD levels of the four (4) water samples ranged from 9 mg/l to 26 mg/l and were all within the GNBS accepted range of <250 mg/l and the World Bank Group IFC EHS Guidelines of 125 mg/l.
- ***Oil and Grease (OG)*** **-** OG levels of the water samples of WQ1 (2.84 mg/l), WQ2 (6.40 mg/l) and WQ4 (5.20 mg/l) were within the GNBS and World Bank Group IFC EHS limits of <10 mg/l. The OG levels of WQ3 (17.1 mg/l) was above the GNBS (<10) Interim Guidelines for Industrial effluent into the Environment. Monitoring indicated that OG is present in the surface waters of the Forest Concession due to the high presence of Gold mining in the area.
- ***Turbidity*** **-** The turbidity level of the water samples ranged from 24.4 ntu to 32.2 ntu. Therefore, the turbidity levels of the four water samples were all above the accepted 10 ntu GNBS Interim Standards. High turbidity levels were expected because turbidity generally increase with distance closer to the bank of a stream or flowing creek. This is expected since the closer the proximity to land, the higher the turbidity level.
- ***Electrical Conductivity*** **-** Electrical Conductivity of the surface water samples within the Toolsie Persaud Timber Traders Inc. Forest Concession ranged from 36 µS/cm - 66 µS/cm and were all within the European Union (EU) standards for water i.e. 0 - 2500 µS/cm. Most streams range between 50 to 1500 µS/cm. Freshwater streams ideally should have electrical conductivity ranging from 150 - 500 µS/cm to support aquatic life.
- ***Total Nitrogen*** **-** Total Nitrogen levels of the surface water samples were not analysed during the dry season.
- ***Nitrates*** - Nitrate ion levels of the water samples ranged from 0.7 mg/l to 1.6 mg/l were all within the US EPA accepted range of 10 mg/l.
- ***Phosphates*** - Phosphate levels of the surface water samples were not analysed during the dry season.
- ***Total Dissolved Solids (TDS)*** **-** The TDS levels of the water samples ranged from 11 ppm to 23 ppm and were all below the U.S. EPA's Maximum Contaminant Level for TDS of 500 ppm.

7.5.2 Wet Season

- ***PH*** - The pH analysis of the surface water samples collected within the Forest Concession ranged from 4.38 to 6.44 pH, indicating that water in the area is acidic. The pH parameter of Sample WQ3 (4.38 pH) was below the GNBS Interim Guidelines for Industrial effluent into the Environment i.e. pH limits (5.0 - 9.0 pH). However, the pH parameters for the other seven (7) sample locations were within the limits of the

GNBS Interim Guidelines for Industrial effluent into the Environment (5.0 - 9.0 pH) as well as the US-EPA and World Bank Group IFC EHS Guidelines.

- ***Water Temperature*** - The surface water temperature reading ranged from 16.3 ^{0}C to 27.9 ^{0}C during time of collection in the field, this was within the GNBS accepted range of <40 ^{0}C.
- ***BOD (Biochemical Oxygen Demand)*** - BOD levels of the surface water samples WQ3 (12.4 mg/l), WQ4 (15.4 mg/l) and WQ8 (18.45 mg/l) were all within the GNBS accepted range of <50 mg/l as well as the World Bank Group IFC EHS Guidelines of 30 mg/l. BOD levels of WQ1, WQ2, WQ5, WQ6 and WQ7 were not detected.
- ***Total Suspended Solids*** **-** TSS results of the surface water samples ranged from 2.00 mg/l - 69.3 mg/l. The highest TSS level was recorded at WQ8 (69.3 mg/l) which was above the GNBS (<50 mg/l) Guidelines as well as the World Bank Group IFC EHS Guidelines of 50 mg/l, because of gold mining activities within the area. The other TSS results i.e. WQ1 (4.16 mg/l), WQ2 (19.5 mg/l), WQ3 (2.00 mg/l), WQ4 (20.0 mg/l), WQ5 (40.0 mg/l), WQ6 (30.0 mg/l) and WQ7 (27.7 mg/l) were all within the limits.
- ***COD (Chemical Oxygen Demand)*** **-** COD levels of the eight (8) water samples ranged from 30 mg/l to 65 mg/l and were all within the GNBS accepted range of <250 mg/l and the World Bank Group IFC EHS Guidelines of 125 mg/l.
- ***Oil and Grease (OG)*** **-** OG levels of the water samples of WQ2 (9.80 mg/l), WQ5 (9.00 mg/l), WQ6 (7.80 mg/l) and WQ8 (8.80 mg/l) were within the GNBS and World Bank Group IFC EHS limits of <10 mg/l. The OG levels of WQ1 (13.0 mg/l), WQ3 (13.0 mg/l), WQ4 (10.6 mg/l), WQ7 (10.0 mg/l) were above the GNBS (<10) Interim Guidelines for Industrial effluent into the Environment. Monitoring indicated that OG is present in the surface waters of the Forest Concession due to the high presence of Gold mining in the area.
- ***Turbidity*** **-** The turbidity level of the water samples ranged from 4.6 ntu to 117.5 ntu. The Turbidity level of WQ4 (4.6 ntu) was within the GNBS Interim Standards of 10 ntu, while the turbidity levels of the other seven (7) samples were all above the accepted 10 ntu GNBS Interim Standards. High turbidity levels were expected because of the fact that turbidity generally increase with distance closer to the bank of a stream or flowing creek as well as the presence of mining within the concession.
- ***Electrical Conductivity*** **-** Electrical Conductivity of the surface water samples within the Toolsie Persaud Timber Traders Inc. Forest Concession ranged from 30 μS/cm - 58 μS/cm and were all within the European Union (EU) standards for water i.e. 0 - 2500 μS/cm.
- ***Total Nitrogen*** **-** Total Nitrogen levels of the water samples were WQ1 (1.4 mg/l), WQ2 (1.1 mg/l), WQ3 (1.9 mg/l), WQ4 (1.5 mg/l) and WQ5 (1.5 mg/l) and were all below the World Bank Group IFC EHS Guidelines of 10 mg/l. Total Nitrogen levels for surface water samples WQ6, WQ7 and WQ8 were not detected.
- ***Nitrates*** - Nitrate ion levels of the water samples ranged from 0.2 mg/l to 1.2 mg/l were all within the US EPA accepted range of 10 mg/l.

- ***Phosphates*** - Phosphate levels of the samples were all < 0.54 mg/l; these were all above the US EPA 1986 (≤ 0.1 mg/l) criteria for total phosphorus in streams. This means that the process of eutrophication occurs in the water bodies within the Toolsie Persaud Timber Traders Inc. Forest Concession.
- ***Total Dissolved Solids (TDS) -*** The TDS levels of the water samples ranged from 12 ppm to 22 ppm and were all below the U.S. EPA's Maximum Contaminant Level for TDS of 500 ppm.

The results of the analyses of surface water quality of the Toolsie Persaud Timber Traders Inc. Forest Concession indicated that the existing water quality of the area is a characteristic of the water quality for similar types of areas within Guyana. The results also indicated levels of contamination because of improper gold mining practices within the area. The water quality standards are set out in Tables 12, 13 and the results of the water sample analyses from the Kaizen Environmental Services (Guyana) Inc are attached in Annex XXI.

7.6 Impact prediction and assessment

Impacts on water resources are likely to emerge from three situations: earthworks necessary for road construction and maintenance, skidding logs, and the discharge of pollutants on the forest floor.

7.6.1 Impacts from earthworks

Earthworks include grubbing roadways-felling trees then bulldozing stumps, scarification of the soil surface to remove the root mat, cut and fills on sloping terrain, and compaction. Other impacts come from excavation works for side drains, culverts, bridges and borrow pits.

The hydrological balance in watersheds depend on the nature of the vegetative cover and capacity of the soil to retain water. According to ter Steege et al (1996) the removal of trees during road construction disrupts both the interception of rainfall and the opportunity for plant debris on the soil surface to trap moisture; further grading soil removes root masses and soil fauna which are generally responsible for soil porosity. Ter Steege et al argue that in respect of changes to the hydrological balance, both interception and uptake are reduced to zero. Soil porosity is further reduced by compaction which in turn is due to deforestation (D'Almeida et al, 2006; ter Steege et al 1996). On sloping terrain, soil particles not protected by leaf litter, may be eroded by rainfall (and even wind) and these particles may enter streams where they modify the physical and chemical properties of the water.

7.6.2 Impacts from Skidding

Skidding is responsible for residual stand damage which impacts forest degradation and therefore the hydrological cycle; less skidding will lead to less compaction (ter Steege et al, 1996; Van der Hout, 1999).

7.6.3 Impacts from oil spills, other pollutants

In the use of heavy-duty machines in logging, it is possible to inadvertently spill oil, diesel, or grease. During logging, the accumulation of small spills during routine handling, or larger, accidental spills, can seriously contaminate soils and drainage water; all oils, especially diesel migrate quickly through the soil.

Table 15: GNBS Standards for Industrial Effluent Discharge

Point source discharge Limits for Industrial Effluent for Operations other than Mining, Forestry and Agriculture

Parameter and Maximum Allowable Limits (All values expressed as mg/L except pH, temperature and as otherwise noted)

Sector	pH	Temp.	BOD5	COD	DO	TSS	N as HN3	Total N	P	CN (Tol.)	P04	C1	Surfac-tant	Phenols	Coli-form	O &G	Other and/or Comments
Breweries	5.0-9.0	< 40	<100 (t.v<50)	<250		<100 (t.v. <50)	<50	N as NH3								10	
Cement bagging, manufacturing	5.0-9.0	<40			>4.0	50											WHO Standards for Industries Manufacturing Operations. Turbidity NTU: Max. dy: <150
Citrus processing plants	5.0-9.0	<40	<50	<250		<50	<50									<10	
Distilleries-(a) Blending halls and wineries	5.0-9.0	<40	<50			<50	<50										
Distilleries –(b) Fermentation/Distillation units	5.0-9.0	<40	<500 (t.v. 100)														
Edible oils	5.0-9.0	<40	<50	<250		50		<10								<10	
Meat and seafood processing	5.0-9.0		<100 (t.v.<50)	<250		<100 (t.v. <50)		<50								<30 (t.v.<10)	
Metal finishers	5.0-9.0	<40				<100 as settle-able solids				<0.5	<10						CD:2.0; Cr(tot):2.0; Hg: 1.0; Cu: 3.0; Pb: 0.1; Zn:3.0; Ni:3.0; Fe:5.0; Ba:10; Cr VI: 0.5
Milk based industries	5.0-9.0	<40	<100 (t.v.<50)	<250		<100 (t.v. <50)	<50									<30 (t.v.<10)	
Paint and ink manufacturing	5.0-9.0		<100			<100								<1.0		<30 (t.v. <10)	Cu:<3.0; Ph.:<1.0; Cr: <2.0; Cr VI: 0.5; Ni: <3.0; Zn: <3.0; Hg:<1.0
Pharmaceutical/chemical production	5.0-9.0			<150	>4.0								<0.2	<0.5		<10	Secondary parameters: No3: 40; SO4 2: 1000; Cl: 300; NH4 as N:1.0

Sector	pH	Temp.	BOD5	COD	DO	TSS	N as HN3	Total N	P	CN (Tol.)	P04	C1	Surfac-tant	Phenols	Coli-form	O &G	Other and/or Comments
Petroleum bulk terminal	5.0-9.0	<40	<50	,250		<100										TPH:<40	Pb: 0.1, Cr GT 0,.1 Cr (+A) 05
Printers and photo-processing establishments	5.0-9.0	<40	<30	<150		<50										<10	Ag:0.5; Cd:0.1; Cr VI: 0.1; Cr (tot): 0.5; Cu: 0.5 Zn: 2.0
Soft drinks plants	5.0-9.0	<40	<100 (t.v. <50)	<250		<100 (t.v.<50)	<50										
Breweries	5.0-9.0	< 40	<100 (t.v<50)	<250		<100 (t.v. <50)	<50	N as NH3								10	
Sugar factories	5.0-9.0	<40	<250 t.v.<100	<250	>4.0	<250 (t.v.<100	<250 t.v.<100										
Textiles	5.0-9.0			<250	>4.0	<500 (t.v. 100)						300	<0.2 deter-gents	<0.5	400 MPN Per 100 mls	<10	Cr(tot): 0.5 Cu:0.5; Ni: 0.5; Zn: 2.0; Co: 0.5
Thermal power	5.0-9.0	<40									5	<free Cl: 0.5				<20	WB Stds for metals: Cr (tot): 0.2; Fe: 1.0; Zn: 1.0; Cu: 1.0; New units are to meet these stds. Old units will be phased out within 3 yrs. or pollution equipment will be installed. New WB stds available. No WB std for phosphate, limit taken from India and Sir Lanka.
General environmental guidelines	5.0-9.0	<40	<50	<250		<50 as TSS	<10		<2	<1 Free: 0.1		<Cl: 0.2		<0.5	<400 MPN per 100 mls	<10	WB Std: Fluorine: 20; No limits given for metals.

Table 16: US EPA Standards and World Health Organization Guidelines

(a) Florida USEPA standards for Recreation, Propagation and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife

Florida USEPA standards for Recreation, Propagation and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife		
Parameter	**Fresh**	**Marine**
Phosphorous (mg/L)		≤ 0.1
pH	6.5-8.5	6.5
Fecal Coliform (CFU/100ml/day)	800	800
Dissolve Oxygen (mg/L)	< 5	<5

(b) World Bank Group International Finance Corporation (IFC) Environmental, Health and Safety (EHS) Guidelines for Wastewater and Ambient Water Quality

Pollutants	**Units**	**Guideline Value**
pH	pH	6 - 9
BOD	mg/l	30
COD	mg/l	125
Total Nitrogen	mg/l	10
Total Phosphorus	mg/l	2
Oil and Grease	mg/l	10
Total Suspended Solids	mg/l	50
Total Coliform Bacteria	MPN / 100 ml	400

(c): European Union (EU) 1998 Water Standards

Pollutants	**Units**	**Guideline Value**
Electrical Conductivity	μS/cm	2500

7.7 Mitigation and monitoring

7.7.1 Overview

TPTTI is committed to conserving water resources within the concession area. The company plans six key initiatives (please also see Table 16) to translate its concerns into action. The

forest monitoring officer will be responsible for water conservation practices. Technical inputs will be sought from a duly qualified consultant to retrieve and interpret water quality data.

7.7.2 Employee education through briefing sessions

The key approach to mitigation to be employed by TPTTI is to make environmental conservation a 'state of mind'. The Forest Monitoring Officer will be tasked to provide briefing sessions to all employees to instil in them to the maximum extent possible to need to think about conservation of the environment generally and the conservation of water resources.

7.7.3. Adherence to the COP.

Guidelines of the COP will be followed to the letter: specifically, Sections 4.4.1-4.4.4 which refers to prescribed buffer zones along waterways; Section 5- *'Construction of road network, drainage structures, and water course crossings'*, Section 8-'*Operational Hygiene', and Section 9 'Camp Hygiene'* will be followed to the letter. At no time whatsoever will vehicles be washed in waterways.

7.7.4 Planning versus weather sensitive events

All earthworks and skidding operations will be planned with great care to reduce road density, skid trail density and the deployment of machines. Road construction and road maintenance works will be avoided during the rainy season.

7.7.5 Side drains

TPTTI will take measures to avoid water running from roadside drains directly into streams; the storm water will be channelled via scrub vegetation or rocks to filter out sediment to the maximum extent possible. Wherever convenient, side drains will lead to pits ('dead sumps') at roadside to allow the storm water to infiltrate into the soil rather than flow over land.

7.7.6 Monitoring

TPTTI has identified five monitoring stations where water samples will be taken four (4) times per year, two during dry spells and two during the rainy season.

7.7.7 Extension work with other land-users (miners)

TPTTI will encourage the mining community to respect its earth work practices and to follow its own practices as far as practicable. TPTTI will post advisory signs within selected buffer zones targeting its own operatives, as well as miners.

TPTTI will collaborate with GGMC extension teams to the maximum extent possible to try to force compliance. TPTTI will not be able to apply any consequences for any non-compliance with its protocol. TPTTI cannot afford the administrative effort required to manage any major conflict in the field.

Table 17: Water Quality Monitoring Plan for TPTTI

ACTIVITY	INSTITUTION (S) RESPONSIBLE	FREQUENCY OF MONITORING	LOCATION OF MONITORING
1. Conduct 'Environmental Awareness sessions' for all field operatives using GFC's COP	TPTTI (Forest Monitoring Officer)	Quarterly	BASE CAMP
2. Avoid earthworks during the rainy season	TPTTI (Forest Monitoring Officer)	-	Roads, skid trails & log markets
3. *Surface water* drainage off roads, log markets and other clearings.	TPTTI (Forest Monitoring Officer)	Quarterly	Roads, skid trails & log markets
4. Cleaning of drainage structures (bridges, culverts) along roads and skid trails;	TPTTI (Forest Monitoring Officer)	Quarterly	
5. Observance of the integrity of buffer zones along water ways	TPTTI (Forest Monitoring Officer)	Quarterly	Roads, skid trails & log markets
6. Data Collection at Permanent Monitoring Stations	TPTTI (Forest Monitoring Officer)	Quarterly	Permanent Monitoring Stations

Requirements

Transportation (ATV)
GPS Device
Water bottles
Laboratory Services
BUDGET G$1,000,000.00 per annum (including costs for laboratory analysis)

8.0 SOILS, LAND AND GEOLOGY

8.1 Introduction

Soil may be defined as *a natural terrestrial surface layer containing living matter and supporting or capable of supporting plants;* and Geology refers to *'the science of the solid earth, including the earth's origin and history, materials comprising the earth, and the processes acting within the earth and upon its surface'* (Strahler & Strahler, 1997).

Soil type and hydrology are major determinants of forest composition (ter Steege et al, 1996). Soil types and their respective properties are generally based on the mineral composition of the original parent material, water table dynamics, acid chemistry, biological action and the extent of weathering (Hammond, 2005). Land form or terrain influences vegetation type to the extent that several kinds of mixed forests are available.

8.2 Definitions and scope

Thematic maps obtained from the GFC (see Annex VIII) indicate the presence of three broad soil types, set out in Table 18.

Table 18: Principal soil types and their core properties (GFC 2018, GLASC, 2013).

Code	Description	Area	%	Key properties
1d, 2d	**Kanhapludults**	**59,703.19**	**89**	**Red yellow podzolic soils and red latosols: they are deep, well drained soils with low fertility and prone to erosion**
2c	**Ustochrepts**	**1,737.02**	**3**	**Light textured, well drained loamy soils, low fertility, and does not erode easily.**
2f	**Ustchrepts**	**5,433.15**	**8**	**Very shallow, excessively drained soils, characterised by rock outcrops, very prone to erosion**

To gain more insight into the soil properties and condition, several soil samples were analysed.

8.3 Methodology

Thirteen (13) soil samples of approximately 40 inches in depth of soil were taken and analysed within the TPTTI's forest concession during October 14 - 17, 2018, April 24 - 27, 2018, and May 11 - 12, 2018. The pH and moisture content of the soil samples were measured in-situ using a Vernier technology device (LabQuest) (see Figure 20) with a pH and soil moisture probe and the soil types were identified physically. Soil samples were taken based on the changes in vegetation observed while in the Concession (see Table 19, Figure 21).

8.4 Results and Discussion

Of the thirteen (13) soil samples taken within the Toolsie Persaud Timber Traders Inc. forest concession, the general soil type was found to be predominantly clay and sandy clay; this was noted from the various soil samples collected throughout the project area. The colour of the soils ranged from light/dark brown to brown, either showing some indication of light

weathering or oxidation. The percentage soil moisture content ranged from 12.7 to 32.6 % and soil pH ranged from 4.3 to 6.0 and this is considered common for sandy and clay soils or soils rich in humus. The pH of the soil in the project area is generally acidic and this is considered common for clay soils. These parameters indicate a healthy soil for a tropical forest.

Figure 20: LabQuest Device used for analysing soil samples (Source: Ellis 2018)

Table 19: Results of soil analysis conducted at TPTTI's forest concession

Soil Type (Clay and Sandy Clay)							
		Soil Depth		**Data**			
Sample ID	**Coordinates UTM 21N**	**Top**	**Sub**	**Soil Moisture (%)**	**Soil Type**	**Soil pH**	**Colour**
S1	0241321, 0704664	√	----	23.0	Sandy Clay	5.2	Dark Brown
S2	0242518, 0702209	√	----	22.0	Sandy Clay	4.9	Dark Brown
S3	0241839, 0697731	√	----	12.7	Clay	4.6	Brown
S4	0236481, 0710229	√	----	18.7	Sandy Clay	5.5	Brown
S5	0242470, 0700281	√	----	25.9	Clay	6.0	Dark Brown
S6	0236426, 0707750	√	----	32.6	Sandy clay	4.9	Light Brown
S7	0242556,0702151	√	----	26.7	Sandy clay	4.6	Brown
S8	0244534,0607435	√	----	27.7	Sandy clay	4.3	Brown
S9	0238472,0706203	√	----	21.1	Sandy clay	4.5	Brown
S10	0242910,0698559	√	----	25.1	Sandy clay	4.5	Brown
S11	0245984,0735997	√	----	21.8	Clay	5.4	Brown
S12	0252344,0723997	√	----	20.1	Clay	4.3	Brown
S13	0238307, 0729594	√	----	17.2	Clay	5.2	Dark Brown

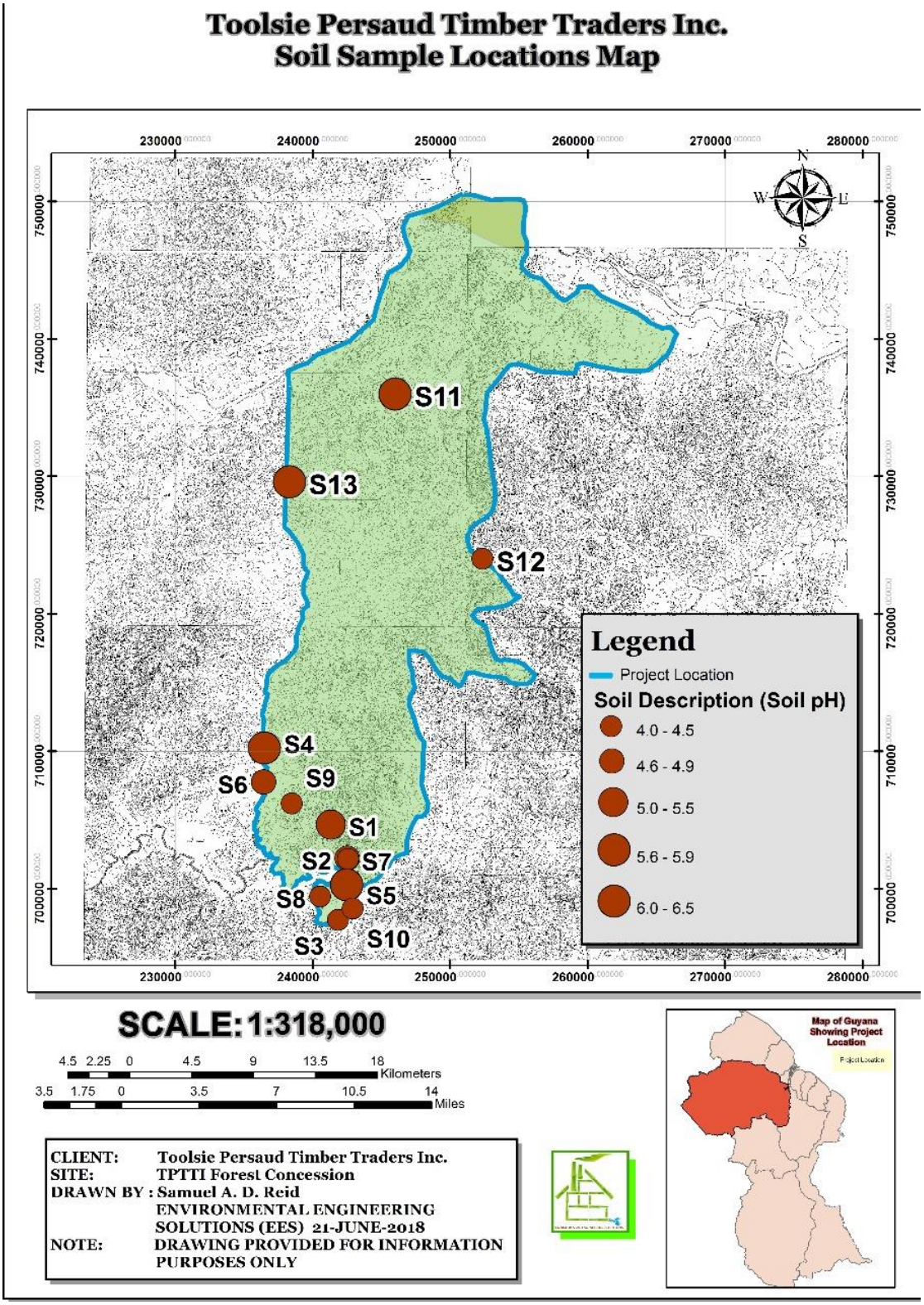


Figure 21: Soil sample points within TPTTI forest concession

8.5 Impact Statement and Assessment

The soils bear the brunt of all interventions on the forest floor including but not limited to road construction and maintenance, skid trail construction, tree felling, log market construction and the setting up of field camps. Physical damage and erosion hazards are very intense where major earth movement occurs such as cuttings on slopes (Richards, 1998). The

skidding of logs 'smears the surface layers of soil and closes pores, reducing infiltration capacity and increasing the likelihood of overland flow and erosion (Richards, 1998; Van der Hout, 1999). TPTTI will be especially careful because of the nature of the terrain and the soil.

A major challenge is expected to come from managing *ex-mining sites* deemed worthy of rehabilitation.

8.6 Mitigation measures

The forest monitoring officer will be responsible for soil conservation practices. Technical inputs will be sought from a duly qualified consultant to take and interpret soil quality data.

TPTTI's efforts to conserve water and waterways are also linked to soil conservation and the two acts will be done together. Other specific actions are as follows:

a. Looking specifically at soils, the main mitigation measure is to plan all interventions so that heavy-duty machines will impact the minimal distance possible and for the minimal time possible. No interventions will be planned during the rainy season.

b. TPTTI will also implement Section 5 of the COP *to the letter*.

c. There will be quarterly briefings with employees to make sure that they maintain vigilance in road use, the management of waste and in their activities near streams.

d. Finally, soil samples will be taken and analysed at the same time as the sampling of water at the permanent monitoring stations.

9.0 AIR QUALITY

9.1 Introduction-Air Quality

Air pollution is defined as the presence of toxic chemicals or compounds (including those of biological origin) in the air, at levels that pose a health risk (Environmental Pollution Centers 2017).

9.2 Definition and scope

Air pollution is one of the most serious environmental problems confronting civilization today and is most often caused by human activities i.e. mining, construction, transportation, industrial work, agriculture, smelting, etc. (Environmental Pollution Centers 2017). This is becoming an increasingly significant problem to growth and development of cities and communities. The air pollutants of major public health concern include: particulate matter, carbon monoxide, ozone, nitrogen dioxide, sulphur dioxide and metals, such as lead (Hedges, 2004) (World Health Organization 2012).

Particulate Matter (PM) - also known as particle pollution is a complex mixture of extremely small particles and liquid droplets that get into the air (USEPA 2017). Once inhaled, these particles can cause serious health effects and can affect the lungs and heart of human beings (USEPA 2017). Particulate Matter comprises both coarse and fine particles. The coarse particles (PM_{10}) have an aerodynamic diameter between 2.5µm and 10µm. Fine particles have an aerodynamic diameter less than 2.5µm ($PM_{2.5}$). These particles are formed from gas by chemical reactions; and condensation of high-temperature vapours during combustion (Fierro 2000).

Total Suspended Particulates (TSP) - This refers to all particles in the atmosphere that are less than 100 micrometres. The amount of PM_{10} and $PM_{2.5}$ are related to the amount of total suspended particulates (TSP) in the air (Alias, Hamzah, and Kenn 2007). Particulate Matter guidelines and standards are instituted (Table 4) due to short term and long-term health effects including premature mortality, chronic respiratory disease, acute respiratory systems, decreased lung functions and aggravated asthma, persistent cough, phlegm, wheezing and physical discomfort (Fierro 2000, p.5) (Alias, Hamzah and Kenn 2007, p.258). These health effects are especially associated with PM_{10} and $PM_{2.5}$. The PM_{10} fraction from TSP can reach the lower regions of the respiratory tract. On the other hand, $PM_{2.5}$ can absorb more toxic and carcinogenic compounds than larger particles and penetrate more easily deep into the lungs (Alias, Hamzah and Kenn 2007, p.256). Additionally, there is increased harm to the environment as PM is a major source of haze that reduces visibility, causes changes to nutrient and chemical balance of the soil and aquatic environment, erosions and staining of structures (residential, commercial, or cultural monuments) (Hedges 2004, p.58).

9.3 Air Quality Standards/Guidelines

The purpose of the ambient air quality standards are to establish maximum limits on parameters of air quality considered desirable for the preservation and enhancement of the quality of air resources and health (Mecklenburg County NC 2012). Air quality standards are set by each country to protect the public health of their citizens and as such are an important component of national risk management and environmental policies. National standards will

vary according to the approach adopted for balancing health risks, technological feasibility, economic considerations and various other political and social factors, which in turn will depend on, among other things, the level of development and national capability in air quality management (World Health Organisation 2006).

Air quality data in Guyana is extremely limited given the constraints relating to the unavailability of equipment and cost associated with this type of data collection. There was no historical air quality data for the Toolsie Persaud Timber Traders Inc. Forest Concession, however, a preliminary assessment of air quality was done on October 14, 15 and 17, 2018, April 24 - 27, 2018 and May 11 and 12, 2018, and it reflected the Total Suspended Particulate (TSP) concentration of the Project location.

9.4 Methodology/Monitoring Procedure

The Total Suspended Particulate (TSP) measurements were taken using the Thermo pDR-1000AN personalDataRAMTM Particulate Monitor (Figure 22). TSP measurements recorded in milligram per cubic meter (mg/m^3), were taken at various sample sites (See Figure 23) after a log interval of 5 minutes (Thermo Electron Corportation 2005). After the 5-minute interval log time, the real time Concentration value, the Maximum Concentration value, and the Time Weighted Average (TWA) concentration in milligrams per cubic meter (mg/m^3) were recorded from each sample site. The wind direction and temperature at time of monitoring at each site was recorded. Conversions from milligrams per cubic meter (mg/m^3) to micrograms per cubic meter ($\mu g/m^3$) were done by taking the milligrams per cubic meter (mg/m^3) measurements x 1000 (Hedges 2004, p.23). Micrograms per cubic meter ($\mu g/m^3$) results were then compared to the United States Environmental Protection Agency (USEPA) 1971 National Ambient Air Quality Standards (NAAQS) for Particulate Matter, as a current TSP limit permissible utilised (See Table 20). Quality assurance and quality control (QA/QC) was practiced, as well as routine parts of the air quality monitoring during the calibration, operation, and maintenance of the monitoring equipment.

Table 20: National Ambient Air Quality Standards for Particulate Matter, 1971. (Source: USEPA 2016).

Air Pollutant	National Ambient Air Quality Standards (NAAQS) 1971	Averaging Time	Level ($\mu g/m^3$)	Form
Total Suspended Particles (TSP)	Primary	24-hour	260 $\mu g/m^3$	Not to be exceeded more than once per year.
		Annual	75 $\mu g/m^3$	Annual geometric mean.
	Secondary	24-hour	150 $\mu g/m^3$	Not to be exceeded more than once per year.
		Annual	60 $\mu g/m^3$	Annual geometric mean.

Figure 22Thermo pDR-1000AN personalDataRAMTM Particulate Monitor (Source Ellis, 2018):

Figure 23: Air Quality Monitoring near a creek within the Concession (O. Ellis, 2018).

9.5 Data set

The following Table 21 and maps (Figure 24, 25) show the results of Total Suspended Particulates concentration taken within and around the Toolsie Persaud Timber Traders Inc. Forest Concession. Table 18 below contains the Average Concentration, Time Weighted Average (TWA) and Maximum Concentration of the air quality during the monitoring period.

Table 21: Results of TSP Measurement within and around TPTTI's concession.

Sample ID	Coordinates UTM 21N	Time		Data µg/m³			Wind		Temp. (°C)
		Start	End	TWA	Max. Con	Avg. Con	Direction	Speed (m/s)	
Dry Season									
AQ1	0241321, 0704664	12:22	12:28	19	51	29	NW	0.0	30.0
AQ2	0242518, 0702209	14:24	14:30	28	52	18	NW	0.0	29
AQ3	0241839, 0697731	15:38	15:43	25	75	21	NW	0.0	29
AQ4	0242470, 0700281	11:49	11:54	30	68	41	NW	0.0	27.4
Wet Season									
AQ1	0236426, 0707750	13:25	13:31	112	165	115	NW	0.0	30.0
AQ2	0242556, 0702151	10:08	10:14	100	142	94	NW	0.0	28.4
AQ3	0244534, 0607435	14:45	14:51	103	144	104	NW	0.0	29.6
AQ4	0238472, 0706203	14:43	14:49	109	174	112	NW	0.0	26.6
AQ5	0242910, 0698559	10:15	10:21	124	146	123	NW	0.0	27.4
AQ6	0245984, 0735997	11:21	11:27	89	109	92	NW	0.0	23
AQ7	0252344, 0723997	07:35	07:41	99	109	93	NW	0.0	25
AQ8	0238307, 0729594	09:40	09:46	184	203	173	NW	0.0	26

9.6 Impact Assessment

9.6.1 Dry Season

Monitoring showed the TSP levels of TWA and Maximum Concentration (Max. Conc.). TWA of the monitored area ranged from 19 - 30 µg/m^3, while maximum concentration ranged from 51 - 75 µg/m^3 respectively, during the monitoring period (Table 5).

- The TWA readings varied among the four (4) sites, with the highest TWA concentration recorded at AQ4 (30 µg/m^3), AQ2 (28 µg/m^3), AQ3 (25 µg/m^3), and AQ1 (19 µg/m^3). In comparison with the USEPA 1971 National Ambient Air Quality Standard (NAAQS) 150 µg/m^3 24-hours average, the values recorded at AQ1, AQ2, AQ3, and AQ4 were all below the TSP Air Quality Standard during the monitoring period.

- The highest Maximum Concentration were at AQ3 (75 µg/m^3), AQ4 (68 µg/m^3), AQ2 (52 µg/m^3) and AQ1 (51 µg/m^3). The Maximum Concentration is the highest value detected by the sensor during the monitoring time (5 minutes); therefore, this does not represent the average maximum concentration. In comparison with the USEPA 1971 NAAQS 150 µg/m^3 24-hours average, measurements showed that AQ1, AQ2, AQ3, and AQ4 were all below the USEPA 1971 NAAQS - TSP AQS during the time of monitoring.

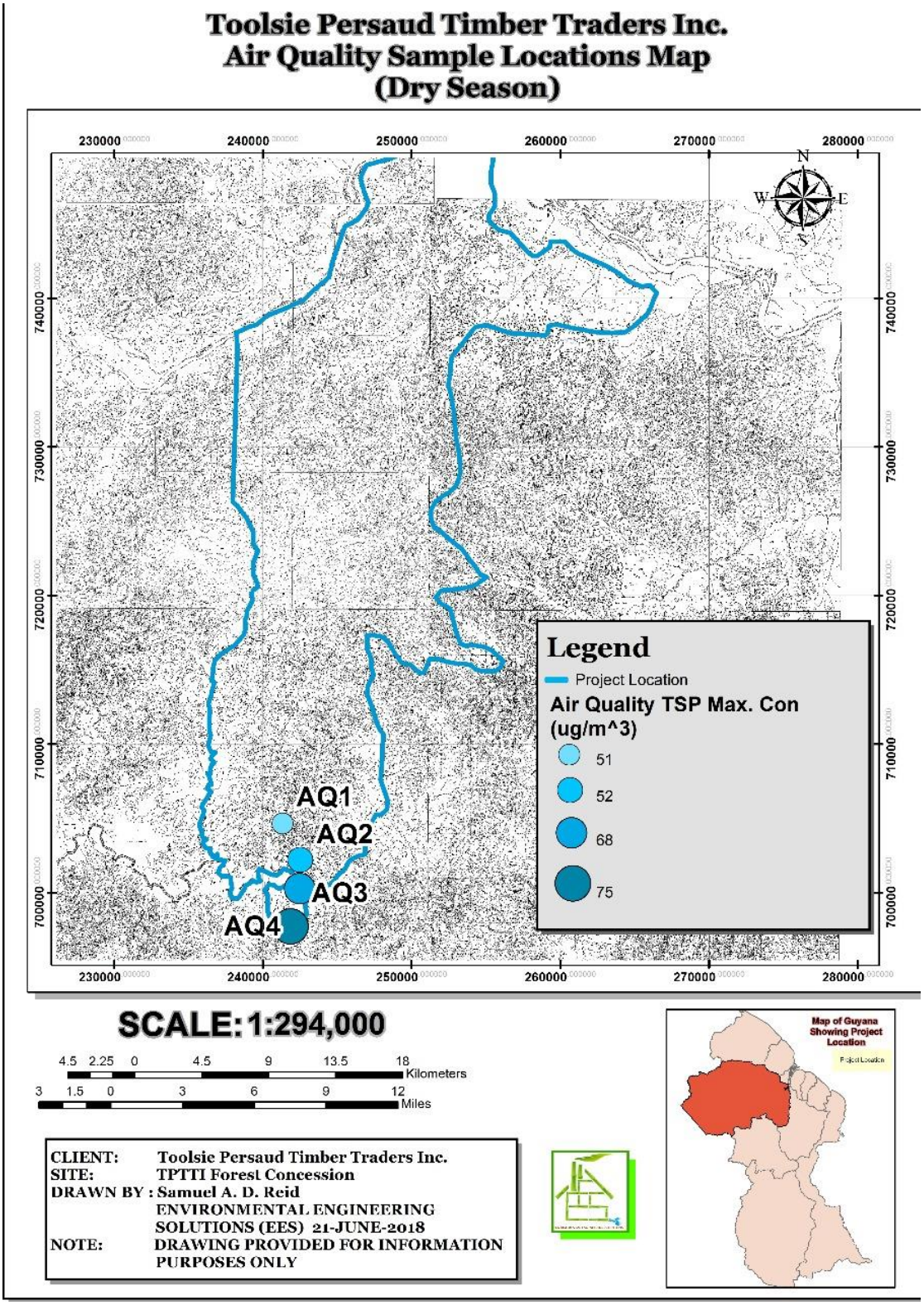


Figure 24: Air Quality sample points-TPTTI's Forest Concession-Dry Season (Reid, 2018)

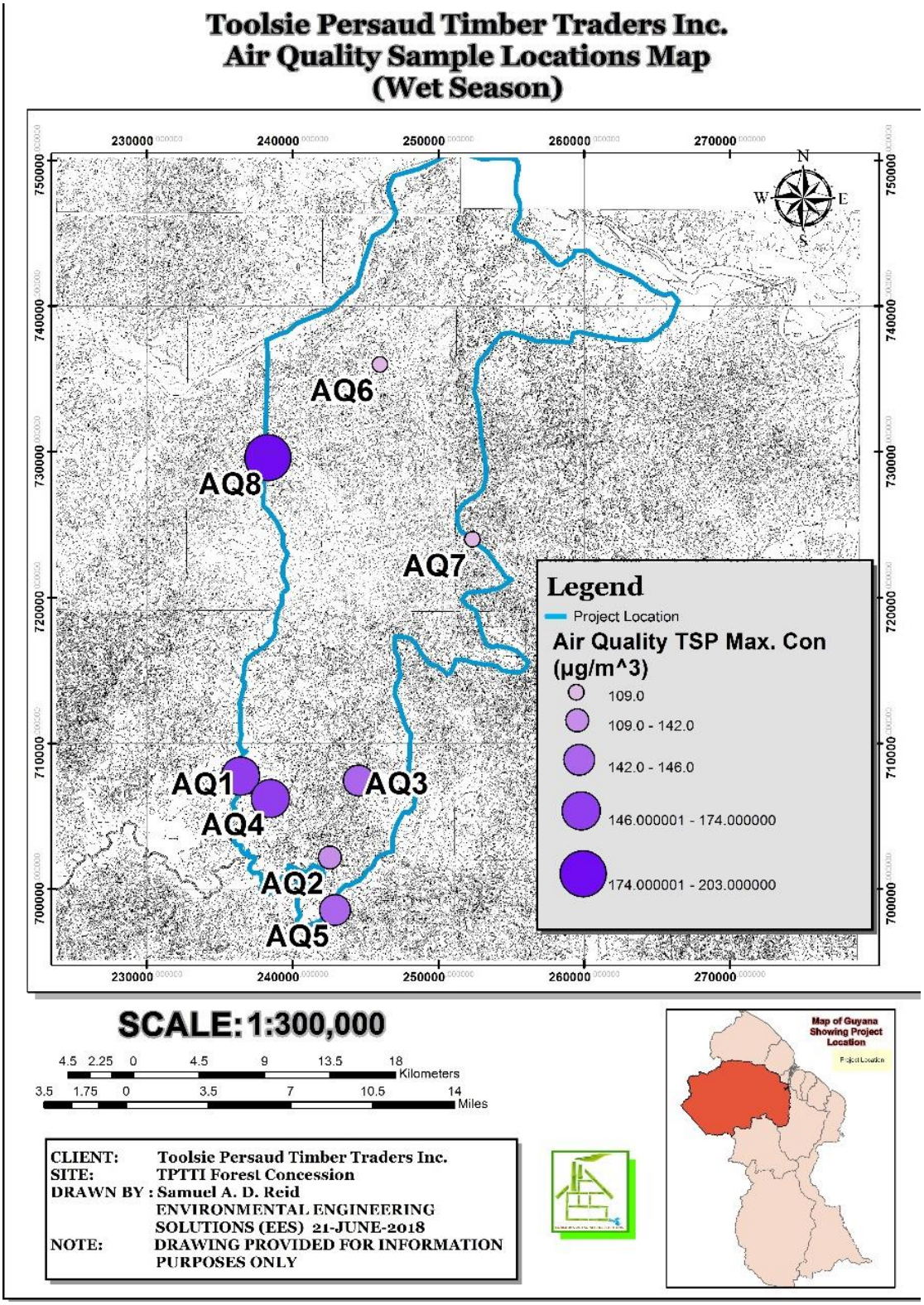


Figure 25: Air Quality Locations-TPTTI's Concession-Dry Season (Reid, 2018)

- The average concentration values recorded at the Toolsie Persaud Timber Traders Inc. Forest Concession were AQ4 (41 µg/m^3), AQ1 (29 µg/m^3), AQ3 (21 µg/m^3), and AQ2 (18 µg/m^3), these values were all below the USEPA 1971 National Ambient Air Quality Standards (NAAQS) 150 µg/m^3 24-hours average.

9.6.2 Wet Season

Monitoring showed the TSP levels of TWA and Maximum Concentration (Max. Conc.). TWA of the monitored area ranged from 89 - 184 µg/m^3, while maximum concentration ranged from 109 - 203 µg/m^3 respectively, during the monitoring period.

- The TWA readings varied among the eight (8) sites, with the highest TWA concentration recorded at AQ8 (184 µg/m^3). In comparison with the TSP USEPA 1971 National Ambient Air Quality Standard (NAAQS) 150 µg/m^3 24-hours average, the values recorded at AQ8 was above the TSP Air Quality Standard. TWA levels for the other seven (7) sample points i.e. AQ1 (112 µg/m^3), AQ2 (100 µg/m^3), AQ3 (103 µg/m^3), AQ4 (109 µg/m^3), AQ5 (124 µg/m^3), AQ6 (89 µg/m^3) and AQ7 (99 µg/m^3) were all below the limit during the monitoring period.

- The highest Maximum Concentration were recorded at AQ8 (203 µg/m^3), AQ4 (174 µg/m^3) and AQ1 (165 µg/m^3). In comparison with the USEPA 1971 NAAQS 150 µg/m^3 24-hours average, measurements showed that AQ8, AQ4 and AQ1 were above the USEPA 1971 NAAQS - TSP AQS during the time of monitoring while the other five sample points i.e. AQ2 (142 µg/m^3), AQ3 (144 µg/m^3), AQ5 (146 µg/m^3), AQ6 (109 µg/m^3), and AQ7 (109 µg/m^3) were all below the limit.

- The highest average concentration value was recorded at AQ8 (173 µg/m^3), this value was above the USEPA 1971 National Ambient Air Quality Standard (NAAQS) 150 µg/m^3 24-hours average while the other seven (7) values were below.

Most of the TWA, Average and Maximum concentration readings were below the USEPA 1971 National Ambient Air Quality Standards (NAAQS) 150 µg/m^3 24-hours except for AQ8 and the maximum concentration values of AQ4 and AQ1 due to human activity i.e. mining during the time of monitoring.

9.7 Mitigation measures

Mitigation measures will be applied at the concession level, at the five monitoring stations and on the Kartabu-Puruni Road/Iteballi.

Concession area

The forest monitoring officer will be responsible for air quality management including addressing complaints from stakeholders and for preparing reports in this regard to the EPA and GFC. Technical inputs will be sought from a duly qualified consultant to take and interpret air quality data.

At the concession level, dust may not be much of a problem because trucks will make one trip per day and will not travel more than 50km/hr. Every effort will be made to maintain vehicles in a fully functional state so that exhaust emissions are within the projected parameters for the machine.

Permanent Monitoring Stations

Air quality will be monitored at the five permanent monitoring stations to be implemented by TPTTI while water quality and soil quality parameters are taken.

Kartabu-Puruni Road/Iteballi

On the Kartabu-Puruni Road, the following measures will apply (see Summary in Table 21):

a) Trucks will always travel < 65km/hr. and will always be using rotating orange beacons on the top of the cab or travel with its main headlights on;

b) Truck cabs will be sprayed in orange colour to ensure the vehicle is visible from a distance.

c) Trucks will always slow down to 25 km/hr. near communities, unless there are humps on the road when trucks will come to a stop before crossing the hump.

d) No logs will be hauled at night.

Table 22: Summary of Measures for TPTTI's Air Quality Monitoring Plan

ACTIVITY	**PARTY RESPONSIBLE**	FREQUENCY OF MONITORING	**LOCATION**
Data Collection at Permanent Monitoring Stations	TPTTI (Forest Monitoring Officer	Quarterly	Permanent Monitoring Stations
Ensure all vehicles are in a fully functional state	TPTTI (Forest Monitoring Officer)	Quarterly	Iteballi Service Station
Engagement with the mining community, other stakeholders	TPTTI (Forest Monitoring Officer)	Quarterly	
Requirements • Transportation (ATV) • GPS Device • Thermo pDR-1000AN personalDataRAMTM Particulate Monitor • Laboratory Services			
BUDGET G$1,000,000.00 per annum (including costs for laboratory analysis)			

10: CLIMATE AND CLIMATE CHANGE

10.1 Introduction-Guyana's climate[19]

Guyana has a tropical climate with almost uniformly high temperatures and humidity, and much rainfall. Seasonal variations in temperature are slight, particularly along the coast. Although the temperature never gets dangerously high, the combination of heat and humidity can at times seem oppressive. The entire area is under the influence of the northeast trade winds, and during the midday and afternoon sea breezes bring relief to the coast. Guyana lies south of the path of Caribbean hurricanes, and none is known to have hit the country.

Temperatures in Georgetown are quite constant, with an average high of 32°C and an average low of 24°C in the hottest month (July), and an average range of 29°C to 23°C in February, the coolest month. The highest temperature ever recorded in the capital was 34°C and the lowest only 20°C. Humidity averages 70 percent year-round. Locations in the interior, away from the moderating influence of the ocean, experience slightly wider variations in daily temperature, and night time readings as low as 12°C have been recorded. Humidity in the interior is also slightly lower, averaging around 60 percent.

Rainfall is heaviest in the northwest and lightest in the southeast and interior. Annual averages on the coast near the Venezuelan border are near 250 cm, farther east at New Amsterdam 200 cm, and 150 cm in southern Guyana's Rupununi Savannah. Areas on the northeast sides of mountains that catch the trade winds average as much as 350 cm of precipitation annually. Although rain falls throughout the year, about 50 percent of the annual total arrives in the summer rainy season that extends from May to the end of July along the coast and from April through September farther inland. Coastal areas have a second rainy season from November through January. Rain generally falls in heavy afternoon showers or thunderstorms. Overcast days are rare; most days include four to eight hours of sunshine from morning through early afternoon.

Climographs for Iteballi, about 100km, east of the concession and Aranka about 30km up Cuyuni River (see Figures 26 and 27 respectively).

10.2 Concepts-Climate Change

Much of the energy the earth absorbs from the sun is reradiated as heat to the atmosphere: some of this reradiated heat is trapped in the atmosphere: while some of it escapes into space much of the atmospheric energy is in turn reradiated back to earth and this process helps maintain earthly temperatures that ensure life on earth. Greenhouse gases in the atmosphere including water vapour, carbon dioxide, methane, and nitrous oxide act to make the earth's surface warmer because they emit heat energy in all directions including downwards and are directly responsible for maintaining a greenhouse effect that ensure global temperatures that sustain life.

[19] Countrydtudies.us/Guyana/21.htm

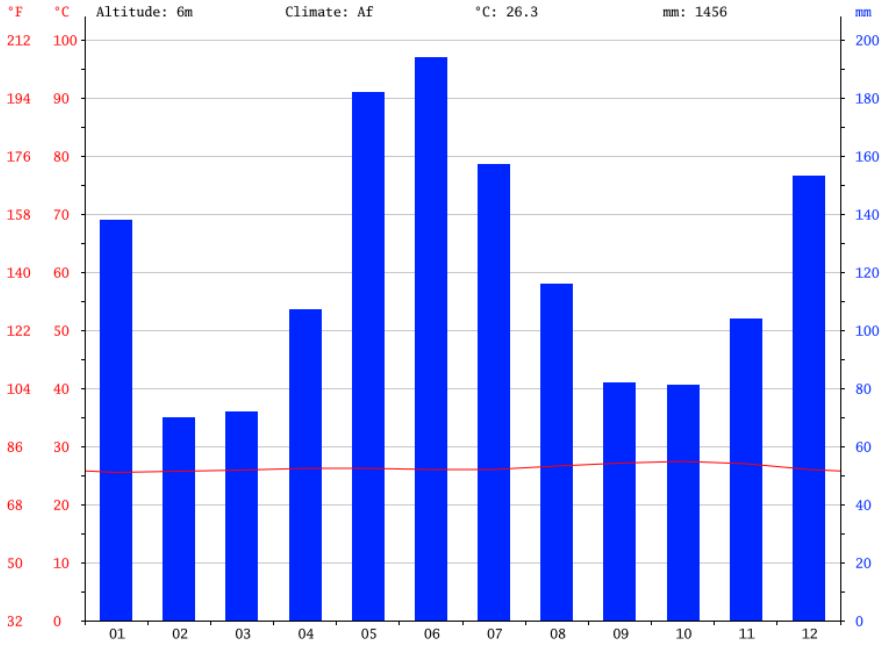


Figure 26 Climograph for Iteballi, L.B. Mazaruni River[20].

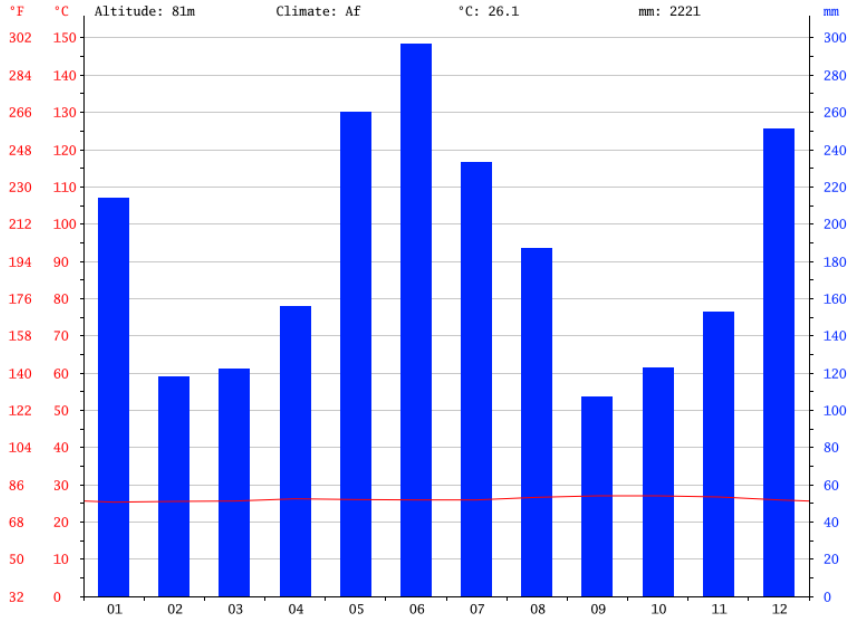


Figure 27: Climograph for Aranka, LB Cuyuni River

It is generally believed that the *accelerated addition* of greenhouse gases to the atmosphere would lead to relatively more reradiated energy and therefore higher temperatures on earth which would upset the natural equilibrium of nature. Scientists also believe that the accelerated addition of the gases that provoke the greenhouse effect is due in part to the

[20] https://en.climate-data.org/location/775816/

combustion of fossil fuels, deforestation-which reduces the amount of CO_2 absorbed by plants, agricultural activities, and the use of certain gases in refrigerators and air-conditioners.

The term *global warming* is used to describe the rising temperatures resulting from human activities while the term climate change refers to the complete suite events that will change, including patterns of temperature, wind, and rainfall (Primack & Corlett, 2005).

Scientists also believe that CO_2 is primary gas responsible for global warming, and part of their response to the threat is to conserve forests and encourage new forest growth. Forest conservation helps ensure the absorption of CO_2 that may otherwise escape into the atmosphere.

Forests contain a substantial part of the Earth's carbon, current rates of forest loss contribute 20% of total emissions of CO_2 (Van Bodegom, Savenjie & Wit, 2009). Forests are not only important for absorbing CO_2, forests also help maintain uniformity in natural temperatures by its influence on micro-climate. The more extensive the forests, the greater the impact.

According to Richards (1998), forests maintain climatic equilibrium through its impacts on microclimates based on damping effects on wind movement, humidity in the forest environment, temperatures in the forest environment, transpiration, evapotranspiration and hydrological influences.

10.3 Key relevant policy, legislation, guidelines, standards etc.

Section 24 (h) of the Protected Areas Act, 2011 sets out that Objectives of the National protected Areas System includes '*assist in combatting climate change by*

a) *Ensuring that Guyana's existing forests are maintained, and protected degradation and their ecosystem functions are safeguarded*
b) *Promoting the restoration and expansion of Guyana's natural forest cover*
c) *Protecting marine ecosystems*
d) *Protecting freshwater ecosystems and important watersheds*.

The Water and Sewerage Act, 2002 provides for the setting up of the Hydrometeorological Department whose functions include 'to establish, manage, and operate national systems to monitor atmospheric conditions, climate change and water resources'.

10.4 Global Initiatives to safeguard forests

Over the years the international community have developed initiatives to help countries with major forest resources to safeguard them on the one hand and on the other to encourage countries with massive industrial bases to put limits on their gas emissions.

According to Ghazoul & Sheil (2010) the major international and bilateral initiatives to conserve forests are:

a) **Emphasis on conservation areas**: protected area systems, indigenous and extractive reserves, conservation concessions and debt for nature swaps;

b) **Forest conservation and livelihoods**: sustainable forest management, reduced impact logging, forest certification, ecotourism, payment for environmental services (PES), bio-prospecting, wildlife management, ecotourism and enterprises based on NTFPS.

Certification is widely advocated as a strategy to conserve the world's forests and the biodiversity which they contain (Sheil, Putz & Zagt, 2010).

c) **Governance**: combat on corruption, the Kyoto Protocol and REDD+

The UNFCCC was established at the Earth Summit in Rio-de-Janeiro in 1992, followed in 1997 by the more powerful and legally binding Kyoto Protocol (see Table 4).

10.5 Initiatives in Guyana

In Guyana, the Office of Climate Change (OCC), situate within MOTP, works across the Government of Guyana to support work on climate adaptation, mitigation, and forest conservation; it drives the development of the GSDS the advancement of the Government's green agenda; it also and coordinates the Government of Guyana's engagement with international forestry programmes such as the Forest Carbon Partnership Facility, the Forestry Investment Programme and UN-REDD.

A major initiative of the OCC is its engagement with UNDP-which has pledge support for Guyana's 'green' endeavours-to finalise official guidelines for the reduction of Green House Gases (GHG) of municipalities across Guyana. The guidelines were defined in the final draft of the Nationally Appropriate Mitigation Actions (NAMA): greening of Towns in Guyana.

Generally, Guyana-collaboration with international agencies and environmental NGOs, has been very proactive in putting measures in place to contribute to climate mitigation initiatives.

Initiatives include:

a) The establishment of the Iwokrama International Centre, 1996.

b) The establishment of the Environmental Protection Agency (1997;)

c) The requirement for ESIAs and/or Environmental Management Plans for large land based or industrial projects;

d) The development of a protected areas system;

e) The development of Codes of Practices for the forestry sectors and the mining sectors respectively;

f) The adoption of *reduced impact logging* as the basic standard for commercial timber operations;

g) The establishment of a Faculty of Earth and Environmental Sciences, University of Guyana, 2017;

h) The establishment of a PES project with Norway;

i) The development of a VPA with the EU (2018)

j) Revised forest policy and forestry legislation that address broader forest values (rather than timber production), 2018.

k) The signing on to many international agreements and conventions (see Table 3);

l) The development of a Low Carbon Development Strategy, 2030;

10.6 Initiatives by TPTTI

Climate change mitigation requires a shared understanding of the issues and a collective approach to generating solutions for problems as they emerge. A major issue is the availability of data to guide decision makers in adopting prescribed practices.

TPTTI will take five approaches to local initiatives to manage climate change:

a) Keep abreast of nation policy positions and discussions initiated mainly by the DOE-MOTP: TPTTI will undertake weekly scans of DPI's website.

b) Follow the guidelines, standards and practices recommended by the GFC and the EPA: TPTTI will engage directly with the GFC in development of its logging operations; TPTTI will also engage with the EPA in reporting on environmental

c) Participate in discussions on sectored initiatives on issues of sustainable forest management climate such as those embodied in formal initiatives like the VPA between GOG and the EU; and

d) Participate in local (Iteballi based) initiatives on waste management, noise abatement or dust nuisances.

10.7 Responsibility for climate change-based initiatives

TPTTI's forest monitoring officer will be responsible for managing the company's efforts at climate change mitigation.

TPTTI's climate change-based initiatives will be linked to data collected on water quality and air quality respectively

11.0 BIOLOGICAL RESOURCES

11.1 Flora

11.1.1 Overview

The merchantable timber resource SFEP 2/2013 is the primary resource of TPTTI's business interest.

Ter Steege (2000) classified the forests within the Kartabu Triangle primarily as *Central Guyana Wet Forests*, but TPTTI believes that there is some overlap with *Northwest Wet Forests* and. In composition, the forests appear within the concession area appear like the Central Wet Forests, except that there are no extensive white sands described as the Berbice Formation, typical of Central Wet Forests. The forests within the concession area are predominantly *clayey loam soils on undulating terrain*.

Despite marked differences in terrain across the concession area, the vegetation map (see Annex X) sourced from the GFC indicate a *homogeneous forest type* for 97% of the concession area. The forest types indicated on the vegetation map are: (a) 1.1 Mixed forests on undulating or hilly terrain, comprising 1,735.63 ha (3% of the concession area, all of which are in the biodiversity reserve); and (b) 1.2 Mixed forests on flat to undulating terrain, generally on clay or loam, comprising 65, 137.73 ha (97% of the concession area). GFC's notation on its map also indicate the overlapping nature between Northwest Wet Forests and Central Guyana Wet Forests.

The type 'Mixed forests on undulating or hilly terrain' occurs only at the northern tip of the forest concession area; the biodiversity reserve was put into the northern extremity of the concession area).

11.1.2 Preparatory work

The consultants reviewed two existing data sets covering the forest concession. TPTTI conducted 100% pre-harvest inventory over 700ha at the southern end of the concession area, however 100% pre-harvest inventories are biased towards merchantable timber harvests and does not for example capture data on understory species or other plant communities such as palms or lianas.

Barama Housing-a logging enterprise that had formerly displayed an interest in the northern part of the concession area-conducted management level inventory over the northern extremity of the concession area; the data, in terms of species composition appeared consistent with that reported by ter Steege's (2000). (Barama Housing's data set also indicated a wider variety of merchantable species, which supports the decision to put the biodiversity reserve at the northern tip of the concession.

Despite the existence of the two data sets, the consultants decided to undertake additional work targeting inter alia, more information on the understorey conditions.

11.1.3 Methodology

The consultants used the procedures prescribed by the GFC, the key protocol of which is illustrated in Figure 28 (see also Annex XVI).

Essentially, three parallel transect lines of length 7km and 2km apart were cut in a north south orientation perpendicular to the main internal stream system within the concession area.

Circular plots of radius 17.84m and area of 0.1ha (with a sub-plot of radius 7.98m and an area of 0.02ha were set out at the start of the line and thereafter at intervals of 500m. Fifteen plots were enumerated per line, giving rise to a total sample of 45 plots (4.5ha)

Trees in the main plot were taken from 35cm DBH while trees in the subplot were taken in the range 10cm to 34.9cm. Several key site factors were recorded as per the form used.

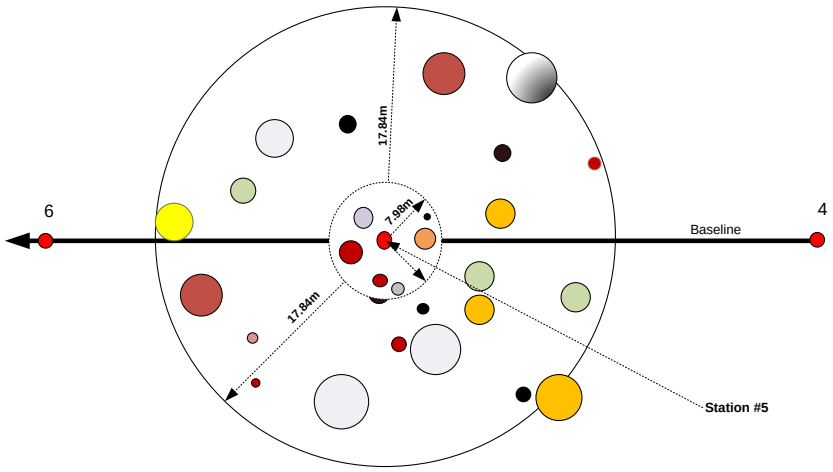


Figure 28: Diagram showing plot layout for ML Inventory

11.1.4 Data Processing

The enumeration data was placed on a master spread sheet. A second 'clean' spread sheet was generated from the first after the removal of all trees with Risk classes 3 or 4. Also trees not normally harvested such as Asepoko (*Pouteria guianensis*), Parakusan (*Swartzia jenmanii*) and Yarula (*Aspidosperma excelsum*) were removed from the database; this resulted in the removal of 37.7% of the trees initially enumerated (-trees that would not be considered for harvest but will remain in the forest and contribute to all forest functions). (From a conservation point of view, it should be noted that after 'tree marking activity' up to 20% of the trees remaining from the earlier cull, may not be harvested due to site conditions-buffer zones, steep slopes-or their proximity to other (protected) trees.

11.1.5 Results

General features

88% of the forest types were characterized as mixed forests and 82% of the plots were on sloping terrain, with slope % ranging from 2 to 16% and a mean of 5.68%: this confirms the nature of the dominant forest type as mixed forests the nature of the terrain is generally flat to undulating terrain. There were small pockets of swamp encountered near large rivers with typical or indicator species such as Mora (*Mora excelsa*), and Corkwood (*Pterocarpus spp)*.

55% of the plots were characterised by windfall trees, which seem to indicate the occasional presence of very strong winds.

15% of the plots were characterised by either extensive low bushes or ropey (liana) forests: it is possible that these plots were affected by heavy storms in the recent past that created gaps and allowed for light demanding lianas to develop. The most common lianas were Kufa (*Clusia spp*.), Mibi (*Heteropsis jenmanii*), Monkey Ladder (*Bauhinia guianensis*) and Kapadulah

(*Davilla spp.*). Palm trees present were Ite (*Mauritia flexuosa)* and Manicole palm (*Euterpe edulis*) in the swampy areas and representatives of *Astrocaryum* spp. and *Bactris spp.* on sloping ground.

Generally, too, based on data from sub-plots, there is a robust understory vegetation, representing juvenile trees of the species in the canopy layer.

In ex-mining areas, *mats* of lianas interspersed with weeds were common and these suppressed seedlings of the dominant trees in the area.

*Operational data-**Merchantable** stock*

Species abundance-merchantable stock: (after culling trees of bad form or trees that are not merchantable at this time, the most abundant species enumerated were Black Kakaralli (13.2%), followed by Mora (12.6%), Soft Wallaba (10%), Morabukea (9.5%), Haiariballi (8.4%), Wamaradan (7.9%), and Greenheart (6.3%). Purpleheart came in with a value of 1.1% of all trees enumerated. A list of the merchantable species enumerated is listed in Table 20. For merchantable stock, the diameter at breast height ranged from 35cm to 110 cm with a mean diameter of 50.1cm. The merchantable stem heights ranged from 5m to 20m with the mean stem height being 10.5m. 46% of all trees were in the dbh class 35-44.9cm while 47% of all trees were in the diameter class 45cm to 74.9cm (see Figure 29).

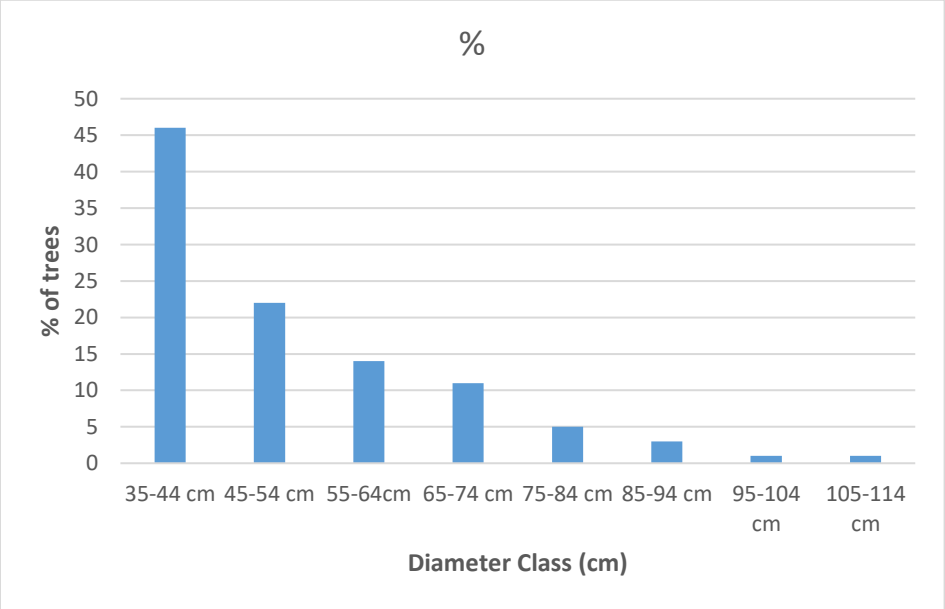


Figure 29: Diameter Class distribution-merchantable stock, SFEP 2/2013

The merchantable stocking of trees (see Table 23) has been computed at 64.43±13.16m^3/ha for a 95% confidence level. This implies that generally, the minimum volume expected per ha is 51m^3, far more than the 20m^3 the company plans to harvest.

Table 23: List of merchantable species encountered in SFEP 2/2013

#	Common Name	Botanical Name	Family Name	CITES	IUCN
	Species recorded during ML Inventory				
1	Aromata	Clathrotropis brachypetala	LEGUMINOSAE/Papilionoideae	-	-
2	Baromalli	Catostemma spp.	BOMBACACEAE	-	-
3	Black Kakaralli	Eschweilera spp.	LECYTHIDACEAE	-	-
4	Blackheart	Acosium praeclara	LEGUMINOSAE/Papilionoideae	-	-
5	Burada	Parinari spp	CHRYSOBALANACEAE	-	-
6	Fukadi	Terminalia spp	COMBRETACEAE	-	-
7	Greenheart	Chlorocardium rodiei	LAURACEAE	-	-
8	Haiariballi	Alexa spp.	LEGUMINOSAE/Papilionoideae	-	-
9	Itikiboroballi	Swartzia spp	LEGUMINOSAE/Papilionoideae	-	-
10	Ituri Wallaba	Eperua grandiflora	LEGUMINOSAE/Caesalpiniaceae	-	-
11	Kabukalli	Goupia glabra	CELASTRACEAE	-	-
12	Kereti	Ocotea spp.	LAURACEAE	-	-
13	Kokoritiballi	Pouteria spp	SAPOTACEAE	-	-
14	Kurokai	Protium decandrum	BURSERACEAE	-	-
15	Limonaballi	Chrysophyllum pomifera	SAPOTACEAE	-	-
16	Monkey Pot	Lecythis zabucajo	LECYTHIDACEAE	-	-
17	Mora	Mora excelsa	LLEGUMINOSAE/Caesalpiniaceae	-	-
18	Morabukea	Mora gonggrijpii	LEGUMINOSAE/Caesalpiniaceae	-	-
19	Purpleheart	Peltogyne pubescens	LEGUMINOSAE/Caesalpiniaceae	-	-
20	Ruri	Chaetocarpus spp.	EUPHORBIACEAE	-	-
21	Shibadan	Aspidosperma alba	APOCYNACEAE	-	-
22	Soft Wallaba	Eperua falcata	LEGUMINOSAE/Caesalpiniaceae	-	-
23	Tatabu	Diplotropis purpurea	LEGUMINOSAE/Papilionoideae	-	-
24	Ulu	Trattinickia sp.	BURSERACEAE	-	-
25	Wamara	Swartzia leiocalycina	LEGUMINOSAE/Papilionoideae	-	-
26	Waramadan	Dycorynia guianensis	LEGUMINOSAE/Caesalpinioideae	-	-
27	Wina Kakaralli	Lecythis corrugata	LECYTHIDACEAE	-	-
28	Crabwood	Carapa guianensis	MELIACEAE	-	-
29	Dukali	Parahancornia amapa	APOCYNACEAE	-	-
30	Hububalli	Loxopterygium sagotii	ANACARDIACEAE	-	-
31	Locust	Hymenea courbaril	LEGUMINOSAE/Caesalpiniaceae	-	-
32	Simarupa	Simaruba amara	SIMAROUBACEAE	-	-
	Bulletwood	Manilkara bidentata	SAPOTACEAE	-	-
	Dukaliballi	Brosimum paraense	MORACEAE	-	-
	Hakia	Tabebuia serratifolia	BIGNONIACEAE	-	-
	Manni	Symphonia globulifera	GUTTIFERAE	-	-
	Pakuri	Platonia insignis	GUTTIFERAE	-	-
	Washiba	Tabebuia sp.	BIGNONIACEAE	-	-

11.2 Fauna

11.2.1 Overview

Guyana is a relatively rich country in terms of Faunal assets (see Tables 24, 25)

Table 24: Relative number of described vertebrates, Guianan Countries (Hammond, 2005)

Class	Guyana	Suriname	French Guiana	Guianas
Mammals	221	180	191	234
Birds	752	672	699	812
Fish, skates and eels*	420	318	334	440
Amphibians	81	94	72	118
Reptiles	140	143	162	206
Total[21]	1426	1365	1416	1765

**Fresh water only.*

Table 25: Relative No. Of described mammals-Guianan Countries (Hammond, 2005)

ORDER	Guyana	Suriname	French Guiana
Marsupialia	15	11	12
Xenarthra	10	10	10
Chiroptera	126	105	109[a]
Primates	8	8	8
Carnivores	16	15	15
Perissodactyla	1	1	1
Artiodactyla	5	5	5
Rodentia	40	25	31
Total	**221**	**180**	**191**

[i]ncluding a new species and name revisions in Simmon and Voss (1998) and Voss et al(2001).

The SFEP area is rich in avian, reptilian and mammalian fauna. The major surprise was the non-sighting of any monkeys in the southern part of the concession area, but one species was frequently observed in the northern part of the concession area, on right bank Cuyuni River.

Boat captains and miners in the Puruni District did indicate however that monkeys are only encountered during specific times of the year.

A major challenge was to define the rainy season. The major wildlife census planned for April 2018 was almost aborted because the team encountered heavy regular rainfall consistent with the wet season. Not a single capture by wire traps was made. The rather dense and dark

[21] The computation of the values for totals are not quite clear to the consultants.

understory made it difficult to spot mammals such as deer or jaguar. There was however an exceedingly heavy presence of peccaries, who proved to be very aggressive, most likely because there were many juvenile 'piglets' with them.

Riverine surveys and nocturnal surveys proved more productive.

11.2.2 Methodology

Formal surveys of fauna were done February through April 2018. The consultants engaged in four kinds of surveys (see Figure 30, see Annex XVII):

a) Surveys designed to do a census of terrestrial mammals, reptiles, and arboreal fauna
b) Surveys designed to a census of birds
c) Surveys designed to capture inter alia invertebrates, insects
d) Riverine surveys designed to do a census of fishes and reptilian fauna

The idea behind the methodology outlined in Figure 30 was to allow the consultants be able to estimate the abundance of species observe, by linking numbers to a unit area. Unfortunately, apart from birds and reptiles, the 'capture' within the sample plots was very poor: virtually no sighting of any mammal except peccaries; nothing was caught in traps or net and the team relied on sightings, signs and calls beyond the actual sample plots.

The use of the seine in the Puruni River, proved more productive. The seine was set up in three 30-minute intervals, early morning: fishes caught were examined, identified then thrown back into the river.

The first set of wildlife surveys were conducted about three months after the ML inventory and used the same transects (see Annex XII) as the ML inventory crews. The second set of surveys were conducted in April in a similar manner except that the transects[22] were cut during the survey itself.

Surveys were conducted south of Arimu Road due to either mining activity in the north of the concession area or frequent trips by ATV. However, at least one major survey was done near the source of the Ekabago River, near the Arimu Road; this required the partial use of an ATV.

Several tools were used including fishing rods, wire traps, seine, and a mist net for birds (see Figure 31). Seines and mist nets were set for periods of 30mins during the early morning 07:30 to 8:30 hours and during the late afternoons. Riverine surveys were done during the early mornings and at night; a boat was rented for this purpose. For birds, pre-recorded 'calls' were used to ensure some birds reveal themselves as they came out of the canopy to 'investigate' the intruder inn their territory.

Apart from the formal census itself, the team sighted two very important indicator species: an otter in the Puruni River and a Jaguarondi near Mara-Mara River. Caimans were seen virtually everywhere.

[22] This was done mostly by using a GPS rather than cutting lines as obtained with the first set of inventories

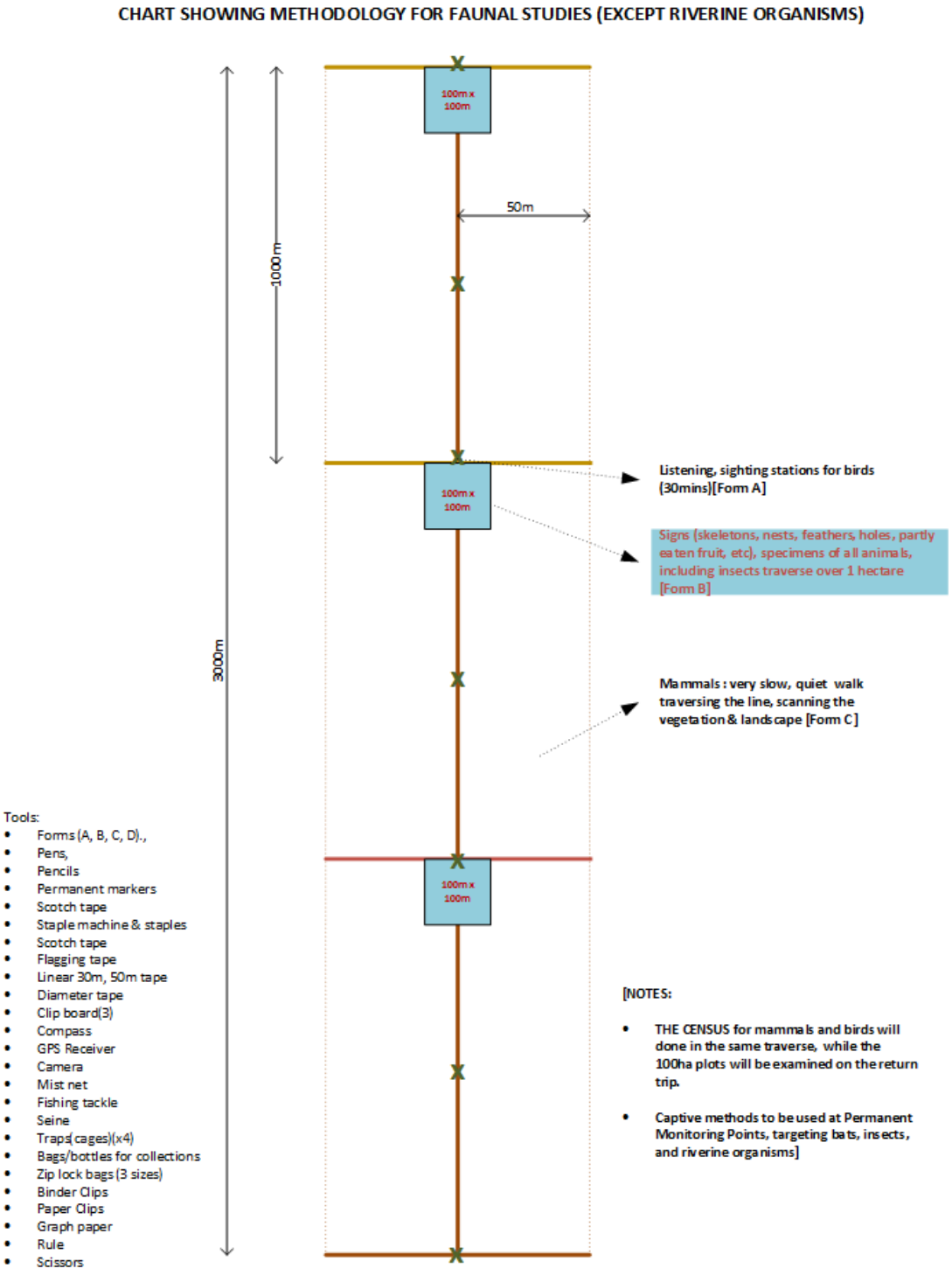


Figure 30: Chart showing methodology used to survey terrestrial fauna

Figure 31: Photo illustrating technicians setting up a mist net.

(*In hindsight, cameras would have been the best option for the census given the distances traversed for the census*). It was impractical to cover the entire transect lines between 6:00 to 6:30 hrs., and between 17:30 and 18:00 hrs., when, in the experience of the technicians, the large mammals tend to be very active.

11.2.3 Results

Lists of the various species of animals recorded on the concession area are set out in Tables

26 -Mammals; 27 -Amphibians and reptiles; 28 -Birds, 29-Fishes and 30-Insects while a few illustrations of animals captured are shown in Figures 32 and 33. (Rainfall and dark understorey conditions prevented the collection of good photographs).

Figure 32: Photograph illustrating fishes trapped, Puruni River

Figure 33: Photograph of an Emerald Tree boa[23], (Corallus caninus), Waiamu Landing, RB Cuyuni River

[23] This snake was removed from the point where it was seen near Waiamu Landing and taken about 500 m upriver and another 100m into the forest and set loose.

Table 26: Mammals recorded in and around SFEP 2/2013

Method of detection: S-seen; H-Heard, T-Track, R-Reported

#	SCIENTIFIC NAME	COMMON NAME	METHOD OF DETECTION				CITES	IUCN
			S	H	T	R		
1.0 MARSUPIALIA/Opossums								
1.1	DIDEPHIDAE/Didelphinae: Opossums							
	1.1.1Philander opossum	Grey four-eyed opossum	+					
	1.1.2 Marmosa murina	Murine mouse Opossum	+					
2.0	CHIRPOTERA/BATS							
	2.1 PHYLLOSTOMIDAE							
	2.1.1 Carollia perspicillata	Common short tailed bat	+					
	2.1.4 Rhinophylla pumilio	Little fruit bat	+					
	2.2 MOLOSSIDAE							
	2.2.1 Molossus molussus	Free tailed bat	+					
	2.3 EMBALLONURIDAE							
	2.3.1 Saccopteryx bilineata	White lined sac winged bat	+					
	2.3.2 Saccopterx leptura	Brown Sac-winged bat	+					
3.0	PRIMATES							
	3.1 CEBIDAE							
	3.1.1 ALOUATTINAE: Alouatta seniculus	Howler monkey		+			II	
	3.1.2 CEBINAE: Cebus olivaceus	Wedge-capped Capuchin	+				II	
	3.1.3 CEBINAE: Saimiri sciurieus	Squirrel Monkey				+	II	
4.0	CARNIVORA/Carnivores							
	4.1 PROCYONIDAE							
	4.1.1 PROCYONIDAE: Nasua nasua	South American Coati				+		
	4.2FELIDAE							
	4.2.1 PANTHERINAE: Panthera onca	Jaguar			+		I	CR
	4.2.2 FELINAE Leopardus pardalis	Ocelot				+	I	
	4.2.3 FELINAE Puma concolor	Puma				+	II	
	4.2.4 FELINAE Herpailurus yagouaroundi	Jaguarondi	+				II	
5.0	PERISSODACTYLA							
	5.1 TAPIRIDAE/Tapirs							
	5.1.1 Tapirus terrestris	Tapir				+	II	CR
6.0	ARTIODACTYLA							
	6.1 TAYASSUIDAE/Peccaries							
	6.1.1 Pecari tajacu	White-lipped peccary	+				II	
	6.2.2 Tayassu tajacu	Collared peccary	+				II	
	6.2 CERVIDAE/Deer							
	6.2.1 Mazama americana	Red brocket deer	+					
7.0	RODENTIA							
7.1	DASYPROCTIDAE							
	7.1.1 Dasyprocta agouti	Red-rumped agouti	+					
7.2	AGOUTIDAE							
	7.2.1 Agouti paca	Paca				+		

Table 27: Amphibians and Reptiles

Method of detection: S-seen; H-Heard, T-Track, R-Reported

#	SCIENTIFIC NAME	COMMON NAME	METHOD OF DETECTION				CITES	IUCN
			S	H	T	R	I	II
1.0	BUFONIDAE/Toads							
	1.1 Bufo marinus	Common Toad	+					
	1.2 Bufo guttatus	Land toad	+					
2.0	HYLIDAE/Frogs							
	2.1 Hyla granosa	Tree frog				+		
	2.2 Hyla boans	Barking frog		+				
3.0	LEPTODACTYLIDAE							
	3.1 Eleutherodactylus sp.							
	3.2 Leptodactylus knudseni							
	3.3 Leptodactylus sp.							
4.0	TEIIDAE							
	4.1 Ameiva ameiva	Lubo lizard	+					
	4.2 Kentropyx calcaratus	Forest lizard	+					
5.0	GEKKONIDAE							
	5.1 Hemidactylus mabouia	Skink lizard	+					
6.0	TROPIDURIDAE/Lizards							
	6.1Tropidurus hispidus							
	6.2 Plica plica	Forest lizard	+					
	6.3 Plica umbra	Forest lizard	+					
7.0	7.1 Amphisbaenidae							
	7.2 Amphisbaenidae alba							
8.0	DENDROBATIDAE							
	8.1 Epipedobates femoralis							
9.0	COLUBRIDAE/Serpents							
	9.1 Chironus carinatus	Black racer				+		
	9.2 Leptophis ahaetulla	Vine snake	+					
10.0	BOIDAE							
	10.1 Corallus caninus	Emerald tree boa	+					
	10.2 Boa constrictor	Land Camoudi				+		
	10.3 Epicrates cenchria	Rainbow boa				+		
11.0	VIPERIDAE/							
	11.1 Laches muta	Bushmaster				+		
	11.2 Bothrops atrox	Labaria	+					
12.0	ALLIGATORIDAE							
	10.1 Melanosuchus niger	Black caiman	+					
13.0	TESTUDINIDAE							
	11..Geochelone denticulata	Yellow foot turtle	+					

Table 28: Birds recorded in and around the concession area

Method of detection: S-seen; H-Heard, R-Reported

#	SCIENTIFIC NAME	COMMON NAME	Detection			CITES	IUCN
			S	H	R		
1.O TINAMIDAE/Tinamous							
1.1	Tinamous major	Great Tinamou	+				
2.0 ACCIPITRIDAE/Hawks, Eagles							
2.1	Accipiter superciliosus	Tiny Hawk	+				
2.2	Harpagus bidentataus	Double-tooth kite	+				
3.0	FALCONIDAE/Falcons, Caracaras						
3.1	Daptirus ater	Black Caracara	+				
3.2	Ibycter americanus	Red-throated Caracara	+				
4.0 CRACIDAE/ Curassows, Guans							
4.1	Penelope jacquacu	Spix's Guan	+				
4.2	Crax alector	Black Curassow	+				
5.0	COLUMBIDAE/Pigeons, Doves						
5.1	Patagioenas speciosa	Scaled Pigeon	+				
5.2	Leptofila rufaxilla	Grey fronted dove	+				
6.0	PSITTACIDAE/Parrots						
6.1	Amazona farinosa	Mealy Parrot	+				
6.2	Ara chloropterus	Red and Green Macaw	+				
7.0	CUCULIDAE/Cuckoos						
7.1	Coccyuzus americanus	Yellow billed cuckoo		+			
8.0	TROCHILIDAE/Hummingbirds						
8.1	Glaucus hirsutus	Rufus-breasted Hermit	+				
8.2	Phaethornis ruber	Reddish hermit	+				
9.0	TROGONIDAE/Trogons						
9.1	Trogon viridis	White tailed Trogon	+				
10.0	BUCCONIDAE/Puffbirds						
10.1	Notharchus tectus	Pied Puffbird	+				
10.2	Monasa atra	Black Nunbird	+				
11.0	RAMPHASTIDE/Toucans						
11.1	Pteroglossus aracari	Black necked Aracari	+				
11.2	Ramphastos vitellinus	Chanel-billed Toucan	+				
12.0	PICIDAE/Woodpeckers						
12.1	Picumnus exilis	Golden spangled Piculet		+			
12.2	Celeus undatus	Waved woodpecker	+				
13.0	THAMNOPHILIDAE/TYPICAL /Ant birds						
13.1	Cymbilaimus lineatus	Fasciated Antstrike		+			
14.0	TYRANNIDAE/Flycatchers						
14.1	Myiopagis gaimardii	Forest Elaenia		+			
15.0	COTINGIDAE/Cotingas						

#	SCIENTIFIC NAME	COMMON NAME	Detection			CITES	IUCN
			S	H	R		
15.1	Querula purpurata	Purple throated Fruitcrow		+			
15.2	Lipaugus vociferans	Screaming Phia		+			
16.0	THRAUPIDAE/Tanagers						
16.1	Hemithraupi guira	Guira Tanager		+			
16.2	Dacnis cayana	Blue Dacnis		+			
16.3	Tangara mexicana	Turquoise Tanager		+			

Table 29: Fishes recorded within the concession area

#	SCIENTIFIC NAME	COMMON NAME	IDENTIFICATION			CITES	IUCN
			S	R	O		
1.0	AGENEIOSIDAE						
	1.1 Ageneiosus inermis	Dawala	+				
2.0	ANOSTOMIDAE						
	2.1 Leporinus spp	Daray		+			
	2.2 Leporinus fasciatus			+			
3.0	AUCHENIPTERIDAE						
	3.1 Trachycorystes trachycorystes	Boots	+				
	3.2 Trachycorystes geleatus	Wax fish		+			
	3.3 Tatia aulopygia aulopygia			+			
4.0	BELONIDAE						
	Potamorrhaphis guianensis	Needle nosed fish	+				
5.0	CHARACIDAE						
	5.1 Acestrorhynchus falcirostris	Larger dogfish		+			
	5.2 Astyanax sp		+				
	5.3 Moenkhausia copei		+				
	5.4 Myleus setiger		+				
	5.5 Pristobrycon striolatus	Perai	+				
	5.6 Pygocentrus nattereri	Red belly Perai	+				
	5.7 Serrasalmus rhombeus	Black Perai	+				
	5.8 Tetragonopterus chalceus		+				
	5.9 Triporttheus roundatus		+				
	5.10 Thoracococharax stellatus		+				
6.0	CICHLIDAE						
	Crenicichla notophtalmus	Sunfish		+			
7.0	CURIMATIDAE						
	Psectrogaster sp.						
8.0	CYNODONTIDAE						
	Hydrolycus tatauaia	Biara		+			
	Hydrolycus armatus						
9.0	DORADIDAE						
	Platydoras armulatus	Armoured catfish	+				
	Leptodoras linneli	Bitterhead	+				
	Pseudodoras niger		+				
	Doras microlepsis		+				
	Pterodoras granulosas		+				
10.0	LORICARIDAE						
	Hypostomas spp.		+				
11.0	OSTEOGLOSSIDAE						
	Osteoglossum bicirrhosum	Arawana	+				
12.0	PIMEOLDIDAE						
	Leiarius marmoratus	Tigerfish	+				
	Paulicea spp	Seana	+				
	Practocephalus hemiliopterus	Skeete, banana fish	+				

#	SCIENTIFIC NAME	COMMON NAME	IDENTIFICATION			CITES	IUCN
			S	R	O		
	Pimelodella crisata						
	Pseudoplatystoma fasciatum	Cullet	+				
13.0	POTAMOTRYGONIDAE						
	Potamotrygon sp.	Stingray		+			
14.0	PROCHILODONTIDAE						
	Prochilodus nigricans	Yakatu		+			

Method of detection: S-seen, R-Reported

Table 30: Insects recorded within the concession area

(Method of detection: S-seen; H-Heard, R-Reported)

#	SCIENTIFIC NAME	COMMON NAME				CITES	IUCN
			S	H	R		
1.0	COLEOPTERA/ Beetles						
1.1	1.1 CERAMBYCIDAE						
	1.1.1 Long horned beetles	Beetles	+				
	1.2 CURCULIONOIDEAE						
	1.2.1 Snout beetles	Beetles	+				
2.0	HYMENOPTERA						
	2.1 FORMICIDAE						
	2.1.1 Atta spp	Acushi ants	+				
3.0	HOMOPTERA/HEMIPTERA						
	3.1 Cicadidae	Cicadas/Sun bee	+				
	3.2 Gerridae	Water bugs	+				
4.0	ORTHOPTERA						
	4.1 Gryllidae	Crickets	+				
	4.2 Tettigoniidae	grasshoppers	+				
5.0	LEPIDOPTERA						
	5.1 NYMPHALIDAE	Butterflies	+				
	5.2 PIERIDAE	Butterflies	+				
6.0	MANTODEA	Praying mantis	+				
7.0	ODONATA	Pond flies/dragonflies					
8.0	ISOPTERA						
	9.1 Termitoidae	Termites/Wood ants	+				
9	DIPTERA						
	PHLEBOTOMIDAE/PSCHODIDAE	Flies, sandflies	+				
	CULICIDAE	Mosquitoes	+				

11.3. Impact Assessment

11.3.1 Flora

Preparatory road building tasks and timber harvesting leads to alteration of forest structure (height class distribution and diameter class distribution). This alteration in structure affects the microclimate (in terms of wind, humidity temperature and light conditions in the understory which in turn influences seed germination and seedling development.

The removal of logs during timber harvesting tasks represents a loss of nutrients for the soil as well as plant genetic material; trees of good form are normally harvested so perhaps the best genetic material may be exported.

Poorly executed logging and skidding damages residual trees and may unwittingly produce forest gaps and forest fragmentation which creates modified, mostly unfavourable for seedlings of merchantable species that thrive in shade.

11.3.2 Fauna

Logging practices affect fauna directly by dispersing them and by altering their habitats; the intensity of impact of these 'disruptions' depend a great deal on the species of animals and their capacity to adapt quickly to changes (Fimbel, Grajal and Robinson, 2001).

11.4 Mitigation and Monitoring Measures

For flora, TPTTI will follow strict RIL practices, planning managing all interventions on the forest resources. TPTTI will pay attention to directional tree felling and skid trail planning.

GFC induced yield ceiling, the use of RIL generally, selective felling practices and the application of diameter limits for felling trees ensure that the forest environment, including juvenile trees are conserved. In the circumstances, further silvicultural interventions are not necessary. Active and extensive reforestation practices could lead to greater alteration of the forest environment than sustainable logging. Intensive silvicultural practices would also lead to the migration of many species of fauna.

Although the logger is interested in merchantable species it is recognized that non-merchantable species, lianas, palms, and epiphytes all play a significant role in maintaining conditions that facilitate the growth of merchantable species.

Initial road works lead to gaps which in turn lead to the proliferation of light demanding species such as Congo Pump (*Cecropia spp.*), Bloodwood (*Vismia spp*.), Tauroniro (*Humiria balsamifera*) and Kabukalli (*Goupia glabra*) and grasses such as *Scleria spp*. However, after initial gap opening and closure of the canopy over roads, many of these species subside.

The consultants cannot find any instances in Guyana where invasive species has been a problem. (The consultants have never seen the major invasive species locally, Jamun (*Syzygium cumini*) in natural forests.

For fauna, TPTTI's field operatives would avoid confrontation with fauna; vehicles will always stop and allow animals crossing the road to do so; this applies particularly to snakes, sloths, anteaters, and ground dwelling birds.

Strict no hunting and no fishing policies will be enforced by TPTTI. Signage to this effect will be posted along the primary roads (see Annex XXIV).

One of the best ways to conserve fauna is to avoid contaminating the forest floor with 'foreign objects' that could potentially injure fauna. For this reason, TPTTI will avoid littering the forest floor or polluting waterways.

(TPTTI and its consultants will rely on hidden cameras for all future work related to wildlife censuses at the permanent monitoring stations or elsewhere).

Forest gaps stymy the movement of fauna that will not use open spaces ((Fimbel, Grajal and Robinson, 2001).; every effort will be made to avoid gaps and fragmented forests.

Prescriptions of the COP regarding logging operations (Chapter 6) operational hygiene (Chapter 8) and Camp Hygiene (Chapter 9) will be followed.

Field operatives will be encouraged to take an interest in fauna. Registers will be kept at the base camp where field operatives record sightings of mammals.

12.0 ECOSYSTEM SERVICES

12.1 Introduction

The Protected Areas Act, Act 14 of 2011 defines an ecosystem as *'the dynamic complex of animal, plant and microorganism communities and their non-living environment interacting as a functional unit'*. An ecosystem refers to a set of biotic and abiotic components woven together in such a way that the system sustains itself. The biotic components refer to animals and plants. The abiotic components refer to edaphic parameters and atmospheric parameters respectively.

12.2 Definitions and scope

The biotic components of ecosystems comprise a diversity of animals and of plants respectively.

The coexistence of plants and animals in the forest environment lead to the following:

(a) plant-plant interactions (such as epiphytic plants or parasitic plants on a host tree),

(b) animal-plant interactions (such as bees pollinating flowers or birds disseminating seeds); and

(c) animal-animal interactions (such as predation, for example carnivores, feeding on herbivores)

For local tropical forests, abiotic components include

(a) ***Soil***-which provide mechanical support to plants, facilitate their growth through nutrient cycling processes from the weathering of primary rock , the decomposition of organic material and the leaching of solutes (Richards, 1998); soil ph., soil temperature, soil moisture, soil texture and water retention capacity are also major factors influencing plant growth and soil biology.

Edaphic properties are frequently linked to landform; for example, the classification of montane and sub-montane forests is based on altitude. Certain edaphic properties (soil texture, ph., extremely free drainage, or impeded drainage due to hardpans) in association with landform may severely restrict the nature of the vegetation present; for example, Richards (1998) refers to six different types of vegetation in Trinidad & Tobago: lower montane forests, evergreen seasonal forests, semi-evergreen seasonal forests, deciduous seasonal forest, thorn woodland and cactus scrub. Hammond (2005) refers to the Guiana Shield as a vast expanse of low-land forests, mountains, wetlands, and savannah. The diversity of forest types in Guyana (see Figure 29) is aligned to topography and terrain.

(b) ***Environmental (including microclimatic) phenomena:*** rainfall, wind, sunlight, relative humidity.

The interaction of biotic and abiotic components of ecosystems creates what are commonly referred to geo-chemical cycles: for example, the carbon cycle the hydrological cycle.

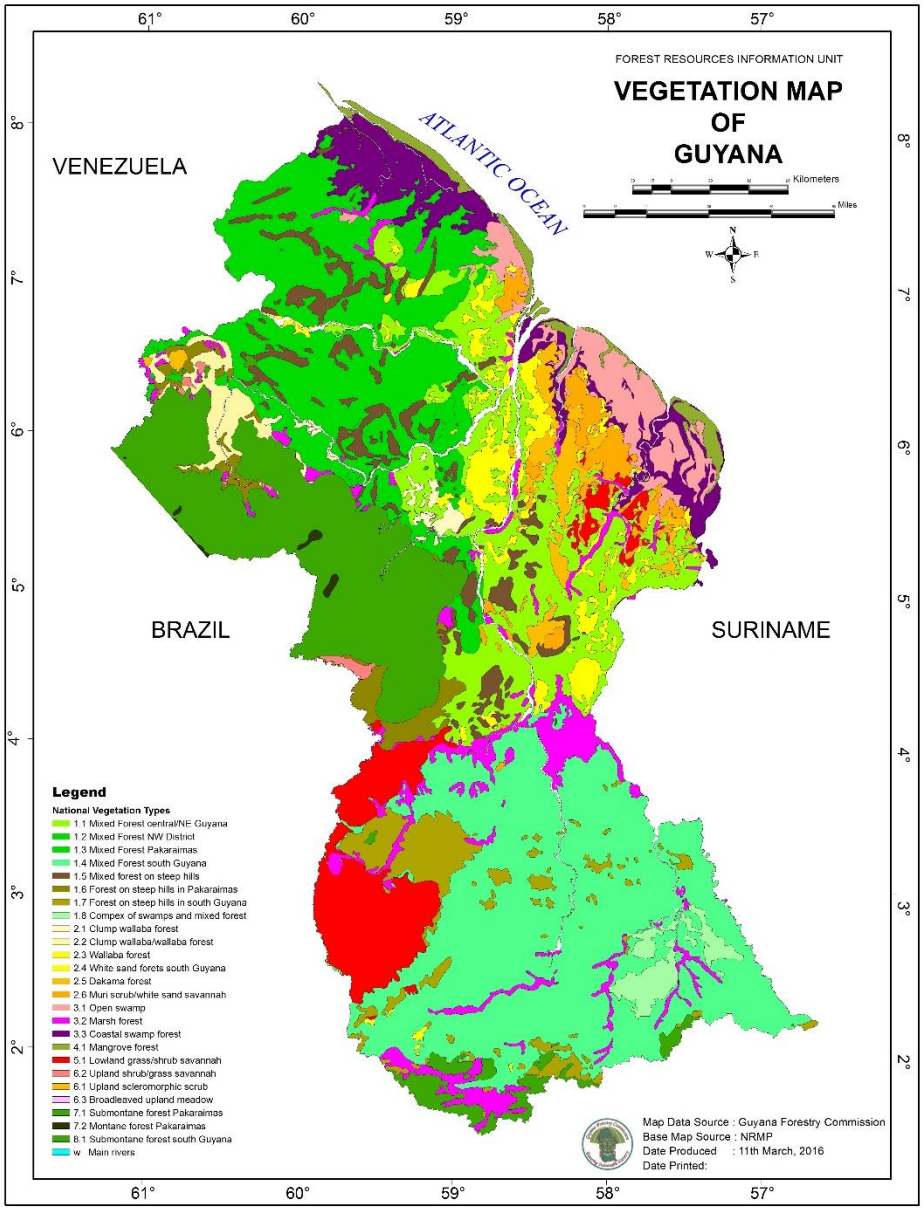


Figure 34: Forest type map of Guyana (GFC)

12.3 Key relevant policy, legislation, guidelines, standards etc.

Section 5(a) of the Guyana Forestry Commission Act No. 20 of 2007, mandates the GFC to prepare plans, codes of practice and guidelines for the conservation and management of forests; this by implication includes the conservation of ecosystems. Section 5(b) of the same Act, mandates the GFC to research, collate, analyse, prepare, and disseminate data, statistics and other information about forests and all aspects of forestry including forest ecology and the use of forest produce. The GFC prescribes that a minimum of 4.5% of the *productive forests* within State Forest authorizations ≥8,000ha must be preserved. TPTTI has already earmarked and area of 3,015 ha for a biodiversity reserve (see Table 9, Annex XI).

The Protected Areas Act 2011 has the following preamble: an Act to provide for the protection of Guyana's natural heritage and natural capital, the creation, management and financing of

a national system of protected areas; the maintenance of ecosystem services of national and global importance including climate regulation; the establishment and management of a protected areas trust fund; the fulfilment of Guyana's international environmental responsibilities; public participation in protected areas and conservation; and related purposes.

Section 24 of the protected areas Act 2011 specifies that the objectives of a national protected areas system, includes:

a) Conserve Guyana's biological diversity

b) Protect ecologically viable areas representative of all ecosystems and habitats naturally occurring in Guyana, and its natural landscapes and seascapes

c) Protect ecologically significant areas which are vulnerable; and

d) Safeguard and maintain ecosystem services

12.4 Existing information, Surveys and Baseline studies

The protected areas network (see Figure 30), the forests managed by the Iwokrama International Centre and forest reserves managed directly by the GC are all part of the attempts at the national level to conserve ecosystems. The total current protected areas comprise those areas that *formally* constitute the NPAS, in addition to an area of 3716.81km^2 managed by IIC and an area of 6,250 km^2 of *private property* managed by the *Konashen Indigenous Community*). In addition, within the '*productive forests'* category on *active* forest concessionaires, forest concessionaires *and* the GFC together co-manage a total of 866.6 km^2 of biodiversity reserves[24].

[24] Holders of forest concession agreements/ State Forest authorizations for areas >8000 ha must establish a biodiversity on an area equivalent to 4.5% of the area designated as *productive forests* of the concession. The location of the reserve must be agreed with the GFC.

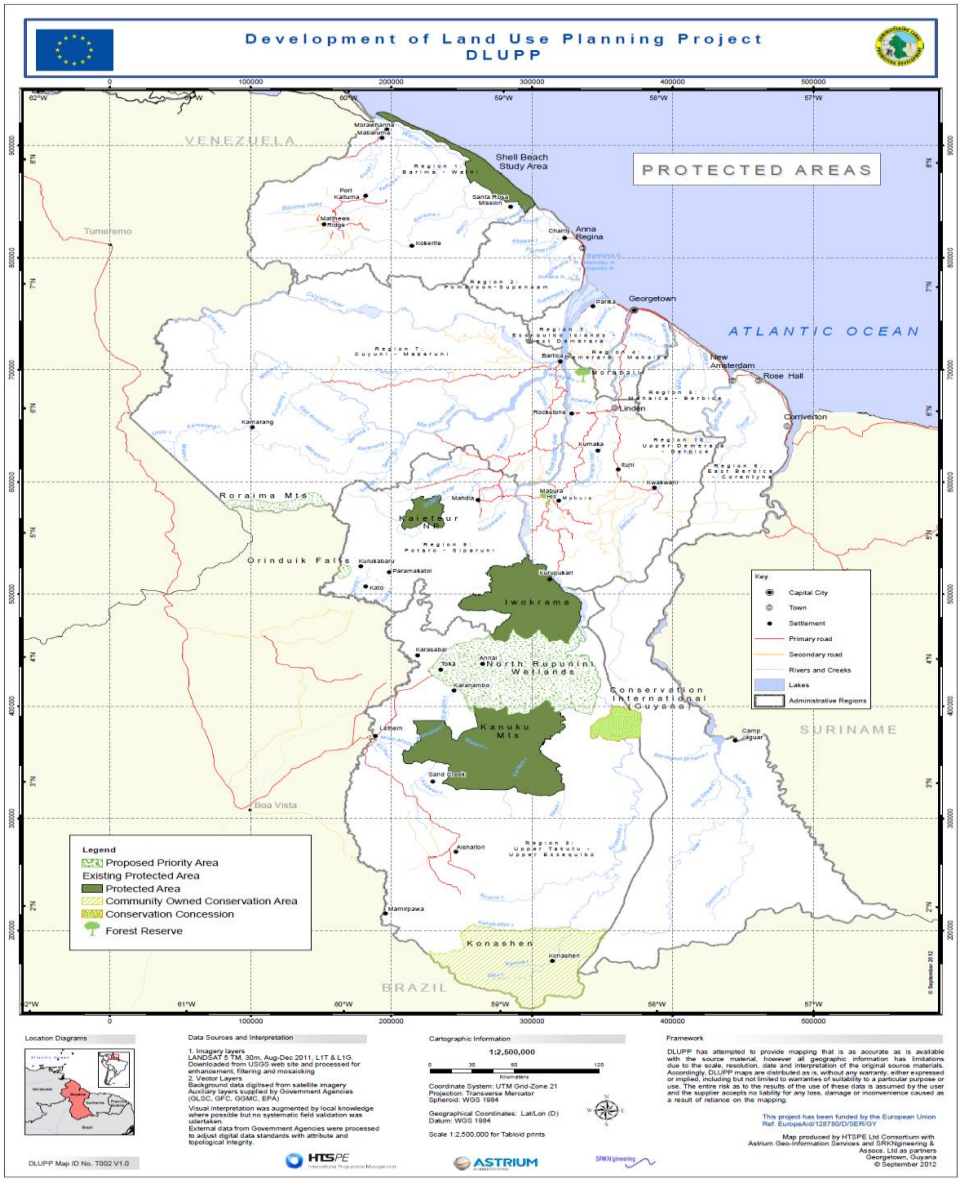


Figure 35: Map showing location of protected areas (GLASC, 2013)

According to TEEB (2010), ecosystems are critical because they provide humans with four categories of services (see also Table 30):

(a) Provisioning services-ecosystem services that describe the material or energy outputs from ecosystems, including food and fresh water.

(b) Regulating services: these are services that ecosystems provide by acting as regulators, for example in regulating the quality of air and soil.

(c) Habitat or supporting services: for example, habitats provide the means for survival; and

(d) Cultural services: experiences with aesthetic phenomena.

Table 31: Typical ecosystem services garnered from forests

THE EONOMICS OF ECOSYSTEMS AND BIODIVERSITY: CATEGORIES OF ECOSYSTEM SERVICES (http://www.teebweb.org/resources/ecosystem-services/)
1.0 Provisioning Services: Provisioning Services are ecosystem services that describe the material or energy outputs from ecosystems. They include food, water and other resources.
1.1 Food: Ecosystems provide the conditions for growing food. Food comes principally from managed agro-ecosystems, but marine and freshwater systems or forests also provide food for human consumption. Wild foods from forests are often underestimated.
1.2 Raw materials: Ecosystems provide a great diversity of materials for construction and fuel including wood, biofuels and plant oils that are directly derived from wild and cultivated plant species.
1.3 Fresh water: Ecosystems play a vital role in the global hydrological cycle, as they regulate the flow and purification of water. Vegetation and forests influence the quantity of water available locally.
1.4 Medicinal resources: Ecosystems and biodiversity provide many plants used as traditional medicines as well as providing the raw materials for the pharmaceutical industry. All ecosystems are a potential source of medicinal resources.
2.0 Regulating Services: Regulating Services are the services that ecosystems provide by acting as regulators, for example, regulating the quality of air and soil or by providing flood and disease control.
2.1 Local climate and air quality: Trees provide shade whilst forests influence rainfall and water availability both locally and regionally. Trees or other plants also play an important role in regulating air quality by removing pollutants from the atmosphere.
2.2 Carbon sequestration and storage: Ecosystems regulate the global climate by storing and sequestering greenhouse gases. As trees and plants grow, they remove carbon dioxide from the atmosphere and effectively lock it away in their tissues. In this way forest ecosystems are carbon stores. Biodiversity also plays an important role by improving the capacity of ecosystems to adapt to the effects of climate change.
2.3 **Moderation of extreme events**: Extreme weather events or natural hazards include floods, storms, tsunamis, avalanches and landslides. Ecosystems and living organisms create buffers against natural disasters, thereby preventing possible damage. For example, wetlands can soak up flood water whilst trees can stabilize slopes. Coral reefs and mangroves help protect coastlines from storm damage
2.4 Waste-water treatment: Ecosystems such as wetlands filter both human and animal waste and act as a natural buffer to the surrounding environment. Through the biological activity of microorganisms in the soil, most waste is broken down. Thereby pathogens (disease causing microbes) are eliminated, and the level of nutrients and pollution is reduced.
2.5 Erosion prevention and maintenance of soil fertility: Soil erosion is a key factor in the process of land degradation and desertification. Vegetation cover provides a vital regulating service by preventing soil erosion. Soil fertility is essential for plant growth and agriculture and well-functioning ecosystems supply the soil with nutrients required to support plant growth.
2.6 Pollination: Insects and wind pollinate plants and trees which is essential for the development of fruits, vegetables and seeds. Animal pollination is an ecosystem service mainly provided by insects but also by some birds and bats. Some 87 out of the 115 leading global food crops depend upon animal pollination including important cash crops such as cocoa and coffee (Klein et al. 2007**)**

THE EONOMICS OF ECOSYSTEMS AND BIODIVERSITY: CATEGORIES OF ECOSYSTEM SERVICES (http://www.teebweb.org/resources/ecosystem-services/)
2.7 Biological control: Ecosystems are important for regulating pests and vector borne diseases that attack plants, animals and people. Ecosystems regulate pests and diseases through the activities of predators and parasites. Birds, bats, flies, wasps, frogs and fungi all act as natural controls**.**
3.0 Habitat or Supporting Services
Habitats for species: Habitats provide everything that an individual plant or animal needs to survive: food; water; and shelter. Each ecosystem provides different habitats that can be essential for a species' lifecycle. Migratory species including birds, fish, mammals and insects all depend upon different ecosystems during their movements.
Maintenance of genetic diversity: Genetic diversity is the variety of genes between and within species populations. Genetic diversity distinguishes different breeds or races from each other thus providing the basis for locally well-adapted cultivars and a gene pool for further developing commercial crops and livestock. Some habitats have an exceptionally high number of species which makes them more genetically diverse than others and are known as 'biodiversity hotspots'.
4.0 CULTURAL SERVICES
4.1 Recreation and mental and physical health: Walking and playing sports in green space is not only a good form of physical exercise but also lets people relax. The role that green space plays in maintaining mental and physical health is increasingly being recognized, despite difficulties of measurement.
4.2 Tourism: Ecosystems and biodiversity play an important role for many kinds of tourism which in turn provides considerable economic benefits and is a vital source of income for many countries. In 2008 global earnings from tourism summed up to US$ 944 billion. Cultural and eco-tourism can also educate people about the importance of biological diversity**.**

12.5 Impact prediction and assessment.

The key issues of interest for loggers are the functional aspects of forests and the need to ensure that these processes are not unduly disrupted because they form the basis of forest sustainability.

The core processes include:

a) Pollination: this refers generally to the transfer of pollen between flowers: birds and insects are the main agents

b) Seed dispersal: seed dispersal and seed predation affect the regeneration potential of forest stands; the higher the quantity of viable seeds, the more robust the regeneration. Most animals that feed on fruit facilitate seed dispersal. Seed predation may have negative effects on forest regeneration; insects that feed on seed and seedlings have the potential to kill their host (Basset, 1999).

c) Nutrient cycling: nutrient cycling depends on soil moisture, soil ph., soil texture and the nature of the soil itself-whether shallow or deep or whether freely draining or waterlogged, etc.

d) Infiltration of water into the soil: forest floor conditions such as the presence of a litter layer, soil organisms, soil texture and site conditions help determine the degree to which water infiltrates into the soil and percolate in the subsurface.

12.6 Mitigation and monitoring

Ecosystem conservation considerations have been built into the forestry legislation, and COP and forest management guidelines.

The legislation grants power to the GFC to set conditions for timber harvesting, restrictions on felling trees, and restrictions on felling species.

The Forest management guidelines include prescribing fell cycles, forest organization-compartments and blocks; annual allowable area, annual allowable cut, maximum yield per hectare.

TPTTI will be using RIL principles and practices in association with the COP. Other measures to be taken to conserve water resources, soil and air quality will also contribute to ecosystem conservation.

Damage to the shared ecosystems within the area held by SFEP 2/2013 is inevitable. Mining leads to the removal of entire habitats and modification of the geological features underlying them (TEEB, 2010). Miners within the concession area will be encouraged to support conservation projects by TPTTI. The draining of ponds evolving from exploratory pits and mined sites are areas where miners and TPTTI can cooperate.

CHAPTER 13.0 NOISE AND VIBRATION

13.1 Introduction

Noise and vibration are major problems associated with logging operations. TPTTI plans to take whatever steps are necessary to reduce noise and vibration on the concession area.

13.2 Definitions and scope

Noise may be defined as unwanted sound judged to be unpleasant, loud or disruptive to hearing. Noise becomes pollution, when there is an excessive amount of it that causes discomfort to those who hear it. Similarly, vibration is tolerable up to a certain limit then as one remains exposed to a certain level, discomfort sets in.

13.3 Legislation

The *Environmental Protection (Noise Management) Regulations 2000* (see Section 5.4.3) is the primary noise management legislation in Guyana. The EPA and the GNBS have published standards (see Tables 2, 32) to guide developers.

Table 32: GNBS Guideline Values for Noise in Specific Environments (GNBS, 2010)

Categories	Daytime (06:00h-18:00h) Limits in dB (A)	Night-time (18:00h-06:00h Limits in dB (A)
Residential	75	60
Institutional	75	60
Educational	75	60
Industrial	100	80
Commercial	80	65
Construction	90	75
Transportation	100	80
Recreational	100	70

13.4 Baseline information

The existing sound environment throughout the Toolsie Persaud Timber Traders Inc. Forest Concession was characterized almost completely as sounds of nature within an Industrial Area. Noise measurements were taken at various strategic locations within and around the Forest Concession. Noise levels were recorded using a Sound Level Meter (ExTech 407730) (Figure 36) Values were taken at four (4) locations within the Forest Concession during the Dry Season (Figure 37) on October 14 - 17, 2018, and eight (8) locations during the Wet Season on April 24 - 27, 2018, and May 11 - 12, 2018 (Figure 38). Noise decibel levels are not to be greater than the established permissible noise levels/limits of the Guyana National Bureau of

Standards (GNBS) Guideline values for Noise in specific environment (Table 29) which has been adopted by the Environmental Protection Agency (EPA).

Toolsie Persaud Timber Traders Inc... Concession is in a Forested Area/Zone; however, since there is no Category for Forests, therefore the Area can be considered Industrial.

Figure 36: Noise meter used for field work

13.4 Results and Discussion

Noise levels within the Toolsie Persaud Timber Traders Inc. Forest Concession were all 40 dB during the Dry Season and ranged from 40 dB to 56.1 dB during the Wet Season. The sampled areas for both the Dry Season and Wet Season never exceeded 57 decibels (dB).

Dry Season: During the time of monitoring within the Forest Concession, all of the four (4) noise levels recorded held the value of 40 dB. The noise measurements were all below 100 dB Daytime (06:00 h - 18:00 h) Industrial limits of the Guyana National Bureau of Standards (GNBS) Guidelines for the Measurement and Assessment of Noise in the Environment.

Wet Season: During the time of monitoring within the Forest Concession, the highest noise level recorded was at N6 (56.1 dB) during the wet season. It is important to note that the noise measurement recorded at N6 was negligible (i.e. below 100 dB Industrial Daytime limits).

The noise measurements of the other seven (7) areas recorded within the Toolsie Persaud Timber Traders Inc. Forest Concession were as follows:

- N1 (40.0 dB),
- N2 (40.0 dB), N3 (40.0 dB),
- N4 (40.0 dB),
- N5 (56.0 dB),
- N7 (51.6 dB), and
- N8 (40.0 dB).

These sample points showed small increments in noise levels and were because of sounds from rainfall during the time of monitoring. However, these levels were all below the 100 dB Daytime (06:00 h - 18:00 h) Industrial limits of the Guyana National Bureau of Standards (GNBS) Guidelines for the Measurement and Assessment of Noise in the Environment.

13.5 Data

Table 33 below shows the noise conditions within the project location.

Table 33: Noise levels within and around TPTTI 's forest concession

Sound Level (dB)						
Sample ID	**Coordinates UTM, 21N**	**Time**		**Data**	**Wind**	
		Start	**End**	**Decibel (dB)**	**Direction**	**Speed (m/s)**
Dry Season						
N1	0241321, 0704664	12:22	12:24	40.0	NW	----
N2	0242518, 0702209	14:24	14:26	40.0	NW	----
N3	0241839, 0697731	15:38	15:40	40.0	NW	----
N4	0242470,0700281	11:49	11:51	40.0	NW	----
Wet Season						
N1	0236426, 0707750	13:25	13:28	40.0	NW	0.0
N2	0242556, 0702151	10:08	10:11	40.0	NW	0.0
N3	0244534, 0607435	14:45	14:47	40.0	NW	0.0
N4	0238472, 0706203	14:43	14:45	40.0	NW	0.0
N5	0242910, 0698559	10:15	10:18	56.0	NW	0.0
N6	0245984, 0735997	11:21	11:24	56.1	NW	0.0
N7	0252344, 0723997	07:35	07:37	51.6	NW	0.0
N8	0238307, 0729594	09:40	09:43	40.0	NW	0.0

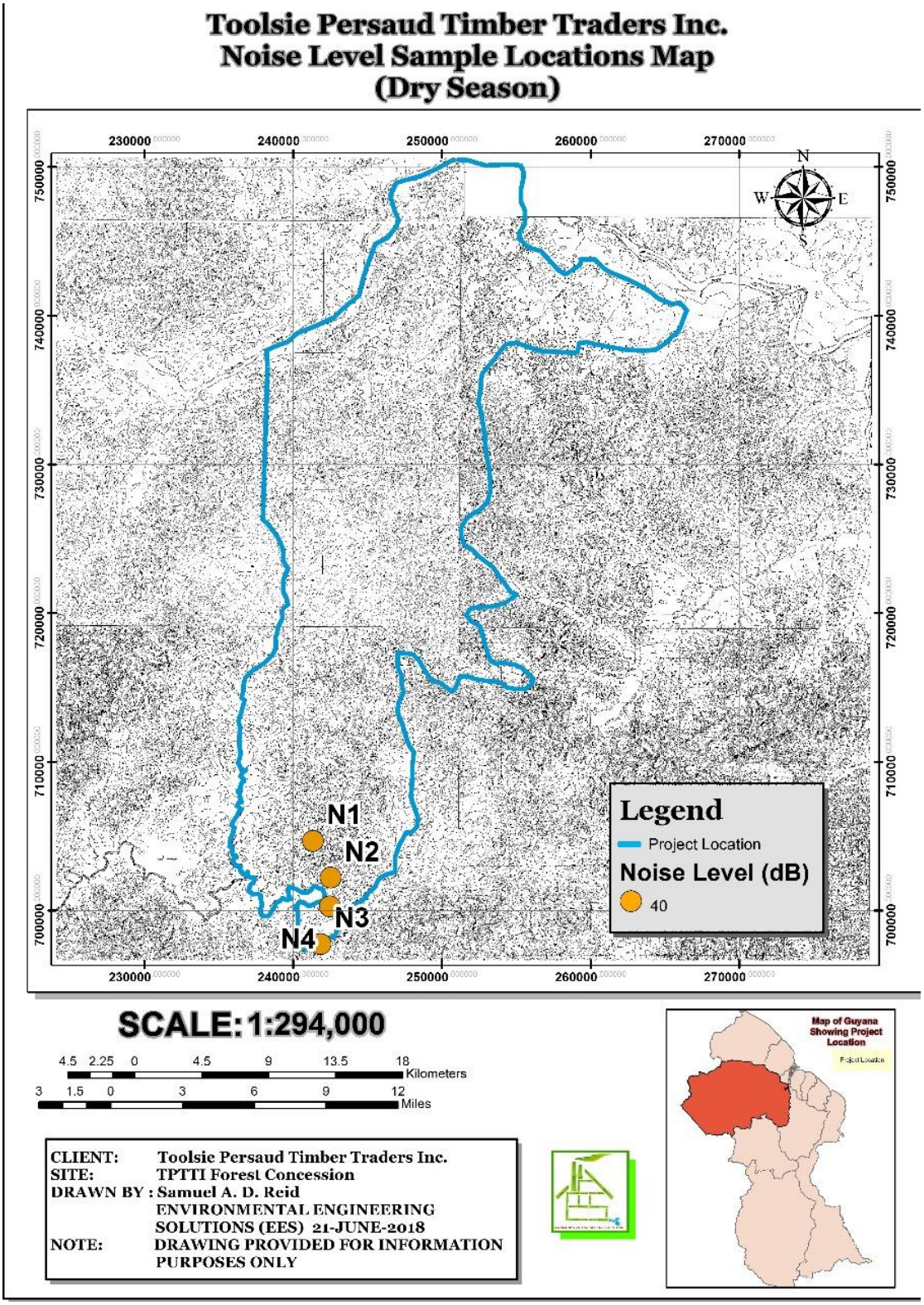


Figure 37: Noise measurement for Sample Points within TPTTI's forest concession, Dry Season (S. Reid, 2018)

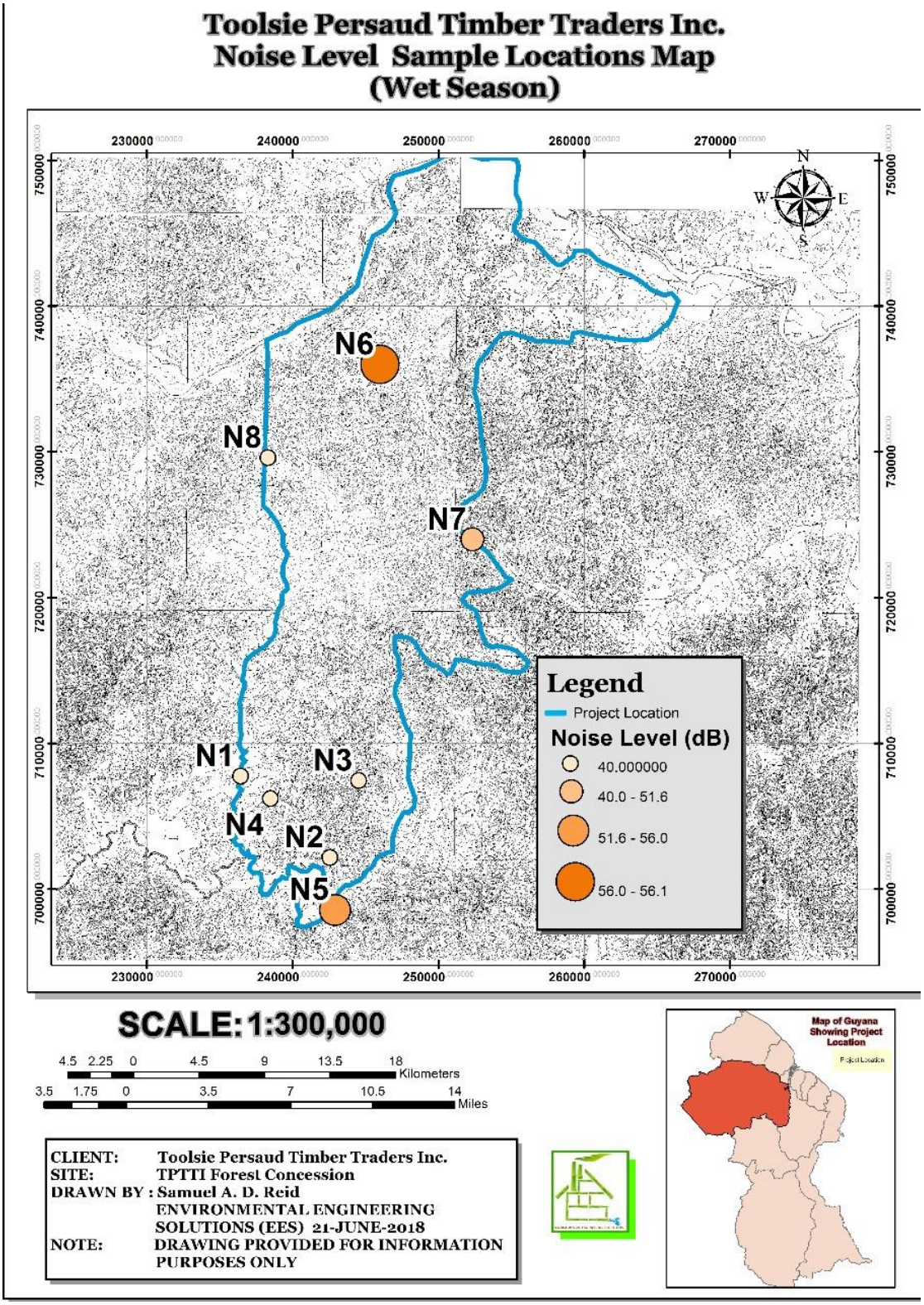


Figure 38: Noise measurements Sample Points within TPTTI's forest concession, Wet Season (S. Reid, 2018)

13.6 Impact Assessment

The heavy-duty machines and chainsaws that TPTTI will deploy will make noise. Logging practices impact wildlife generally by altering habitats and dispersing populations but there is reason to believe that different faunal groups react differently to these practices (Fimbel, Grajal and Robinson, 2001. Noise and vibration nuisances will normally be very temporary, save for tree felling and skidding operations. Fortunately, a maximum of 900 ha will be affected per year.

For miners along the Tiger Creek Road and the Kartabu-Puruni Road dust and vibration will be a nuisance, although TPTTI's vehicles will only be a very small proportion (1%) of the total traffic on the road at any time.

13.7 Mitigations Measures

TPTTI will apply the following basic measures:

a) For the concession area, TPTTI's lorries will slow down whenever they pass any camps or other vehicles or pedestrians.

b) TPTTI will not transport logs at night; in addition, all barge loading operations at Iteballi will normally stop after 18:00 hrs.

c) TPTT's will always slow down to 15mpg at Iteballi and along the Kartabu-Puruni Road

d) All vehicles will be kept in a fully functional state such that operational parameters are in line with those determined by the respective manufacturers.

e) Finally, all operators will be trained to use their vehicles, responsibly.

14.0 LAND SCAPE AND VISUAL RESOURCES

14.1 Introduction

The forest concession is discrete only in terms of its boundaries, all other events have a regional context to the extent that events on the concession area may have effects far beyond the boundaries of the concession area. For example, the Mara-Mara River with some of its right bank tributaries starting in the concession, flow into the left bank Puruni River, and the Puruni River in turn flows into the Mazaruni River. Therefore, pollution for example of the Mara-Mara River could affect people living on the lower left ban Mazaruni River. In fact, both the communities of Iteballi and Karrau on the lower left bank Mazaruni, had had to invest in wells for potable water. Also, fauna is not constrained in any way by the boundaries of the concession area. According to Ghazoul & Sheil (2010), a deeper appreciation of scale and landscape is now changing the way we the management of tropical forests.

14.2 Definitions and Scope

Landscapes are a composite of various ecosystems. Rainforest landscapes are influenced by variables such as weather, drainage, and soil **(**Ghazoul & Sheil, 2010). At a regional scale, Hammond (2005) describes 'a massive landscape designated the Guiana Shield simply as a land of old rock, poor soils, much water, extensive forests and few people'. Some authors also refer to the term landscape ecology-the study of spatial patterns, processes and change across biological and cultural structures within areas encompassing multiple ecosystems (Wade and Sommer, 2006).

14.3 Key relevant policy, legislation, guidelines, and standards.

The core policy, guidelines, and standards in Guyana in respect of landscapes seem oriented towards avoiding forest gaps, forest fragmentation and forest degradation.

The GFC has always characterised forest types by linking species composition with edaphic factor and altitude, for example, the forest concession contains a forest type described as 1. *Mixed forests on hilly or undulating terrain.*

The GFC, in its forest concession administration protocols determine where logging should occur (Sections 6, 10 of the Forests Act, 2009), the proportion of productive area, the proportion of productive area should be set aside as a biodiversity reserve, annual allowable area (ha) and the annual allowable cut (m^3) and the maximum yield per hectare (m^3/ha) that should be extracted. There are provisions for forest protection (Section 24, 30 of the Forests Act, 2009). There are prescriptions in the Forests Regulations to avoid clear felling at all costs by limiting the diameter at breast height of trees that should be felled. There are many prescriptions seeking to conserve the forest environment by for example, prescribing standards for roads (see Section 5 of the COP) and log markets, managing skid trail alignment and skid trail density, and the conservation of water courses. Also, there is the effort to limit gaps by prescribing the minimum distance between trees that should be felled. Felling trees is also prohibited on slopes.

14.4 Impact prediction and assessment

Logging could modify landscapes by altering forest structure via the distribution of diameter classes, changing the proportion of each species and by affecting forest architecture via alteration of the height class structure of the forests (van der Hout, 2000; Ghazoul & Sheil, 2010). Forest gaps and forest fragmentation are a major source of concern. Fires and extended flooding are also capable of extensive forest degradation. Accelerated erosion frequently leads to accelerated sediment loads in waterways which degrade the aesthetic values of the landscape (see Figure 39)

Figure 39: Illustration of aesthetic degradation of landscapes

14.5 Mitigation and monitoring

In a situation where reduced impact logging is encouraged and applied, landscape changes are not anticipated due to logging activity. It is unfortunate, that many parts of the concession area are pockmarked with mining sites (see Figure 40) which, in a situation of shared land use, could stymy mitigation efforts.

Figure 40: Illustration of landscape degradation

Landscape conservation will be a natural consequence of mitigation measures adopted for the conservation of soil and the conservation of water ways.

15.0 CULTURAL HERITAGE

15.1 Introduction

Guyana belongs to all Guyanese, and it is anticipated that a shared cultural heritage will also imply shared responsibility for managing the common heritage bequeath to all Guyanese.

15.2 Baseline information

To date only miners have been encountered in the area. Also, the miners do not seem to have an interest remaining within the concession area; they are always on the move doing reconnaissance work or mining itself. The miners' have two interests: firstly, whether logging activities would interfere with their mining activities; secondly, they are interested in the proposed road layout within the concession area (which they can use to their advantage). No farms or homesteads or any structure indicating recent occupation was observed *within* the concession area or the surrounding areas

Stakeholders in nearby communities such as at Tiger Creek Junction and Puruni Landing have strictly business interests

Although the area has abundant peccaries and tapirs, no hunter was observed in the area, neither did the consultants observe anyone selling wild meat at any time at Puruni Landing. Indeed, substantial quantities of chicken, beef and pork are sold at Puruni, and all that meat was most likely brought in form Bartica or Georgetown.

There is 'bush' fish available at Puruni Landing but its use does not seem to be popular.

Along the northern boundary of the concession area, at Waiamu Landing and at Quartzstone there are a few very simple dwellings where those involved in transporting goods and personnel 'hang out'. Meals can be bought there too but none of the residents there gave the impression that they plan to 'live indefinitely' at those locations. Security and malaria are the primary concerns of the 'residents' at Waiamu and Quartzstone Landing.

TPTTI's employees will be living and working on the concession area for several weeks at a time and are likely to develop an affinity for the area.

15.3 Impact predictions

TPTTI develops its road network and in fact making access to the concession easier, it is difficult to contemplate which stakeholders may wish to use the road, save for miners, of course. A roundtrip between the concession area and Iteballi comprises 212 km: enough to challenge hunters, fishermen, amateur hunters, and illegal loggers. Malaria is also quite prevalent in the area. of at least. Travelling to Waiamu Landing or Quartzstone Landing, right bank Cuyuni River by boat via the range of falls in the lower Cuyuni is also challenging and its hardly a trip that anyone other than a miner would take.

15.4 TPTTI's policies

TPTTI will adopt the following policies in the development of the concession:

a) TPTTI will only intervene in the forest resources to push a road or to harvest timber; beyond those activities forest areas of little commercial interest as far as merchantable timber is concerned will be left intact.

b) TPTTI will engage the miners with a view to learning about their intentions in the longer term.

c) TPTTI will be vigilant in isolating and protecting *any* asset of archaeological interest on the concession area and then bringing the relative facts to the authorities.

d) TPTTI will not accommodate families at its base camp

e) TPTTI will not encourage the setting up of any 'bush shops' near to its base camp.

f) TPTTI will post appropriate signs (see Figure 41) at strategic points within the concession area and along its roadways.

Figure 41: Specimens of signage to be posted by TPTTI

g) The establishment of large-scale farming by employees will be discouraged.

16.0 SOCIO-ECONOMIC AND CULTURAL IMPACTS (DIRECT AND INDIRECT)

16.1 Introduction

There are no communities within the boundaries of the concession, neither on the perimeter of the concession area.

TPTTI has to date engaged with four communities along the Kartabu/Iteballi -Puruni Road: Iteballi Village, Takutu Community, Tiger Creek Junction and Puruni Landing. Puruni Landing is far away from operations and TPTTI will have no cause to go there except for meetings or possibly communication facilities.

TPTTI's operations will impact the other three communities only when hauling timber to Iteballi. Tiger Creek junction and Takutu Community lie along the route between the concession area and Iteballi, while logs from the concession area will be unloaded at Iteballi then be transferred to a barge for the trip to Georgetown or other point of sale.

16.2 Definitions and scope

Stakeholders' have legitimate interest in the concession area. Everyone is concerned about the quality of water because it affects human health directly. Other stakeholders might be concerned with the *integrity of watersheds* or *faunal populations* or *endemic tree species* in the area. The National Forest Policy Statement 2018 (GFC, 2018) deliberately includes not only provisions for the sustainable harvesting of timber but also the whole gamut of services-provisioning services, regulating services, habitat or supporting services, or cultural services (TEEB, 2010)

16.3 Baseline studies

The terms of reference for the ESIA study requires full engagement with stakeholders. TPTTI engaged stakeholders at a sector scoping meeting at Grand Coastal Hotel, ECD on January 12, 2018 and subsequently at a public-sector scoping meeting at Iteballi on January 14, 2018.
Subsequently TPTTI's consultants formally interviewed fifty (50) persons along the Kartabo/Iteballi-Puruni Road. (The stakeholder profiles and key stakeholder issues are set out in Section 4.0)

16.4 Impact prediction and assessment

16.4.1 Positive Direct Impacts

There have already been several positive impacts generated even though the full logging project has not started yet. The consultants spent more than G$6 million on field work. A substantial part of this sum was spent chartering ATVs and boats at Puruni Landing (see Figure 42) and at Waiamu Landing and Quartzstone Landing. There will be direct positive economic impacts when operations start. TPTTI's operatives at Iteballi will spend cash at the businesses

there, which will help energize the community economically. TPTTI will be employing young people as clerks/technicians to work at its Iteballi facility. Many of these will be trained to do the tasks they will be required to do.

TPTTI's corporate social responsibility thrust will kick in when operations start. TPTTI will provide any reasonable material assistance required by the Iteballi community; priority will be given to collaboration with other businesses at Iteballi to keep the roads there in a proper condition and to control the dust nuisance in the dry season.

Figure 42:Direct spin off benefits-charter of boat and ATV respectively for forest inventory crews

TPTTI through its workforce at Iteballi will help agitate for improved social services for the community. Many people will also be employed and trained at the forest concession itself for tasks such as forest surveys and mapping, tree identification and forest inventory, tree felling operations, skidding and timber grading operations.

16.4.2 Negative Direct Impacts

TPTTI may need to impose restrictions on the use of its roads within the concession and this could be a cause for conflict. At the same time, TPTTI wants to place restrictions on hunting, fishing, and littering and this may not go down well with persons accessing the concession area.

Trucks in transit will produce dust noise and vibration as they pass the three communities; this is likely to be a source of irritation especially for residents of Iteballi. Children and elderly people may be particularly impacted. In addition, there are a large number and assortment of vehicles using the Puruni Road and there is the risk of accidents, especially in the dry season. (It was noted that persons who were late for the barge crossing drive recklessly).

TPTTI's operations may stir up a wages war at Iteballi if its wage rates are higher than that paid by other loggers in the area. Also, TPTTI's operations could lure away residents already engaged in small businesses who may opt for less risky paid employment.

There could be conflicts among the more experienced lorry drivers and mechanics if TPTTI chooses to hire staff from other (coastal) locations. TPTTI will be purchasing new trucks and needs its own assurances that the persons hired to operate its vehicles will be responsible. Also, TPTTI has an OSH policy (see Annexes XIX): it is vital that persons recruited have the self-discipline to cope with these policies or TPTTI will have to terminate their employment which could be a source of dissatisfaction at the community level.

The core impacts are summarized in Table 34 and evaluated or prioritized in Table 35.

Table 34 Identification of core socio-economic and cultural impacts

#	*Issue*	*Nature of Impact*
1	Employment	Creation of opportunities for employment and training Competition with other labour pools
2	Concession based conflicts	Restrictions on access, road use, hunting and fishing
3	Other conflicts	Restrictions on hiring local people
4	Road hazards	Dust hazards Risk of accidents

16.5 Mitigation measures

The following measures will form the basis of TPTTI's response:

a) TPTTI will enforce its own Environmental Policies (Annex XVIII) and its OSH Policy (Annex XIX) to make sure that corporate discipline is maintained always.

b) TPTTI will follow the provisions of the COP, forest management guidelines and prescribed tasks set out in its Environmental Authorization.

c) TPTTI's Forest Monitoring Officer will be proactive in engaging stakeholders so that any issues of concern will be addressed in a timely and amiable manner.

d) All logging trucks and heavy-duty vehicles will either travel with their lights on always or carry rotating beacons.

Table 35 Matrix of potential social impacts generated by TPTTI's operations

Predicted Impacts	**PROJECT ACTIVITIES**								
	Planning Phase				**Operations Phase**				
	Const. of forward camps	*Const. of primary access roads*	*100% Pre-harvest Inventories*	*Tree marking operations*	*Construction of secondary roads*	*Constr. of Skid trails, Log markets*	*Felling trees & skidding logs*	*Log market operations*	*Log haul to Iteballi Landing by trucks*
Employment	Lo: Rv: St: Av: Im: In: Lp	Ex: Rv: St: Un: M: Sig: Hp	Lo: Rev: St: Un: M: In: Lp	Lo: Rev: St: Un: M: In: Lp	Ex: Rev: St: Un: M: Sig: Hp	Ex: Rev: St: Un: M: Sig: Hp	Ex: Rev: Lt: Un: Im: Sig: Hp	Lo: Rev: St: Av: M: Sig: Hp	Ex: Ir: Lt: Un: Im: Sig: Hp
Concession based conflicts	Lo Rev Lt Un M In Hp	Ex Rev Lt Un M In Hp	Ex Rv Lt Av M In Hp	Lo Rv St AV M In Lp	Ex Hp Ir. Lt Un Sg	Ex Hp Ir. Lt Un Sg	Ex Hp Ir. Lt Un Sg	Lo Rv St Un M In Lp	Lo Ir. Lt, Un M Sg Lp
Other Conflicts	Lo Rev St Av M In Lp	Ex Rv St Un M In Lp	Ex Rv Lt Un M In Lp	Ex Rv St Un M In Lp	Ex Rv Lt Un M In Lp	Ex Rv St Un M In Lp	Ex Rv St Un M In Lp	Lo Rv Lt Un In LP	Lo Ir Lt Un M In Lp
Road Hazards	Lo Rv St Un M In Lp	Ex Rv Lt Un M Sg Hp	Ex Rv Lt Un M In Lp	Ex Rv Lt Un M In Lp	Ex Rv Lt Un M Sg Hp	Ex Rv Lt Un M Sg Hp	Ex Ir Lt Un M Sg Lp	Lo Rv Lt Un M In Lp	Ex Rv Lt Un M Sg Hp

Impact Significance (parameters)

Lo-*localised*, Ex-*Extensive*/ Rv-*Reversible*, Ir-*reversible*/St-*short term*, Lt-*long term*/ Av-*Avoidable*, Un-*Unavoidable*/ M-*Mitigable*, Im-*Immitigable*/ Sig-*Significant*, *In*- Insignificant/Hp-*High probability*, Lp-*Low probability*

Note: All Extensive, Mitigable, Long term, and Significant impacts will have to be prioritized.

17.0 RISKS AND RISK ASSESSMENT

17.1 Introduction/Overview

The directors of TPTTI rely on their association and experiences with TPL generally and with the management of TPL's TSA 4/85, southern side, Kartabu-Puruni Road to take forward its project. The directors of TPTTI believe that they have correctly evaluated all the core variables- elaborated below- that determine whether a logging operation of the kind contemplated will be successful.

17.2 Access

The concession is very accessible, based on the presence of the well-developed Kartabu-Puruni Road designed to accommodate heavy-duty trucks and the (existing) Tiger Creek Road linking the Kartabu Road with the southern side of the forest concession. Altogether, for the next ten years, TPTTI anticipates a mean hauling distance of 106km[25], (5-hour trip) which is well within the effective load haul distance for the MACK logging trucks the company will use. TPTTI will design roads to support speeds of 50km/hr.

17.3 Forest Resources

TPTTI is satisfied with the following parameters for forest resources:

a) The quality of the merchantable stock-as a proportion of the forest stocking,

b) the market demand for the species available, and

c) the distribution of diameter classes for the merchantable species.

17.4 Choice of technology

TPTTI will be extracting **logs** from the concession area. TPTTI's timber harvesting operations will be based on RIL principles and practices which require that every aspect of the forest interventions be planned to reduce environmental impacts and achieve cost savings.

Consequently, TPTTI will deploy the *appropriate* machine for every intervention including but not limited to:

a) Chainsaws *designed for directional tree felling* and with the proper safety features for the protection of the chainsaw operator.

b) Bulldozers, motor graders, compactors for main road clearance and surfacing works
c) Excavators for mining burrow pits, roadside draining design, and bridge and culvert construction

d) Front-end loaders (with fork and bucket) for loading earths into trucks and for loading logging trucks

e) Skidders for transferring logs from stump to log market

[25] This is normal for Guyana

f) Heavy-duty logging trucks with a proven performance record for local forest conditions.

TPTTI is confident that spare parts and the proper maintenance services are available to keep all equipment in their proper functional state. TPTTI is confident that the use of RIL practices associated with a maximum yield of 8.33m^3will and prescriptions on felling trees set out in the COP will neither lead to accelerated forest degradation or forest fragmentation and further, will create minimal impact on fauna.

17.5 Constraints-shared Road use

For TPTTI, shared road use at the concession level is manageable: the company will simply post signs advising that other users must give way to TPTTI's vehicles and of course all 'other' users will use TPTTI's logging roads '*at their own risk'*. Generally, TPTTI will engage with other road users to ensure that all concerns are managed properly and not escalate into conflict.

For the use of the Kartabu-Puruni Road, TPTTI will simply apply basic 'care, consideration, caution, courtesy and common sense' practices in the face of other road users. Specifically, TPTTI's vehicles will slow down near to 'residences or businesses' such as the Takutu location. TPTTI is also committed to supporting road maintenance efforts, by placing some of its equipment at the service of the authorities or simply proactively undertaking maintenance efforts at its own initiative and cost.

17.6 Shared use of Iteballi Waterfront

At least one company currently uses the Iteballi Waterfront as a log depot[26] See Figure 38) while another log depot at the water front is inactive.

Figure 43: Existing log depot at Iteballi-WTTCL

TPTTI will collaborate with that company, and any other approved by the GFC, to address mutual concerns.

[26] The company, WTTCL, first started using the site in the late 1950s.

17.7 Policy Conflicts

It is very probable that expanded mining operations may approach a critical threshold where the total area degraded may conflict with commitments made in international agreements. Then authorities may fear that the incremental value of deforestation and forest degradation through timber harvesting activities will further jeopardize the situation. In which case the authorities may consider halting forest operations because the benefits of timber harvesting may not be worthwhile at the macro level.

Figure 44: Mining may cause conflict with other forestry based national initiatives.

17.8 Constraints-Stakeholder engagements

TPTTI is committed to engaging with stakeholders to minimize conflict and create conditions for continuous operations. Two senior staffs of TPTTI –the *Operations Coordinator* and the *Forest Monitoring Officer*-will have specific responsibility for engaging stakeholders and for managing their concerns.

17.9 Security Issues

TPTTI believes that currently security considerations are unlikely to stymy its operations. However, in a couple of years when its road system is developed, restrictions on hunting and fishing, the proximity of itinerant mining operations, and a diversity of 'bush businesses' traversing the concession area are all potential sources of security concerns. TPTTI will rely on its stakeholder engagement protocols to identify and manage stakeholder issues.

17.10 Labour challenges

TPTTI has a human resources policy which guides its personnel management issues. TPTTI will stress the need for flexible working hours to address the peculiarities of logging operations and time sensitive production targets to ensure profitability. (*Normally*, no work, including hauling logs to Iteballi will be done in the evenings or on Sundays and Holidays).

17.11 Markets

TPTTI believes that the market for local durable timbers will expand and that minimal prices for the best grades of timber will stabilise at US$1,000.00 per cubic meter. TPTTI believes that customers will avoid lumber that has been impregnated with chemicals and will aim for more *naturally durable timbers,* such as those available in local forests.

The company predicts hardwood flooring and decking from tropical timbers will be premium products at the niche market level.

The imminent development of a VPA between GOG and the EU will also guarantee access to more markets. (Indeed, TPTTI believes that its capability for selling in high end markets will depend entirely on its marketing efforts).

17.12 Main cost centres

TPTTI has computed its main cost centres as follows:

a) Capital purchases

b) 100% pre-harvest forest inventory

c) Road construction and maintenance

d) Timber harvesting and extraction (including hauling logs to Iteballi)

e) Preventive maintenance of equipment

f) Labour costs and employee welfare, including training of field operatives

g) Concession administrative costs, including costs linked to the ESIA study and report as well as forest concession charges-acreage fees, royalties, and taxes.

h) Corporate social responsibility

i) Corporate taxes

j) Administrative costs linked to Iteballi facility, the base camp Ekabago and forward camps

k) Forest monitoring tasks

17.13 Analysis and conclusion

The eleven (11) items identified at 17.12 will be responsible for 98% of the operational costs and will be expressed as into cost/m^3. TPTTI expects to generate 10,000m^2 of high-grade lumber per annum and all its research point to an annual incremental increase in the price obtained per cubic meter of high-grade lumber. TPTTI is convinced the company will its investments comfortably within ten (10) years.

18.0 CUMULATIVE IMPACTS

18.1 Introduction

Mining and forestry activities are the drivers of economic development of the Kartabu-Triangle.

It is estimated that gold mining is responsible for 85% of the economic activity in Kartabu-Triangle. Mining also carries several backward and forward economic linkages. Even before Gold production process starts, there is the need to purchase vehicles, generators and pumps, fuel, mining supplies and rations and take these to the mining site, at distances which may exceed 300km. Fuel is the life blood of mining activity and steady supplies is vital for the operation of the dredge, whether (sufficient gold is recovered) or not. Mining is high risk activity and large numbers of people that depend on mining have no guarantees

Logging and timber harvests are much more predictable: timber resources can be quantified; all production variables can be quantified even before the first tree is felled.

Loggers generally cannot afford the wages paid by the mining sector, and frequently operatives in the logging sector transition to the mining sector. It is also the case that many miners eventually opt for a more sedate job in the timber industry: there is less risk, less work hazards, and fixed pay dates.

Mining and forestry will continue to occur within the Kartabu Triangle and beyond in the long term. Their interventions and the quality of remedial or mitigating practices will determine the quality of environmental conservation and management.

18.2 Definitions and scope

Cumulative Effects/Impacts for this study may be defined as the impact on the environment which results from the incremental effects of the timber harvesting when added to mining activities, past, present, and reasonably foreseeable future actions Cumulative effects result from individually minor, but collectively significant, actions taking place over a period.

The nature of the project, particularly the projections for employment and the planned interventions into the resources along with existing land use are the elements used to determine cumulative impacts.

18.3 Cumulative Impacts

18.3.1 Positive impacts

The consultants believe the positive cumulative impacts will occur away from the concession area itself.

The proposed project provides employment opportunities for those skilled field operatives who are not inclined to cope with the rigours and risks of mining and who also wish to be their families on a more regular basis. At Iteballi, there are opportunities for women to get employment as clerks, checkers, and timber graders.

The additional people in the concession area will result in a higher volume and flow of fresh meat and vegetables goods to the area. It appears that all fresh vegetables in the area, beef and pork originate from the coastland. The demand for meat and vegetables will increase and coastal farmers will be assured of income which could lead them to expand their cultivation. Much of this fresh vegetable are transported from Parika, East Bank Essequibo either via Bartica or directly to Iteballi by specially charted speed boats[27]. Therefore, this project will have positive benefits for all those (vendors and boat captains) in the food supply chain. Coastal farmers, especially those on the East Bank Essequibo, including Bonasika will become wealthier. Boat captains and vendors may expand their business and the demand for fuel will be higher.

There are no farmers near Puruni Landing. Farmers at Iteballi may want to invest in their farms again because they can produce and sell greens and vegetables at a cheaper cost than coastal farmers. (The sandy soils near Iteballi re not as rich as coastal clays so farmers at Iteballi will not put coastal farmers out of business.).

Iteballi, like Kartabu Village, Karrau Village, Mazaruni Prisons and Riversview are satellite communities of Bartica. Residents from those villages travel to Bartica for 90% of their business and social requirements. In effect then, Bartica feeds on Iteballi. To make matters worse, Puruni Landing has developed far faster than Iteballi and miners travelling to the upper Mazaruni and the upper Puruni apparently prefer to spend time at Puruni Landing rather than Iteballi. The project by TPTTI will inject cash inflows and promote *'economic stability'* at Iteballi. Established businesses at Iteballi will be supported.

Iteballi has had some difficulty attracting political support for its development[28]. Further only one public agency-the GFC-has an office there (although there is a check point some 5km west of Iteballi, manned by the GPF and the GGMC). The consultants think that if that were indeed the case, it is so because Iteballi is not *perceived* as strategically important to compete successfully with other communities requiring political support and development funds from central Government. Perhaps Central Government does not garner sufficient taxes from Iteballi that would make the community noticeable. Perhaps there are no development plans originating from residents to attract and guarantee the attention of regional officials or central Government. The project by TPTTI will increase the volume of business at Iteballi and certainly there will be statutory taxes paid to central Government and to public agencies such as GFC and GLASC.

Many people passing through Iteballi, have fallen in love with the landscape and the general environment and have chosen to remain there, acquiring agricultural leases from GLASC in the process. It is quite likely that some of TPTTI's employees may be attracted to Iteballi to the extent that they want to stay there. Any increase in the resident population will augur well for its development. (Cell phone services from DIGICEL Company is already available at Iteballi).

Bartica is steadily attracting businesses based in part on the economic vitality of satellite communities. TPTTI's employees will use banking services[29] and money transfer services such as Western Union. Major retail outlets such as Demerara Distilleries Ltd., Banks DIH, Courts Guyana Inc., and ANSA MCAL TRADING, will also benefit from increased expenditure; and this will lead to the further development of Bartica in the long term.

[27] Bateau type craft using Yamaha engines of 150-200hp; some boats carry two engines.
[28] This fact emerged during the public scoping meeting on January 1, 2018
[29] There are three commercial banks in Bartica.

18.3.2 Negative Cumulative Impacts

(a) Stress on families

Field operatives based at the concession will be away from their families for extended periods, and most likely their families will be at Iteballi, Bartica or the coastal belt. Income earned will have to be divided between each employee's concession based 'home' and the family home. Unless managed well, this could lead to unnecessary stress within families. Children will also not benefit from the coaching and counselling of their fathers on a regular basis, and this can only be to their disadvantage.

(b)Expanded Road network

Stakeholders, including miners, are sure to take advantage of the expanded road network that TPTTI will construct. Unlike typical mining roads, these roads will be well constructed and maintained to accommodate heavy-duty timber trucks. An expanded road network could prove to be a challenge for the security forces trying to track down people engaged in illegal practices.

(c)Intensity of interventions on the concession area
The concession area is already impacted by mining operations, and it is straightforward at this time to assign responsibility for environmental issues to mining activities. The interventions necessary to undertake logging will increase the intensity of interventions on the concession area. Over time it will be tedious to assign responsibility for the source of major environmental problems such as forest degradation or poor water quality in streams. If TPTTI plans to export timber to the European Union or to acquire international certification of its forest management systems, it would be tedious to isolate to what extent its operations meet international requirements. This is a major administrative burden for the company.

(d)Conflicts with national policy
Until mining practices improve dramatically (in a few years) based on current initiatives by the GGMC and the GMSTCI, the increased intensity of negative environmental impacts in the short term based on mining and logging on the same area could produce data that are not compatible with national level commitments for a green economy or with commitments made in relation to international commitments and agreements.

18.4 Mitigation and monitoring - Environmental and Social Management Plan

TPTTI is committed to running a *successful* logging operation in line with the terms of its State Forest Authorization and its Environmental Authorization.

19.0: EMERGENCY RESPONSE PLAN

19.1 Overview

This Emergency Response Plan (ERP) is an extension of TPTTI's OSH Policy and its Safety Policy (see Annexes x and Y respectively). The ERP is intended for use by TPTTI's field operatives in relation to potential hazards that may arise during its logging operations or other high-risk activity. The ERP specifically provides information and guidance to assist Company personnel in preventing, reporting, responding to accidents. It also sets out responsibilities and a chain of command for responding to emergencies.

19.2 Purpose

The purposes of the ERP are:

a) To eliminate the potential causes of fire and other emergencies, prevent loss of life and damage to property and the environment

b) To set out procedures to be followed in case of emergencies

c) To establish a command chain in responding to emergencies

19.3 Policies

All personnel must be aware of and take steps to manage hazards in their work area. In addition, all personnel are expected to alert security if they discover a fire or oil or chemical spill in keeping with the procedures set out in this plan. However, only duly trained personnel would respond to fires. Response procedures shall be posted at strategic points in all work areas.

Emergency Response Teams (ERT) and Fire response Teams (FRT) must be identified and trained to respond to fire, oil spills, chemical spills, and medical emergencies. These teams will be drawn from the relevant departments based on the nature of the potential hazards associated with each section

19.4 Responsibilities/ chain of command

(a) Forest Operations Manager

a. Ensure implementation and maintenance of this plan.

b. Report to relevant authorities in case of an emergency

c. Review event analysis reports with relevant line managers/ supervisors and the Administrative Manager.

d. Get as much information as possible on the nature of the emergency from the caller

e. Ensure that the Administrative Manager and members of the relevant ERT are immediately alerted and given the information obtained on the emergency.

f. Ensure the Operations Manager is informed of the emergency.

(b) Line Managers or Supervisors

a. Ensure subordinates are aware of the potential hazards of their work area and that they take the necessary precautions as they carry out their tasks.

b. Ensure subordinates are familiar with and trained in the emergency response procedures.

c. Ensure personnel are provided with and use the prescribed safety equipment to carry out their duties safely.

d. Ensure the inspection of electrical wiring in his or her section/ department on a yearly basis. Ensure electrical technicians monitor electrical wiring biannually.

e. Ensure that oil and other petroleum products used by staff are labelled, safely stored, and handled in accordance with the ERP and any other guidelines provided by the Company.

f. Ensure that all incidents of fire are reported on in accordance with this plan. Line managers shall prepare an Event Analysis of any fire, or oil spill that occurs in his or her department. All such reports shall be copied to the Administrative Manager and the General Manager.

(c) Chief Clerk

a. Provide on-going safety training and briefing sessions for staff associated with operational hazards.

b. Oversee and conduct regular inspections of all emergency response/ clean up equipment to ensure they are in working order.

c. Ensure that the ERTs receive appropriate training to respond to fire, oil, or chemical spills.

d. Assist line managers/ supervisors with the completion of the spill report and incident investigations after any spill or fire.

e. Assist line management with the preparation of an Event Analysis for any oil product spill that exceeds 5 gallons.

(d) Emergency Response Teams (ERTs)

a. Fire Response Team: Promptly respond to and put out fire as trained and as set out in this plan.

b. Medical Response Team: Promptly respond to medical emergency as trained and as set out in this plan.

c. Be aware of the potential hazards of your work area and take precautions to prevent them from occurring during carrying out your duties.

d. Follow good housekeeping practices to prevent accidents, fires, and other emergencies.

e. Be alert for fire, oil, or chemical spills in your work area.

f. Sound the alarm and call security immediately after detecting any fire

g. Call security immediately on observing any oil sheen, spill or if there is an unplanned release of any chemical anywhere.

h. Follow the emergency response procedures set out in this document.

19.5 Fire prevention and response

(a) Potential Fire Hazards

TPTTI believe that fires can be prevented if potential hazards are identified and managed. Good housekeeping target the prevention of fires. Discarded combustible material would be managed in such a manner that such material is not allowed to accumulate. Each work area would be provided with a sufficient number of non-combustible waste or trash receptacles. As far as practicable, staffs will avoid the use flammable cleaning solvents to clean floors, walls, furniture, and equipment.

Potential fire hazards to be avoided include the following:

a. Overloaded electrical circuits, unsafe wiring, and defective extension cords

b. Improper disposal of smoking cigarette butts;

c. Improper use, handling and storage of flammable material e.g. gasoline, waste oil, paint

d. Improper housekeeping resulting in accumulation of flammable material e.g. paper, cardboard boxes, oil-soaked rags, flammable liquids

e. Improper use of welding torches and batteries

(b) Types of Fires and Fire Extinguishers

There are different types of fires, and these determine the type of extinguisher to be used in an emergency. Fires can be classified into four general categories based on the type of materials or fuels involved:

a. Class A Fires: involve ordinary combustible material such as wood, paper, rags, rubbish, and other solids.

b. Class B Fires: involve flammable or combustible liquids such as gasoline, fuel oil, paint, and hydraulic fluids.

c. Class C Fires: involve electricity or electrical equipment

d. Class D Fires: involve combustible metals such as magnesium

Classes A, B and C fires are the ones of major concern.

(c) Fire Response Procedures:

If one discovers a fire:

a. Activate the fire alarm (gong)

b. Call security (number to be established) and report the location of the fire. (Security will inform the emergency response personnel who will respond to the fire as trained.)

c. Ask for help if someone needs rescuing

d. Confine the fire by closing doors, windows, and other openings if time permits and if possible.

e. Evacuate the area and wait in the nearest designated waiting and meeting area.

f. Provide as much information as you can to emergency response personnel

19.6 Oil (petroleum product) spill prevention and response

(a) Storage of Oil

Mismanagement of waste oil can lead to the contamination of water and soil. Many components of oil are toxic to living organisms. Contamination from waste oil results mainly from improper storage or disposal. Waste oil will therefore be carefully stored.

The following practices would apply:

a. Waste oil will be stored in drums. Use of rusting drums will be avoided as they may leak at a future time. Each drum must be labelled with the date that the accumulation started as well as the terms "Hazardous Waste", "Waste Oil", and "Toxic".

b. All drums containing waste oil must be stored in the waste oil storage area which will have retaining walls and floor made of material which is impervious to the migration of oil. The storage area must have a clearly legible sign stating: "Waste Oil." The storage area must also be protected from the weather by a shed.

c. The drums will be stored off the ground on raised pallets to facilitate detection of any leakage.

d. Monthly inspection of the waste oil storage area must be carried out to check for any leakage or potential leaks. During these inspections the condition of the drums must be checked. The floor and the palettes must be checked for any sign of oil leakage.

(b) Oil Spill Response Procedures

In the event of an oil spill the following steps must be taken:

a. Evacuate the area and warn others as necessary

b. Contact security immediately

c. Ask for help if anyone is injured and/ or needs rescuing

d. The security staff responding to the call will notify the Administrative Manager, the Oil Spill Response Team and the Forest Manager

e. If possible, stop the release e.g. by turning off any valve left open

f. Visually inspect the site of the oil spill to obtain enough information to describe the situation to security and response personnel (see Table 33) Be careful, be alert and keep clear if any hazardous chemical is involved. The following minimum information would be gathered:
    i. Spilt material (e.g. used oil or gasoline)
    ii. Estimated quantity of spilt material (or surface area covered or rate of flow)
    iii. Location and direction of the spilt material and direction of flow
    iv. People involved, injuries

g. Help to direct response personnel to location of the spill

h. Response personnel must ensure the release is stopped and clean up the released oil and manage the resultant contaminated material.

i. On the same day of the spill submit event information to your line manager/supervisor and Administrative Manager. This will assist them in completion of the Oil Spill Report Form.

j. Line management with assistance from the Administrative Manager and relevant Department Personnel will perform an Event Analysis.

19.7 Plant maintenance

Regular drills would be carried out to ensure the functional aspects of the ERP. This initial draft plan will be refined within six months of start-up of operations. After this, the plan would be reviewed on a yearly basis and updated as necessary.

19.8 Other protocols

TPTTI developed an Emergency Response Chart for general application (see Figure 45) , a simple reporting format in case of emergencies (see Table 35) and a list of contact numbers in the event of an emergency (see Table 36) to guide the effective management of emergencies.

The Forest Monitoring Officer will review the whole emergency response process to guide its development and make sure everyone understands and internalize the process.

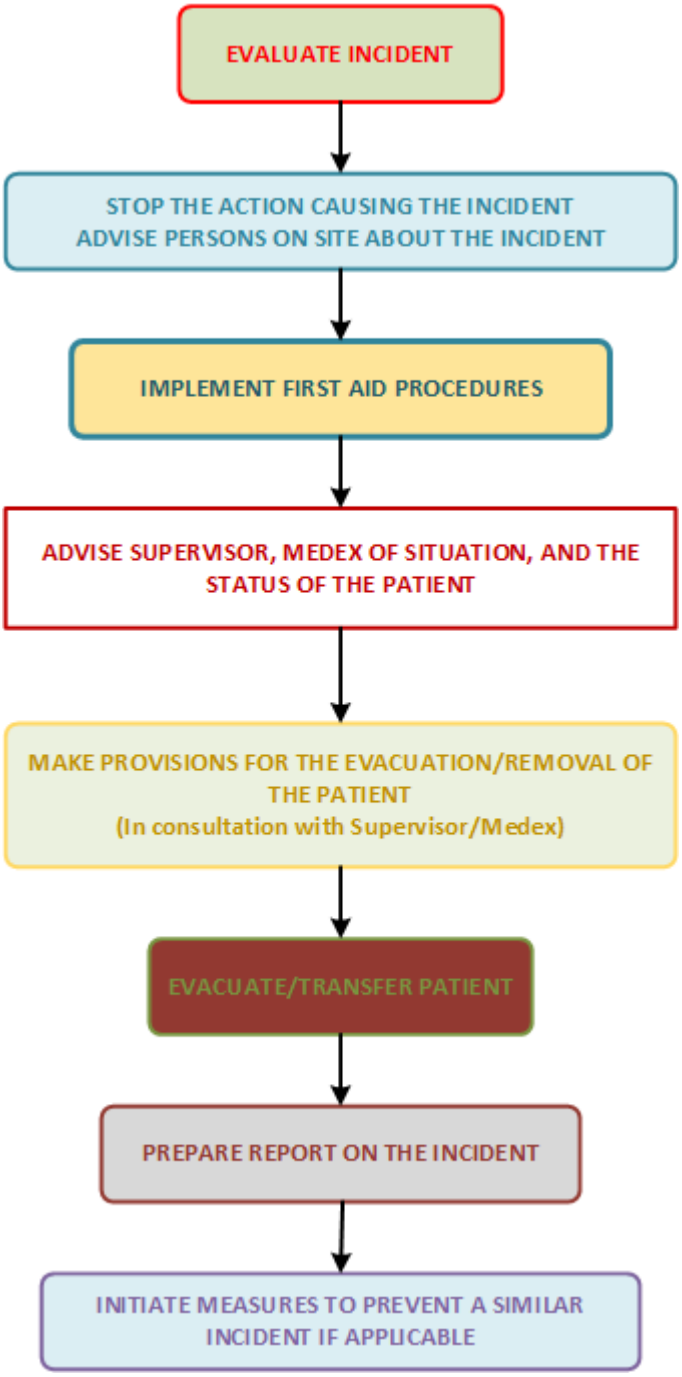


Figure 45:Provisional emergency procedures for TPTTI

Table 36: Specimen Emergency Report Form

#	EVENT	REMARKS
A	EMERGENCY:	
1	Time discovered	
2	Date discovered	
3	Name of responder	
4	First reported by	
B	Reported Injuries	
5	If so, was the medical response team dispatched	
C	FIRE HAZARD	
6	If so, was the fire response team dispatched?	
	OIL /FUELSPILL	
7	Type of Oil or Fuel discharged or spilled:	
8	Estimated Quantity Spilled	
9	Exact Location of Spill	
10	Is it flowing/contained?	
11	Weather Conditions:	
12	Ground Conditions	
13	Action Taken: (A, B or C)	

Table 37: Emergency Contact List

#	Agency	Phone No(s).
1	TPTTI Head Office, Georgetown	226-8556; 225-7507; 227-0381
2	Bartica Hospital	455-2193, 455-2339
3	Belle's Speed Boat Service	455-3006
4	Georgetown Hospital	227-8210/2
5	Air Services Limited	222-4537, 222-4368, 222-2993
6	Bartica Police Station	455-2222
7	Commander-F Division	455-2238
8	GFC-Bartica Office	455-2332
9	Commissioner of Forests, GFC	226-7271/4
10	Regional Chairman	455-2224
11	Regional Executive Officer, Bartica	455-2251
12	Environmental Protection Agency	225-4679, 225-5469, 225-4173

20.0 CONCEPTUAL CLOSURE PLAN

20.1 Factors that may lead to the closure of TPTTI Operations:

The expected life of the project is 60 years following which the company could exercise the option for a renewal of their TSA for another 60 years.

TPTTI has prepared a Closure Plan based on the following scenarios:

a) If the GFC does not grant an extension of the TSA, after its expiry;

b) If there is an increase in mining activities within the compartments, or the mining activities in the compartments make field operations inoperable and unprofitable for TPTTI to continue logging operations

c) If the Kartabu Road deteriorates or its use becomes too problematic (given the increasing number of stakeholders) to such an extent that log transport on it is no longer feasible;

d) If, for any reason there is a heightened threat to the safety and security of field crews.

20.2 Objective of Closure Actions

The principal objectives of the closure actions are to:

a) Conclude all contractual agreements with employees and their Union

b) Conclude all obligations to the Government of Guyana (taxes, royalties, fees, etc.)

c) Decommissioning and removal of all fixtures and structures, equipment, machinery, and other infrastructure from the concession

d) Clean up all debris (tyres, machine parts, oil drums, etc.) from the forest floor.

20.3 Closure Actions:

a) In event of the Company's closure, the GFC, the employees, the Trade Union, RDC and relevant Government authorities, institutions and organizations would be notified. The authorities would be given adequate notice prior to the closure of the field operations (see Table 38).

b) If the Company would ever change ownership, or transferred to any other entity, the employees, the relevant Government authorities, institutions, and organizations would be notified. As the only fixed community in the area, the CDC of Iteballi would be notified. The notification would be provided six (6) months prior to the change in ownership.

c) NIS and PAYE contributions for staff be discontinued; employees would be advised of the status of their payments, that is whether all the appropriate contributions have been handed over to the NIS, GRA respectively. Severance Pay for Employees/Workers will be paid and other moneys due to them as required by Labour Act and the Termination and Severance Payment Act (TESPA). Acreage fees, royalties and taxes of all descriptions required by the Laws of Guyana shall be honoured.

d) Disposition of social infrastructures of the Company will be managed in collaboration with the GFC and the RDC. A comprehensive site clean-up activity will be undertaken at all workplaces to remove all foreign debris from the forest environment.

e) TPTTI will duly inform the FPA regarding the availability of trained technicians. TPTTI will also explore other ways of assisting ex-workers in any material away (for example gifts of tools, priority in the sale of vehicles, etc.). Expatriate staff will be repatriated in accordance with national immigration procedures.

f) If the Company would have logging or sawmilling operations in other locations in Guyana, the transfer of employees/workers would be considered.

Table 38: Summary of closure actions

#	Action	Responsible Party	Consultations	Schedule
1	Prepare a checklist of all activities to be undertaken toward the closure of operations	Operations Manager	Forest manager	-180 days
2	Advise the GFC, GRA and NIS about the closure and address any concerns they have	Operations Coordinator	Chief Clerk	-90 days
3	Prepare a list of all redundant staffs and their CVs or profiles *with a view to sharing the lists with other companies.*	Operations Manager	Forest manager	-90 days
4	Brief employees about the reasons for closure	Operations Manager	Forest manager	-90 days
5	Prepare redundancy packages & Letters of Reference	Operations Manager	Forest manager	-90 days
6	Ensure records related to remuneration packages are up to date	Operations Manager	Chief Clerk	-90 days
7	Take care to secure company assets, especially records	Forest Monitoring Officer	Chief Clerk	-45 days
	Make arrangements to clean up the base camp in the forest area and dispose of all items that could injure animals	Forest Monitoring Officer	Chief Clerk	-45
8	Give employees preference in the sale of disposable assets	Forest Monitoring Officer	Chief Clerk	-30

21.0 THE ENVIRONMENTAL MANAGEMENT PLAN -SUMMARY

21.1 Overview

This chapter summarises the key elements of TPTTI's environmental management plans. It comprises the following elements:

a) Mitigation measures/Mitigation Plan
b) Basic road management plan
c) Wildlife management plan
d) Capacity building and training plans
e) Monitoring Plan

The development of the aforementioned plans is based on a number of considerations:

a) Management experience: the CORE MANAGEMENT team of the company has been involved in logging in the Butukari-Anarika and Manaka districts for many years. The Company has also garnered experience with third party forest management certification and also its relationship with the EPA in the preparation of environmental management plans. The experience of the company has allowed it to develop robust corporate discipline and respect for the public agencies that manage forests.

b) The value of trained employees. TPTTI has ensured through regular briefings, training courses, and coaching that its employees appreciate the company's philosophy on the conservation of the environment and the need for them to share responsibility for full compliance with national guidelines.

c) Customer base: TPTTI's marketing thrust depends a great deal on customer's confidence that the company is a responsible forest operator.

d) Value system/Spiritual values: The management of TPTTI believes that the forest could be exploited for financial benefits and at the same time continue to offer a range of aesthetic values that soothes one's soul. TPTTI believes that forests provide benefits far more than the average person can contemplate.

21.2 Mitigation measures/Mitigation Plan

Impact significance has been taken as a function *primarily* of the following criteria:

a) Magnitude and extent.
b) Reversibility.
c) Longevity.
d) Probability of occurrence.

Based on these criteria the main significant impacts, which need to be mitigated, are as follows:

a) Impacts associated with physical environment: earthworks of various kinds and for various purposes, air quality, water resources, and soil resources.

b) Impacts related to the biological/ecological environment: timber harvesting activities, wildlife, and ecological relationships

c) Impacts related to the socio-economic environment: conflicts over land use, social problems, road safety, waste management

These matters are presented in Tables 39 and 40 in terms of the following:

a. Predicted impact and Proposed mitigation measure and the time frame for implementation (Table 39)

b. Projected situation after implementation of mitigation measures (Table 40)

Table 39: Potential negative impacts and corresponding mitigation measures

Predicted impact.	Proposed mitigation measures	Lead agency	Time frame for implementation
Physical Environment			
Earthworks Grubbing, cut and fills, scarification of soil surface, sub-soil exposure , erosion, compaction, water logging	• Plan roads, bridges and culverts paying attention to topography and the use of stock maps. • Use appropriate machines for all earth works to reduce the time taken to complete each activity. • Consider the weather pattern before initiating major earthworks. • Follow the recommendations of the CoP (Sections 4.5-4.7, Section 5)	TPTTI	During the entire time frame for the project.
Air quality: Dust and smoke (especially along roads) minor changes in micro-climate	• None. In any event, dust and smoke do not represent a major impact. However, Occupational Health and safety must be an integral part of planning and carrying out all operations; for example TPTTI's staff would use dust masks (as well as safety helmets, goggles and ear muffs during normal work. • Vehicles will travel **slowly** <25 km/hr whenever they pass homesteads or communities.	TPTTI	During the entire time frame for the project.
Water resources: negligible increases in turbidity, temperature, ph.; oil spills	• Strict adherence to RIL principles and prescriptions of the CoP, especially regarding buffer zones along waterways. • Maximum care to be taken to ensure all vehicles and machinery are in a proper state. Dispense or change lube oil only in designated areas. • EPA's Brochure on Water conservation to be placed at all public points around the concession. • Regular briefing sessions for field staff would be formalised. • Care taken to avoid excessive spillage of borax solutions whenever used to treat (some species of) timber.	TPTTI, GFC	During the entire time frame for the project.
Biological/ecological environment			
Timber harvesting: destruction of juvenile trees, genetic erosion of species, decline in soil fertility, spillage of oil, increased potential for blow downs	• Implement a system for conducting pre-harvest inventories and preparing stock maps • Use directional felling techniques for felling trees • Plan skid trails on the basis of stock maps; • Use winching techniques. • Use heavy duty machines that are fully functional	TPTTI	During the entire time frame for the project.

Predicted impact.	Proposed mitigation measures	Lead agency	Time frame for implementation
	• Train all field operatives in RIL practices		
Wildlife: modification, destruction of habitats, population changes	• Ensure a systematic manner of timber harvesting so that once a block is harvested, the operation moves on (and animals can return). • Restrict hunting activities by placing advisory notices at strategic points in and around the concession area. • Unique ecosystems, habitats and species will be conserved, by restricting logging in areas where they occur.	TPTTI	During the entire time frame for the project.
Ecological relationships; Modifications of ecological relationships. Increased potential for pests.	• Implement proper RIL practices and prescriptions of the CoP (Sections 8, 9 & 10).	TPTTI, GFC	During the entire time frame for the project.
Socio-economic environment			
Conflicts: restrictions of access, alienation of rights	• Engage residents in discussion and consultations to address mutual concerns.	TPTTI	As required
Social problems: crime, use of alcohol, other disagreeable behaviour; increase in life threatening behaviour through exposure to various illnesses.	• Work with public agencies (Police, staff of the Ministry of Health, and staff of the Ministry of Regional Development) in Region 7 to address emerging issues. • Keep proper records of emerging problems and pass these on to the appropriate agencies.	TPTTI	As required
Road safety: high probability of road accidents.	• Work with the police and the Kartabu-Puruni Road community and other stakeholders to ensure adherence to proper road use practices and to identify road locations requiring special attention. • Make sure that each vehicle is in a full functional state prior to its use on the roadways, within and outside of the concession area. • Place appropriate cautionary signs at sharp turns, steep grades, and bridges and near populated areas. • Promote proper skills set among drivers through training.	TPTTI	During the entire time frame for the project.
Waste management: illnesses resulting from a polluted environment	• Observe prescriptions of the Code of Practice for forest operators 3rd Ed. Sections 8.0, 9.1, 9.2 • Hold frequent briefing sessions with staff to ensure a shared understanding of the consequences of poor control over waste management. • Distribute and put up EPA's brochure on waste management at all camps.	TPTTI	Monthly

Predicted impact.	Proposed mitigation measures	Lead agency	Time frame for implementation
Indigenous, archaeological assets: loss, destruction modification of habitats, landscapes	• Identify and isolate any assets encountered and post appropriate advisory signs and notices; • Ensure such sites are placed on all stock maps • Build fences around assets and place appropriate signs after consultation with MOA. • Consult with the Amerindian Affairs Ministry and the Walter Roth Museum on collaborative efforts to protect any assets discovered • Collaborate with communities to address the conservation of existing and emerging assets. • Offer training & incentives where appropriate		As required

Table 40: Projected situation after application of mitigation measures

Environment Type	*Project Activities*	*Project Phase*	*Potential Environmental Impact*	*Main Mitigation Measure*	*Impact Significant after Mitigation*
Physical Environment (Land/Soil)	Clearing of lands for the construction of base camps, roads, log markets and mechanical workshops	Operations	Removal of specific site vegetation to facilitate the construction of project facilities has the potential to expose the soil to erosion, Scarification of soil surface and sub-soil, soil compaction.	Minimize removal of vegetation and encourages the re-vegetation of site impacted by clearance. Installation of drainage system to accommodate surge in storm water.	Ex: Ir: Lt: Un: M: In:Lp
	Operation of Machineries	Operations	Soil compaction from multiple passes of heavy vehicles over soil surface.	Avoid the use of heavy vehicles during periods of heavy rainfall. Design specific routes for heavy vehicles and equipment to use.	Ex: Ir: Lt: Un: M: Sig: Lo
	Waste Disposal (solid and liquid waste)	Operations	May result in soil contamination from indiscriminate disposal of liquid, solid and hazardous waste	Implementation of a sound waste management system at the location of operation	Lo: Rv: St: Av: M: In: Hp
	Fuel and Oil transportation, handling and storage	Operations	Pollution from fuel and oil as a result of a spill during transportation, handling or storage.	Ensure that fuel, oils and hazardous liquids are stored in a bunded are that has an impervious surface. Due care will be applied so as to prevent spillage whilst handing fuel, oils and potential hazardous liquids.	Lo: Ir: Lt: Av: Im: In: Lp. Lo: Ir: St: Av: Im: In: Lp
	Clearing of lands for the construction of base camps, roads, log markets and mechanical workshops	Construction/ Operations	Potential increase in sediment loads and turbid streams due to surface run off and erosion. Removal of vegetation	Implementation of erosion control measures. Channel storm water to a settling/forested area before discharge into creeks. Create buffer zone around streams and creeks.	Lo: Ir: St: Un: M: Sig: Hp

Environment Type	*Project Activities*	*Project Phase*	*Potential Environmental Impact*	*Main Mitigation Measure*	*Impact Significant after Mitigation*
Physical Environment (Water Resources)	Construction of bridges and the installation of culverts	Construction/ Operations	Possible reduction of stream flow from the installation of bridges and culverts	Construct bridges and culverts in accordance with the GFC's Code of Practice for Timber Harvesting Operations Temporary water-crossings to be decommissioned after usage to ensure that they do not collapse and block stream flow Design bridges to allow for the free flow of water, taking into consideration water flow during period of extremely high intensity rainfall Road culverts should be aligned perpendicular to the road and horizontal to the flow of water	Lo: Ir: Lt: St: Un: Im: Sig: Hp: Av: Lp
	Waste Disposal (solid and liquid waste)	Construction/ Operation	Contamination of water in proximity to disposal, modifications in water temperature, turbidity, ph.; Pollution with oil	Avoid the dumping of waste in creeks and streams. Development and implementation of a waste management plan.	Lo: Ir: St: Un: M: In: Lp
	Fuel and Oil transportation, handling and storage	Construction/ Operation	Contamination of water in proximity to disposal, modifications in water temperature, turbidity, ph; Pollution with oil	All fuel, oils and hazardous liquids will be stored away from streams and creeks Ensure that all fuel, oils and hazardous liquids that will be used by the operation is stored and used in a bunded area.	lo: Ir: Lt: Un: M: In: Lp
Physical Environment (Air)	Operation of chainsaws	Construction/ Operation	Noise, dust and smoke generated from the operation of the various equipment. Changes in microclimate.	Ensure that all operative working in proximity to mills and saws be provided with personal protective gear.	Lo: Ex: Ir: Lt: Un: M: Sig: Hp

Environment Type	*Project Activities*	*Project Phase*	*Potential Environmental Impact*	*Main Mitigation Measure*	*Impact Significant after Mitigation*
	Operation of heavy duty vehicles and equipment	Construction/ Operation	Noise generated for the operation of the various pieces of equipment.	Ensure that all operative working on and in proximity to are provided with personal protective gear	Lo: Ex: Ir: Lt: Un: M: Sig: Hp
	Clearing of lands and of logs and other materials	Construction/ Operation	Excessive exposure of soil and constant traversing of heavy duty vehicles over exposed soil	All employees working in dusty environs will be provided with dust masks. Speed limits will be instituted for vehicles using dusty areas. During extensive dry periods very dusty areas will be soaked on a regular basis.	Lo: R: St: Av: M: In: Lp
	Operation of heavy duty vehicles and equipment.	Operation	Dust and particulate matter resulting from the operations of chainsaws and movement of vehicles.	All employees working in dusty environs will be provided with dust masks. All dust generate from chainsaws and mills will be stored in a secured area.	Lo: Ex: Ir: Lt: Un: M: Sig: Hp
	Disposal of Wood Waste	Operation	Improper disposal of waste generated wood processing activities	All dust generate from chainsaws and mills will be stored in a secured area. Sawdust will be not be accumulated on site.	Lo: Ex: Ir: St: Un: M: Sig: Hp
Biological & Ecological Environment (Flora)	Clearing of lands for the construction of base camps, roads, log markets and mechanical workshops	Construction	Destruction of trees and from the clearing of lands for construction purposes.	Clearing of vegetative areas will be restricted to areas where construction activities will occur. .	Ex: Rv: St: Un: Im: In: Hp:
		Operation	Reduction in tree species specific to the areas of logging.	Use of the GFC, 3rd Ed	Lo: Ex: Ir: Rv: Lt: St: Un: M: Sig: Hp: Lp

Environment Type	*Project Activities*	*Project Phase*	*Potential Environmental Impact*	*Main Mitigation Measure*	*Impact Significant after Mitigation*
	Harvesting of Logs (Logging and extraction)		Genetic erosion of species decline in soil fertility due to removal of biomass from poor soils, Increased potential for blow downs of residual trees due to freer flow of air though the canopy/under-storey.		
Biological & Ecological Environment (Fauna)	Clearing of lands for the construction of base camps, roads, log markets and mechanical workshops	Construction	Modification, fragmentation and destruction of habitats (especially in terms of cover and food sources); depletion in number,/variety of some species	Use of the Guyana Forestry Commission's Code of Practice related to the harvesting of logs and all other guidelines that protect biodiversity.	Ex: Rv: St: Un: Im: In: Hp:
	Presence of humans	Construction and Operation	Increase in the level of predation, modifications of prevailing ecological relationships: plant-plant, plant-animal, animal-animal	All employees will be educated on the conservation and protection of wildlife.	Lo: R: St: Av: M: In: Lp
	All construction and Operation activities	Construction/ Operation	Risk of accidents from the used of the various equipment onsite	All employees will be educated about the Company's OSH practices. All working environments will be presented with First Aid kits. Appropriate signage will be posted around all working areas. Relevant and appropriate safe gear will be provided to all employees.	Lo: R: St: Av: M: In: Lp
	Operation of machineries and equipment	Construction /Operation	Continuous exposure to excessive noise and vibration from the operation of equipment.	All employees working in environs that cause them to be exposed to occupational hazards will be provided with protective gear.	Lo: Rev: St: Av: M: Sig: Hp

Environment Type	*Project Activities*	*Project Phase*	*Potential Environmental Impact*	*Main Mitigation Measure*	*Impact Significant after Mitigation*
Socio-economic Environment (Occupational Health & Safety)	Conflict result from the Change in Land Use activities	Construction /Operation	Restriction of access, alienation of rights, unplanned changes in life style, restrictions on hunting.	All employees will be educated on how to defuse conflicts. Regular monitoring will be conducted to ensure that no illegal activity occurring within concession and if such is observed it will be reported to the relevant authority.	Lo: Rev: St: Av: M: In: Lp
Socio-economic Environment (Employment)	Increase in workforce	Construction /Operation	Increase in the incidences of crime, increase in the use of illicit drugs and alcohol, socially unacceptable behaviour and inappropriate with members of close-by communities.	Illicit drugs and alcohol will not be allowed at camps. All employees will be trained at a minimal level on how to engage with members of close-by communities.	Lo: Rev: St: Av: M: Sig: Hp
	Hiring of Workforce	Construction /Operation	Skills transfer , training opportunities job creation, increase incomes and cash flows	Members of close-by communities will sought after.	Lo: Rev: St: Av: M: Sig: Hp
	Regional Development	Construction /Operation	Improvement of infrastructure. Crime; use of alcohol; health risks, disagreeable behaviour	All staff will be trained in-house on OSH and security	
Socio-economic Environment (Archaeological Resources)	Construction and operational activities	Construction /Operation	Loss, destruction or modification of the assets	In the event that remains are found, all activities in the vicinity of findings will be ceased. The relevant authorities will be notified.	

Impact Significance (parameters)

Lo-**localised,** Ex-**Extensive/** Rev-**Reversible,** Ir-**reversible;/** St-**short term,** Lt-**long term/** Av-**Avoidable,** Un-**Unavoidable;**

M-**Mitigable,** Im-**Immitigable/** Sig-**Significant,** In- **Insignificant/**Hp-**High probability,** Lp-**Low probability**

21.3 Basic Road management plan

21.3.1 Overview

TPTTI's road corridor plan has two main components (see also Table 40):

a) Maintaining the road in a fully function state through proper road maintenance
b) Monitoring road use by third parties

21.3.2 Partnerships

In the pursuit of this plan, TPTTI will seek support from the EPA, the GFC, the GGMDA and the Police.

Table 41: Core elements of TPTTI's road corridor management plan

Action	Responsibility	Objective	Intervals
1. Monitor the road for tree fall, erosion. Also check bridges and culverts to establish their state.	Forest Manager	Maintain the road in a proper state always for maintaining production and safety.	Daily & weekly depending on which specific road segments are used
2.Post signs at junctions, turns, steep grades and bridges		Safety issues	As required
3.Monitoring the use of the road by third parties	Forest Manager	Find out and maintain a data base of who is co-using the concession area. Other developers will be expected to contribute to road maintenance costs	Daily, as often as the opportunity presents itself or via random visits to areas not being logged

21.4 Wildlife Management Plan

TPTTI management has personal interest in the conservation of wildlife and TPTTI is prepared to work with the authorities to manage wildlife, not only to check on illegal hunting, but also to support concession-based research. The key activities for TPTTI are set out in Table 42.

Table 42: Core elements of TPTTI's Wildlife Management Plan

Action	Responsibility	Objective	Intervals
1. Train technicians to recognize the various fauna in the concession area. TPTTI will also source posters from WWF and other agencies	Technicians	Workers should be able to describe accurately the type of animal observed.	Quarterly
2. Maintain a register of sightings of fauna; this register will be restricted to forest roads and forward camps and only target mammals	Technicians	A data base would be critical to track the number, variety and possibly habits of large fauna	On sight
3. Post and maintain no hunting sites all over the forest concession	Technicians	This is an attempt to re-enforce TPTTI's no hunting policy.	As often as required
4. All heavy-duty vehicles to be equipped with 'rotating beacons' to warn animals using the road. (Horns may unduly scare the animals.	Mechanics	The objective is to avoid hitting animals using the roadways	As often as required
5. Be on guard for nesting animals during tree felling operations	Technicians	TPTTI does not wish to kill wildlife or unduly put them at risk	During operations
6. Monitor whether any third party is extracting wildlife from the concession area.	Drivers, technicians	To check on hunting activities. To ensure that TPTTI's technicians are not blamed unnecessarily for harvesting wildlife	During operations
7. TPTTI's employees will avoid all unnecessary noise, events such as fires and any form of littering and ensure that waste is properly disposed of	All employees	These activities will help conserve fauna.	During operations

21. 5 CAPACITY BUILDING AND TRAINING PLANS

21.5.1 Overview

TPTTI intends to build capacity to address obligations emerging from this EIA Report and to better implement approved forest management prescriptions. The objective is to ensure that each worker at the company takes responsibility for good environmental behaviour generally and good forest management practices in particular. To address the requirements of lead agencies and to better comply with national

21.5.2 Training content

Training for selected staff will be as set out in Table 43. TPTTI will conduct a training needs analysis to inform its general capacity building strategy.

Table 43: Initial training options identified for Capacity Building

#	Target group	Subject areas	Agencies
1	Senior staff	Reduced Impact Logging (Decision Makers Course)	FTCI
2	Senior Staff	Conflict Management	To be determined
3	Forest Managers, Block Inspectors, Senior Supervisors	Reduced Impact Logging Foundation Course	FTCI
4	Technicians	Timber Grading Course	GFC
5	Technicians	First Aid	Guyana Red Cross

21.5.3 Methodology

A variety of mechanisms will be used to build capacity, including:

a) Workshops (Trainers provide workshops to groups of participants, usually ranging from three days to fourteen days)
b) Onsite internship or field work:
c) Training of Trainers
d) Training materials:
e) Briefing sessions

21.6 Monitoring Plan

21.6.1 Overview

This *monitoring plan* is intended to address the mitigation measures in a timely and consistent manner. TPTTI needs to collaborate with several agencies to ensure that the mitigation measures are addressed in a meaningful and realistic manner. Table 44 lists the agencies and the collaboration anticipated. Table 45 provides details of monitoring activities; Table 46 provides a checklist for monitoring activities and Table 47 provides a budget for monitoring the environment management plan.

Table 44: List of agencies and the type of collaboration anticipated

#	Agency	Nature of collaboration
1	Ministry of Agriculture (Meteorological Department)	Collection of Rainfall data
2	EPA	Collection/monitoring of environmental data;
3	Guyana Forestry Commission	Consultations, training, forest management
4	CDC-Iteballi, Reg. 7	Consultations
5	Upper Berbice Forest Producers Association, other loggers' associations in the district	Consultations (road use and maintenance, purchases
6	FTCI	Training
7	MOPH	Consultations
8	TPL	Collaboration
9	GGMC	Consultations (mining)
10	GGMDA	Consultations (mining)

It is important to note that TPTTI, as part of its routine operations, will be maintaining a large set of records.

Table 45: Monitoring Plan for TPTTI

Parameter	Institution (s) Responsible	Frequency	Location of monitoring
Physical Environment			
Earthworks • Field operatives have stock maps • Field operatives have copy of the Code of Practice • All roads, skid trails, sawmill sites, log markets and borrow pits are marked • Machines are in a proper functional state	TPTTI, GFC	Quarterly	Sites where earthworks are occurring, field camps
Water Quality: • *surface water* drainage off roads, log markets and other clearings; • cleaning of drainage structures (bridges, culverts) along roads and skid trails; • observance of the integrity of buffer zones along water ways	TPTTI, GFC	Monthly	Areas being logged; logged over areas; primary roads and associated drainage structures.
Air Quality: • Number of illnesses among field operatives apparently related to smoke or dust	TPTTI	Monthly	Camp site, Medex records, Bartica Hospital
Biological/Ecological Environment			
Timber harvesting • canopy openings, • retention of seed trees, • integrity of Biodiversity Reserves. • quality of stock maps	TPTTI	Quarterly	Active logging areas, permanent sample plots and Biodiversity reserves
Wildlife Trapping /hunting • Movement of live animals away from the concession area • Trade in wild meat • Traps, firearms, shells	TPTTI TPTTI TPTTI	Random checks Random checks Random checks	Iteballi crossing Iteballi Concession area
• Ecological Relationships • Unusual trends, for example accelerated plant mortality, pollution of streams, dead fishes or other fauna	TPTTI, GFC	On observance	Concession area
Socioeconomic Environment			
Conflicts • No. of mining camps, type of mining, vehicle movements, • Complaints lodged with the company • Complaints lodged with the RDC or other public agency	TPTTI, GFC,RDC #7 GGMC, Ministry of Reg. Dev., Min. of Human Services	**Quarterly**	**Concession area,**

Parameter	Institution (s) Responsible	Frequency	Location of monitoring
Social & Employment issues • Number of persons recruited from the Iteballi district • Number of persons trained • Increase/decrease in number of families within the concession area • Rate of absence from work • Drunken persons • Disciplinary measures taken	TPTTI	Biannually	Concession area
Road safety • Number of accidents/records • Number of fatal accidents/records • Number, type and position of advisory road signs/records	TPTTI	Quarterly	These will be reported to the EPA, Bartica Police Station,
Health and Safety • Emergency Response Plans, • Health and safety committees, • Status of first aid kits, fire hydrants, • Implementation of OHS practices & the regular use of safety gear	TPTTI, GFC	Biannually	Sawmill site, field locations, housing quarters
Waste Management • Waste accumulation & waste disposal procedures • Apparent increase in vectors (rats, roaches & ,flies)	TPTTI	Monthly	Sawmill complex, field camps
Indigenous/Archaeological assets • Auditing of archaeological and anthropological resources	TPTTI	On observance (Quarterly if observed)	Logging operations [blocks] and sawmill complex

Table 46: General checklist for monitoring operations

ITEM	STATUS (Y-OK/ R-REQ. ATTN.)
Office Area/Field Camps/Sawmill sites: • Emergency Response Plan posted and visible • First Aid box complete and clean	
Personnel : • Records of issue of safety gears • All personnel have and are using safety equipment • Vaccination & sanitation protocols for employees	
Fuel Storage Tanks and Fill Point – Transit Log Yard and Camp • Fire extinguishers and other firefighting aids available nearby • Physical condition of storage tanks, hoses, valves (evidence of leaks)	
Communication Equipment • Check base station radio set is in working order and signal strength is good with base and with handset for field personnel • Check all field handsets are in working order and fully charged	
Fire Fighting Equipment and Emergency Equipment • Check that all fire extinguishers are present, fully charged and the correct number are present with no sign of damage • Check sand buckets are full of dry sand • Check contents of First Aid box are all present and correct	
Warning/Advice Notices • Check all notices and signs are posted as required, are undamaged, clean, and legible at Transit Log Yard and Camp and on secondary roads	
Soak away/Filter at Transit Log Yard and Camp • Soak away filter is clear of all solid particles • Check drains are not blocked or full	
Stock maps • Updated stock maps are available for use by all field crews	
Basic equipment • Compass, clinometers, flagging tapes and GPS are available for use by staff • Equipment tailored for the needs of specific departments (fire extinguishers-workshop; flasks for water collection-forest management division; etc.)	
Vehicles • All vehicles equipped with horns, lights and rotating amber lights • All vehicles are equipped with appropriate tools, first aid kits • All trucks/lorries are equipped with basic communication equipment • All vehicles have chains, rope or straps as appropriate • Maintenance schedules for vehicles are in force.	
Security • All employees have a security badge, carry, and display them on their uniforms	
Camp Hygiene • All camps are provided with potable water: At Iteballi, staff will be provided with potable water from the village well; at forward camps, teams will use creek water that is filtered and treated with chlorine. A limited quantity of bottled water will also be provided • All camps are cleaned regularly, equipped with fires extinguishers, lights and pesticides, other supplies • Waste disposal practices/mechanisms are monitored	
COMPLETED BY: **(*signature and date*)**	

Table 47: Annual Budget for implementing mitigation measures

Impact/Event	Actions	Equipment/tools	Duration	Annual cost (G$)
1.Earthworks & soil	Field visits, briefing sessions, review of stock maps & other records; review of SOPs	Stock maps, GPS, Compass, Clinometer, vehicle	3 days every three months	200,000
2. Air quality	Review of medical records of field operatives; consult medical personnel		2 days every three months	200,000
3. Water quality	Review of medical records of field operatives/ consult medical personnel Biannual monitoring of water quality		2 days every three months One day every six months	200,000 400,000
4. Timber Harvesting	Visits to field crews to verify the use of stock maps, CoP, etc.1	Vehicle	3 days every three months	100,000
5. Wildlife	Recruitment of wild life expert; physical check for traps and shells along frequently used concession roads	Vehicle, camera	One week, about six times per year	500,000
6.Eco-relationships	Recruitment of a consultant; field tour across logged over sites within the concession area	Vehicle, camera	One week, about six times per year	500,000
7. Conflicts	Discussions with community leaders, representatives of miners, public officials (RDC)	Vehicle, camera	2 days every three months	200,000
8. Employment	Review of company records		2 days every six months	150,000
9. Social problems	Discussions with public officials (Police, RDC) and community leaders	Vehicle, camera	2 days every six months	100,000
10. Occupational Health & safety	Verify the use safety gear, SOPs; check on the frequency of briefing sessions	Vehicle, camera	2 days every six months	150,000
11. Road safety	Install, replace and rehabilitate road signs; review safety records	Vehicle, camera, carpentry tools	3 days every three months	200,000
12. Fire equipment	Verify the state of all firefighting equipment		2 days every six months	150,000

Impact/Event	Actions	Equipment/tools	Duration	Annual cost (G$)
13. Training	Review performance of trained personnel, identify new training opportunities		2 days every six months	1,000,000
14. Archaeological sites, indigenous assets	Replace or rehabilitate signs, fences or remove debris.	Vehicle, camera, carpentry tools	Approximately 3 days every three months	300,000
15. Co-monitoring of the Essequibo River Corridor	Joint patrols, faunal surveys, other consultations	Boat & o/b engine; digital camera; radio/phone	10-15 trips per year	1,000,000
15. Contingencies				250,000
		TOTAL		5,600,000

NB. While some activities may be conducted 'in-house', others require the recruitment of experts

21.7 Core approach to stakeholder issues

TPTTI will set up a website on which it will post its half- yearly environmental report or part thereof and at the same time set up a mechanism to respond to feedback or reasonable information requirements from stakeholders.

TPTTI has been using one to one relations with various stakeholders in Region 7 to discuss operational issues and it will continue to do so.

22.0 WASTE MANAGEMENT PLAN & PRACTICES

22.1 Overview

TPTTI has developed an **Environmental Policy** that will be the basis of its environmental management practices.

TPTTI is also committed to full compliance with Camp Hygiene prescriptions set out in GFC's Code of Practice for Forest Operations, 2018[30], conditions set out in its Environmental Authorization and all applicable laws and guidelines, including those prescribed by the Ministry of Health and Regional and Local Authorities.

The management of waste generally, and of hazardous materials in particular, is a significant component of TPTTI's field operations. TPTTI, on the one hand, intends to make sure that all waste discharged at the forest concession can be processed by microorganisms that decompose, detoxify, and eventually recycle waste materials. On the other hand, TPTTI also wants to ensure that its waste do not lead to the growth of pathogenic microorganism that cause serious illness among humans or lead to pollution of the soil and water and eventually environmental degradation.

22.2 Administration of Hazardous materials

The Supervisor-Iteballi Operations will be directly responsible for the administration of hazardous substances at Iteballi. His responsibility will also include managing hazardous waste generated at field bases and forward camps and brought to Iteballi.

TPTTI anticipates annual consumption of hazardous materials as follows:

#	Substance	Unit	Annual Consumption	Frequency of Purchases
1	Diesel	litre	400,000	Fortnightly
2	Gasoline	litre	200,000	Monthly
3	Grease	litre	1,300	Quarterly
4	Hydraulic fuel	litre	2500	Quarterly
5	Battery water	litre	108	Quarterly
6	OTC Insecticide	litre	108	Quarterly
7	Paint	litre	120	Quarterly

22.3 Core strategies for waste management

TPTTI 's core strategies for waste management generally and hazardous waste in particular are (a) TPTTI's Management to commitment to proper environmental management, and (b) a shared approach to environmental management across the entire organization. Management commitment would ensure that resources are available to enable all staffs to apply approved environmental management considerations in the course of their work.

[30] Chapter 8 deals with Operational Hygiene and includes Section 8.3 which deals specifically with "Fuel, Oil and Hazardous Chemical Handling and Storage as well as Section 8.4 that deals with 'Waste Management'. Chapter 9 deals with Camp Hygiene.

22.4 Kinds of waste

In summary, five kinds of waste are predicted: (a) Human waste and human induced domestic waste, (b) hazardous waste and (e) wood waste.

22.4.1 Human waste and human induced domestic waste

(Overhead tanks will be used for distributing potable water. Screens and filters will be used to improve the quality of water available to staffs). For the base camp and at Iteballi septic tanks will be used for managing human waste (see Annex XXV). A mass of charcoal will be placed at the outlet of septic tanks, in essence filtering liquid waste emanating from the septic tank; the filtrate will then be channelled via a PVC pipe with diameter ≥152.4mm to a pit covered with stone, sand and wood debris; the pit would be placed at least 100m from any natural water way.

At temporary forward camps, latrines will be used for human waste. Latrines will be well ventilated and constructed not less than 100m from any natural way.

Solid domestic waste, particularly food materials, wrappers and paper products, empty cans and bottles and clothing will be thrown into pits constructed specifically for the purpose. These pits will be excavated at points not less than 150m from staff accommodation and as far as possible, natural depressions in the soil surface will be used. All tins (especially those that contained foodstuffs such as sardines will be squashed (to avoid injury to scavengers such as foxes) before being placed in the pit.

Liquid domestic waste-originating mainly from washstands, bathrooms and kitchen sinks will be channelled to pits constructed for the purpose. The pits will also contain wood debris or natural vegetation tolerant of domestic waste and pits will be placed at distances not less than 100m from waterways.

22.4.2 Hazardous waste

Hazardous waste includes fuel & oil, paint and grease, batteries, residual insecticides, and their containers. TPTTI's core management strategy for Hazard waste is employee awareness of the environmental hazards and their consequences for human health and the environment. TPTTI will store the bulk of hazardous items at special concrete and wooden bonds at its Iteballi Administrative Base where it can manage and **secure** such items. Fuels and Oils will be stored in bunded concrete & zinc sheet structures. Bonds will have ample signage-for example 'No Smoking'-, ample lighting, appropriate fire extinguishers[31] , sand buckets and 24 hr security. Special protocols will be put in place to deal with leaks or spillages. At Iteballi, other hazardous substances such as hydraulic fluids, batteries, paint, and insecticides will be stored in locked, ex-shipping containers. Relatively minor hazardous materials will be deployed at field locations because most vehicle refuelling, and servicing will occur at Iteballi. Fuel storage at field locations will be avoided, mainly for security issues. Fuel for field equipment such as skidders and bulldozers will be taken to the field and placed in the machines immediately.

For combatting malaria, TPTTI will provide Long Lasting Insecticide Nets (LLINS) or Insecticide Treated Mosquito Nets (ITNs) rather than extensive fogging or indoor residual spraying (IRS)

[31] Classes A, B

exercises using an appropriate adulticide or larvicide. TPTTI prefers to seek assistance from MOH for support in relation to fogging.

TPTTI will provide 600ml cans of OTC insecticides such as BAYGON, PROTEX or FISH for indoor use.

Hazardous waste management at Iteballi will focus primarily on the avoidance of spills, proper disposal of waste, and the proper storage and disposal of hazardous waste generated at, and retrieved from Field Bases and Forward Camps.

Field crews would be required to do everything possible to conserve a wholesome forest environment by avoiding all forms of pollution. Hazardous waste management at field bases and forward camps would focus on the avoidance of spills, the proper use of hazardous materials and the proper storage of hazardous waste in bins provided for the purpose.

Field supervisors will be directly responsible for overall waste management at forward camps and along roadways.

Wood Debris

Wood debris generated at log markets on the forest concession and from tree fall will be placed on the forest floor and left to degrade naturally.

Wood debris at forward camps will be put into pits receiving liquid waste to encourage filtering of the liquid waste, and to facilitate the infiltration of water into the soil. Slow infiltration rates allow soil fauna and flora to aid the degradation of the wastewater.

22.5 Overall Responsibility for Environmental Management

The Forest Monitoring Officer will be responsible for environmental management. He/she is also responsible for engaging stakeholders for promoting a shared approach to environmental management. The Forest Monitoring Officer will also be responsible for building all employees' awareness via appropriate training materials, signage, and briefing meetings.

23.0 CONCLUSION AND RECOMMENDATION

The consultants believe that the technology, policies, and practices adopted by TPTTI will ensure that the overarching interests of stakeholders regarding the forest resources will be preserved. The consultants have also reviewed comments by stakeholders, all of whom are looking for increased economic activities in the area, and the consultants believe that the logging project could help meet their expectations.

The consultants believe that TPTTI will honour commitments set out their Environmental Authorizations. Indeed, the fact that the company already has a *Safety Policy*, *a Human Resources Policy* and an *OSH Policy* reflects a company that cares about its corporate image and its corporate discipline.

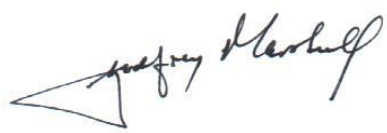
The consultants are also confident that the GFC will be able to monitor TPTTI's operations effectively. Also, GGMC's initiatives to improve mining practices are expected to show results in the short term (3-5 years).

The consultants have reviewed the economic activities in the Kartabu Triangle generally and do believe that this logging project will lead to major *residual* economic benefits for residents, at Iteballi in particular. By adding to the volume of economic enterprises in the Kartabu Triangle, TPTTI will contribute to more political attention to the district, and consequently the allocation of more budgetary support for the development of the Triangle.

A wooden bridge has been constructed across the Mara-Mara River and there is a road linking the Mara-Mara River to the Ekabago River. Already, public agencies such as the EPA, the GGMC and the GFC have been using that road to boost forest monitoring efforts. TPTTI's projections are that it will inject U$600,000 per year directly into the economy of the Kartabo Triangle. TPTTI will also support will be invested in the economy of the Kartabu Triangle and support preventative maintenance of the Iteballi-Puruni Road.

The consultants are of the view that the award of an Environmental Authorization (and consequently a State Forest Authorization) will promote forest conservation efforts and environmental management in the Puruni District. TPTTI's environmental conservation measures will help sensitise other land users on conservation issues and encourage them to do the same.

The consultants unreservedly support the issue of an Environmental Authorization to TPTTI.



G. Marshall
Team Leader

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ANNEXES

ANNEX I: Extracts (Section 3.0 and 4.1) of the Terms of Reference for the ESIA study and Report

3.0 Scope of the ESIA

In accordance with Part IV (11) (5) of the EP Act Cap.20:05, every environmental impact assessment shall contain the following information:-

(a) Description of the project, including in particular:-

i. the geographical area involved, the physical characteristics of the whole project and the land-use requirements during the construction and operational phases, including plans, drawings, and models;
ii. the main characteristics of the production process, including the nature and quantity of the materials used, plans, drawings and models;
iii. an estimate, by type and quantity, of expected contaminants, residues and emissions (water, air and soil pollution, noise, vibration, light, heat, radiation) resulting from the operation of the proposed project;
iv. the length of time of the project;

(b) An outline of the main alternatives studied by the developer and an indication of the main reasons for his choice, taking into account the environmental factors;

(c) A description of the likely significant effects of the proposed project on the environment resulting from:-

(i) The existence of the project;
(ii) The use of natural resources;
(iii) The emission of contaminants, the creation of nuisances and the elimination of waste, and a description of the forecasting methods used to assess the effects on the environment;

(d) An indication of any difficulties (technical deficiencies or lack of knowledge or expertise) encountered by the developer in compiling the required information;

(e) A description of the best available technology;

(f) A description of any hazards or dangers which may arise from the project and an assessment of the risk to the environment;

(g) A description of the measures which the proposed developer intends to use to mitigate any adverse effects and a statement of reasonable alternatives (if any) and reasons for their rejection;

(h) A statement of the degree of irreversible damage, and an explanation of how it is assessed;

(i) An emergency response plan for containing and cleaning up any pollution or spill of any contaminant;

(j) The developer's programme for rehabilitation and restoration of the environment; and

(k) A non-technical summary of the information provided under the preceding paragraphs.

4. O Requirements for the Environmental and Social Impact Assessment and Environmental Impact Statement

4.1 Organization of the Report (Environmental Impact Statement)

The EIA Report shall focus on significant environmental issues and must provide all the relevant information needed by the EPA to consider fully any adverse or beneficial impacts of the proposal.

The introduction to the EIA shall provide an explanation of the scope of the proposal and the issues and decisions which led to the proposal at this time and in this context, including a history of events leading up to project formulation, envisaged time scale for implementation and project life, anticipated establishment costs and actions already taken at the project site. Suggested table of contents;

Glossary

Executive (non-technical) Summary

Chapter 1: Introduction and Background, ESIA Team (Detail CV in appendices)

Chapter 2: Approach and Methodology, Significance Criteria, Area of Influence

Chapter 3: Project Alternatives

Chapter 4: Stakeholder identification and consultation (records/minutes etc. in appendices)

Chapter 5: Legislative and Regulatory Framework

Chapter 6: Description of Proposed Project (location, design etc.)

Chapter 7: Water Resources

- *Introduction*
- *Definitions and scope*
- *Key relevant policy, legislation, guidelines, standards etc.*
- *Existing information, Baseline studies*
- *Impact prediction and assessment*
- *Mitigation and monitoring - Environmental and Social Management Plan*

Chapter 8: Soils, Land and Geology

- *Introduction*
- *Definitions and scope*
- *Key relevant policy and legislation*
- *Existing information, Baseline studies*
- *Impact prediction and assessment*
- *Mitigation and monitoring - Environmental and Social Management Plan*

Chapter 9: Air Quality

- *Introduction*
- *Definitions and scope*
- *Key relevant policy, legislation, guidelines, standards etc.*
- *Existing information, Baseline studies*
- *Impact prediction and assessment*
- *Mitigation and monitoring - Environmental and Social Management Plan*

Chapter 10: Climate and Climate Change

- *Introduction*
- *Definitions and scope*
- *Key relevant policy, legislation, guidelines, standards etc.*
- *Existing information, Baseline studies*
- *Impact prediction and assessment*
- *Mitigation and monitoring - Environmental and Social Management Plan*

Chapter 11: Biological Resources

- *Introduction*
- *Definitions and scope*
- *Key relevant policy, legislation, guidelines, standards etc.*
- *Existing information, Surveys and Baseline studies*
- *Impact prediction and assessment*
- *Mitigation and monitoring - Environmental and Social Management Plan*

Chapter 12: Ecosystem Services

- *Introduction*
- *Definitions and scope*
- *Key relevant policy, legislation, guidelines, standards etc.*
- *Existing information, Surveys and Baseline studies*
- *Impact prediction and assessment.*
- *Mitigation and monitoring - Environmental and Social Management Plan*

Chapter 13: Noise and Vibrations

- *Introduction*
- *Definitions and scope*
- *Key relevant policy, legislation, guidelines, standards etc.*
- *Baseline*
- *Impact prediction and assessment*
- *Mitigation and monitoring- Environmental and Social Management Plan*

Chapter 14: Landscape and Visual Resources

- *Introduction*
- *Definitions and scope*
- *Key relevant policy, legislation, guidelines, standards etc.*
- *Baseline*
- *Impact prediction and assessment*
- *Mitigation and monitoring - Environmental and Social Management Plan*

Chapter 15: Cultural Heritage

- *Introduction*
- *Definitions and scope*
- *Key relevant policy, legislation, guidelines, standards etc.*
- *Baseline studies*
- *Impact prediction and assessment*
- *Interactions*
- *Mitigation and monitoring - Environmental and Social Management Plan*

Chapter 16: Socio-Economic and Cultural Impacts (direct and indirect)

- *Introduction*
- *Definitions and scope*
- *Key relevant policy, legislation, guidelines, standards etc.*
- *Baseline studies*
- *Impact prediction and assessment*
- *Mitigation and monitoring - Social Management Plan*

Chapter 17: Risks and Risk Assessment

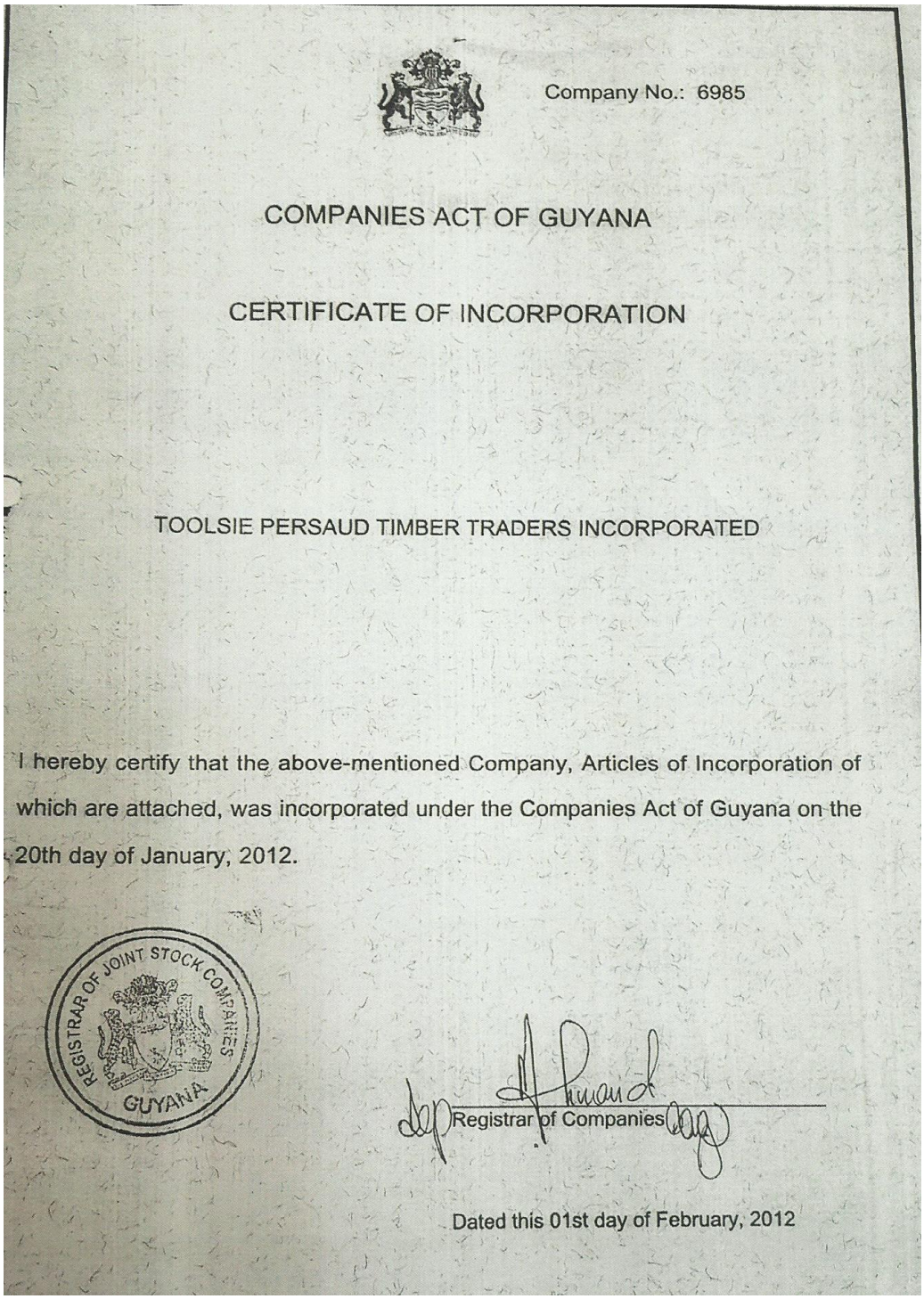
- *Introduction*
- *Definitions and concepts*
- *Key relevant legislation*
- *Prediction and assessment*
- *Mitigation and monitoring - Environmental and Social Management Plan*

Chapter 18: Cumulative Impacts

- *Introduction*
- *Definitions and scope*
- *Key relevant legislation, guidelines*
- *Baseline*
- *Impact prediction and assessment*
- *Mitigation and monitoring - Environmental and Social Management Plan*

Appendices

- All relevant documentation from the ESIA including records of consultations, data collection/survey forms etc.
- Emergency Response Plan
- Conceptual Rehabilitation and Closure Plan



Company No.: 6985

COMPANIES ACT OF GUYANA

CERTIFICATE OF INCORPORATION

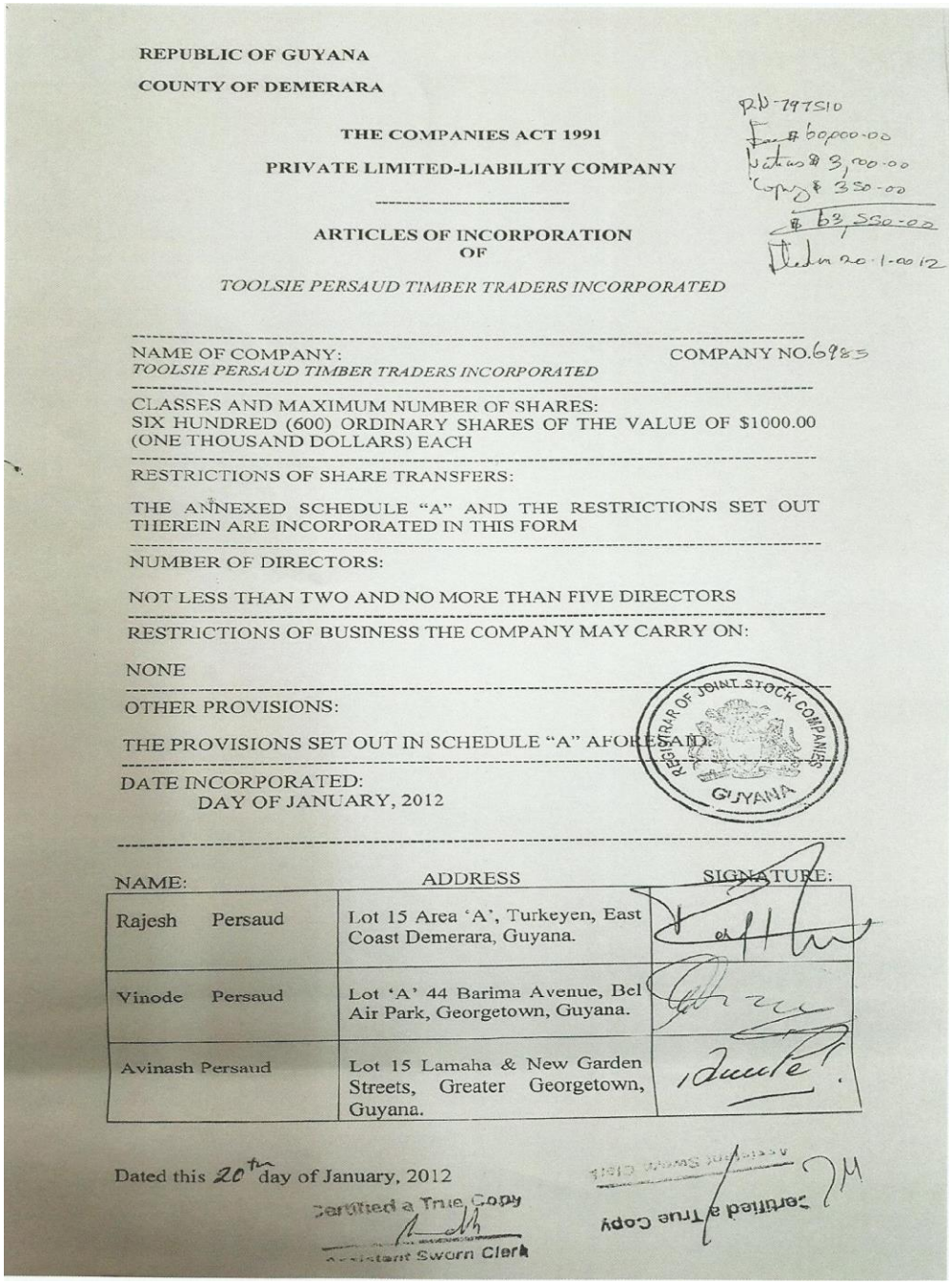
TOOLSIE PERSAUD TIMBER TRADERS INCORPORATED

I hereby certify that the above-mentioned Company, Articles of Incorporation of which are attached, was incorporated under the Companies Act of Guyana on the 20th day of January, 2012.

REGISTRAR OF JOINT STOCK COMPANIES GUYANA

Registrar of Companies

Dated this 01st day of February, 2012



REPUBLIC OF GUYANA

COUNTY OF DEMERARA

RD-79751O
Fee $ 60,000-00
Stamps $ 3,000-00
Copy $ 350-00
$ 63,350-00
20-1-2012

THE COMPANIES ACT 1991

PRIVATE LIMITED-LIABILITY COMPANY

ARTICLES OF INCORPORATION
OF

TOOLSIE PERSAUD TIMBER TRADERS INCORPORATED

NAME OF COMPANY: COMPANY NO.6985
TOOLSIE PERSAUD TIMBER TRADERS INCORPORATED

CLASSES AND MAXIMUM NUMBER OF SHARES:
SIX HUNDRED (600) ORDINARY SHARES OF THE VALUE OF $1000.00 (ONE THOUSAND DOLLARS) EACH

RESTRICTIONS OF SHARE TRANSFERS:

THE ANNEXED SCHEDULE "A" AND THE RESTRICTIONS SET OUT THEREIN ARE INCORPORATED IN THIS FORM

NUMBER OF DIRECTORS:

NOT LESS THAN TWO AND NO MORE THAN FIVE DIRECTORS

RESTRICTIONS OF BUSINESS THE COMPANY MAY CARRY ON:

NONE

OTHER PROVISIONS:

THE PROVISIONS SET OUT IN SCHEDULE "A" AFORESAID.

DATE INCORPORATED:
DAY OF JANUARY, 2012

REGISTRAR OF JOINT STOCK COMPANIES GUYANA

NAME:	ADDRESS	SIGNATURE:
Rajesh Persaud	Lot 15 Area 'A', Turkeyen, East Coast Demerara, Guyana.	
Vinode Persaud	Lot 'A' 44 Barima Avenue, Bel Air Park, Georgetown, Guyana.	
Avinash Persaud	Lot 15 Lamaha & New Garden Streets, Greater Georgetown, Guyana.	

Dated this 20th day of January, 2012

Certified a True Copy

Assistant Sworn Clerk

Certified a True Copy

REPUBLIC OF GUYANA

COUNTY OF DEMERARA

THE COMPANIES ACT 1991
(SECTION 67 & 75)
PRIVATE LIMITED-LIABILITY COMPANY
WITH SHARE CAPITAL

NOTICE OF DIRECTORS
OF
TOOLSIE PERSAUD TIMBER TRADERS INCORPORATED

NAME OF COMPANY — COMPANY NO. 6985
TOOLSIE PERSAUD TIMBER TRADERS INCORPORATED

Notice is given that on this 5th day of January, 2012 the following persons were appointed Directors of the Company.

NAME:	ADDRESS:	OCCUPATION
Rajesh Persaud	Lot 15 Area 'A', Turkeyen, East Coast Demerara, Guyana	Businessman
Vinode Persaud	Lot 'A' 44 Barima Avenue, Bel Air Park, Georgetown, Guyana.	Businessman
Avinash Persaud	Lot 15 Lamaha & New Garden Streets, Greater Georgetown, Guyana.	Businessman

REGISTRAR OF JOINT STOCK COMPANIES GUYANA

Certified a True Copy
Assistant Sworn Clerk
2012-2-3

Certificate of Registration

Taxpayer Identification Number (TIN)

Taxpayer Name: TOOLSIE PERSAUD TIMBER TRADERS INC.

Business Name: TOOLSIE PERSAUD TIMBER TRADERS INC.

Taxpayer Type: COMPANY

Address: 10-12 LOMBARD AND SUSSEX STREETS
GEORGETOWN

Date Issued: February 05, 2013

This Taxpayer has been registered under the provisions of the Income Tax (Amendment) (No. 2) Act # 15 of 2006

Tax Office: HEAD OFFICE

TIN: 014559043

Commissioner General
Guyana Revenue Authority

GRA6041249

STATE FOREST EXPLORATORY PERMIT
Regulation 7B(1)

No. SFEP: 02/2013

Permission is hereby granted to **TOOLSIE PERSAUD TIMBER TRADERS INC.** of **Lot 10-12 Lombard & Sussex Streets, Georgetown, Guyana** under **Regulations 7B** of the Forest Regulations made under the Forests Act, Cap 67:01, to occupy and commence exploratory operations within the area of State Forests shown on the plan annexed hereto, more particularly described as falling within the following boundaries:

Right Bank Cuyuni River, Left Bank Puruni River, Left Bank Ekabago River: Right Bank Mara-Mara River.

Commencing at the **mouth** of the **Waiarimpo River** on the **right bank Quartzstone River** having approximate UTM geographic coordinates of **02 66 242 E, 07 40 780 N;** thence up the **left bank Waiarimpo River** for approximately **4.1 km** to a point having approximate UTM geographic coordinates of **02 64 751 E, 07 37 711 N;** thence by a **cut line** in a **Westerly** direction for approximately 4.9 **km** to a point having approximate UTM geographic coordinates of **02 59 185 E, 07 37 649 N;** thence by a **cut line** in a **Southerly** direction for approximately **0.6 km to a point** having approximate UTM geographic coordinates of **02 59 161 E, 07 37 068 N;** thence by a **cut line** in a **Westerly** direction for approximately 5.0 **km to a point** having approximate UTM geographic coordinates of **02 54 139 E, 07 37 203 N;** thence by another **cut line** in a **South-Westerly** direction for approximately **1.9 km to a point on** an unnamed tributary having approximate UTM geographic coordinates of **02 53 081 E, 07 35 678 N;** thence across and up the **left bank** of this unnamed tributary to a point near its source having approximate UTM geographic coordinates of **02 52 798 E, 07 30 867 N;** thence by a **cut line** in a **South-easterly** direction for approximately **1.0 km to a point** near the source of an unnamed tributary having approximate UTM geographic coordinates of **02 53 001 E, 07 29 874 N;** thence down the **right bank** of this unnamed tributary to its mouth on **left bank** of another unnamed tributary having approximate UTM geographic coordinates of **02 53 286 E, 07 28 069 N;** thence up the **left bank** of this unnamed tributary for approximately **2.6 km** to a

1

APPENDIX I

SFEP: 02/2013

1. **Area:**
   66.873 Hectares (165.247 Acres).

2. **Period:**
   Three (3) years

3. **Land to be excluded**
   All lands legally held.

4. **Type of Forests**
   Mixed forest

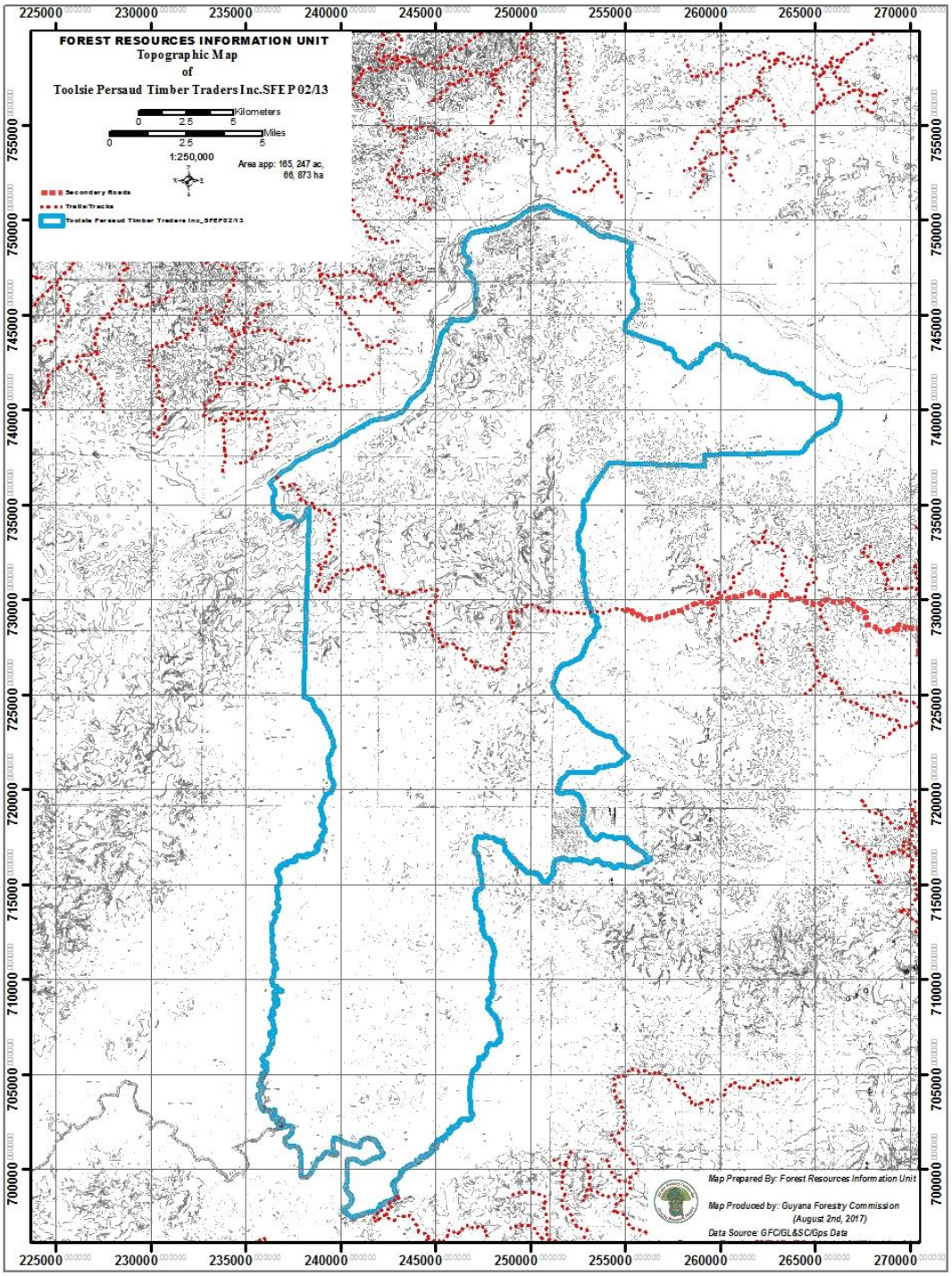
5. **Penalty for Offences:**
   As set out in the Forest Act Chapter 67:01 and its regulations.
   As set out in the Environmental Protection Act No. 11 of 1996.

6. **Acreage Fees:**
   A fee of **US$0.15 per acre, per annum** is charged on all forested area as amended by regulations made under the Forests Act.

6

Annex V: Outline of Map of SFEP 02/13, R.B. Cuyuni River

(*Please see also Map 1 attached)*



Annex VI: Description of Concession area

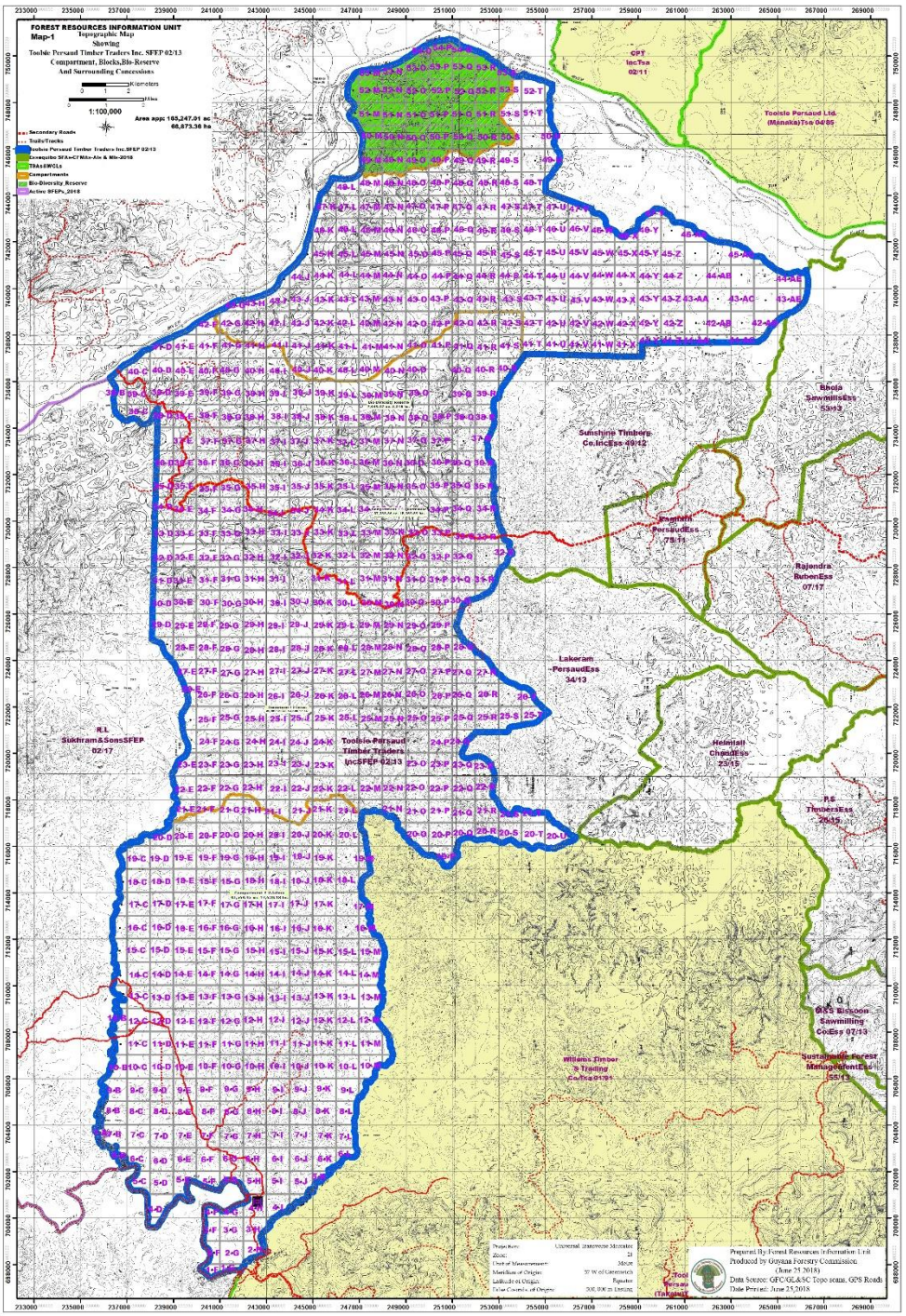
Toolsie Persaud Timber Traders Incorporated SFEP 02/13
Right Bank Cuyuni River, Left Bank Puruni River, Left Bank Ekabago River: Right Bank Mara-Mara River.

Commencing at the **mouth** of the **Waiarimpo River** on the **right bank Quartzstone River** having approximate UTM geographic coordinates of **02 66 242 E, 07 40 780 N;** thence up the **left bank Waiarimpo River** for approximately **4.1 km** to a point having approximate UTM geographic coordinates of **02 64 751 E, 07 37 711 N;** thence by a **cut line** in a Wes**terly** direction for approximately 4.9 **km** to a point having approximate UTM geographic coordinates of **02 59 185 E, 07 37 649 N;** thence by a **cut line** in a **Southerly** direction for approximately **0.6 km to a point** having approximate UTM geographic coordinates of **02 59 161 E, 07 37 068 N;** thence by a **cut line** in a West**erly** direction for approximately 5.0 **km to a point** having approximate UTM geographic coordinates of **02 54 139 E, 07 37 203 N;** thence by another **cut line** in a South-West**erly** direction for approximately **1.9 km to a point on** an unnamed tributary having approximate UTM geographic coordinates of **02 53 081 E, 07 35 678 N;** thence across and up the **left bank** of this unnamed tributary to a point near its source having approximate UTM geographic coordinates of **02 52 798 E, 07 30 867 N;** thence by a **cut line** in a **South-easterly** direction for approximately **1.0 km to a point** near the source of an unnamed tributary having approximate UTM geographic coordinates of **02 53 001 E, 07 29 874 N;** thence down the **right bank** of this unnamed tributary to its mouth on **left bank** of another unnamed tributary having approximate UTM geographic coordinates of **02 53 286 E, 07 28 069 N;** thence up the **left bank** of this unnamed tributary for approximately **2.6 km** to a point having approximate UTM geographic coordinates of **02 51 457 E,07 26 374 N;** thence by a **cut line** in a **South-Westerly** direction for approximately **0.9 km to a point** near the source of an **unnamed tributary** of **Middle Arimu River** having approximate UTM geographic coordinates of **02 51 154 E, 07 25 462 N;** thence down the right bank of this unnamed tributary to its mouth on **left bank** on **Middle Arimu River** having approximate UTM geographic coordinates of **02 52 027 E, 07 24 323 N;** thence across and down the **right bank Middle Arimu River** for approximately **4.2 km** to the mouth of an unnamed tributary having approximate UTM geographic coordinates of **02 55 131 E, 07 21 743 N;** thence up the **left bank** of this unnamed tributary for approximately **2.1 km** to a point having approximate UTM geographic coordinates of **02 53 326 E, 07 20 905 N;** thence by a **cut line** in a Wes**terly** direction for approximately **1.3 km** to a **point** near the source of an **unnamed tributary** of another unnamed tributary having approximate UTM geographic coordinates of **02 52 001 E, 07 20 920 N;** thence down the **right bank** of this unnamed tributary to its mouth on **left bank** this other unnamed tributary having approximate UTM geographic coordinates of **02 51 575 E, 07 20 498 N;** thence across and down the right bank of this unnamed tributary to its mouth on **left bank Little Arimu River** having approximate UTM geographic coordinates of **02 56 298 E, 07 16 414 N;** thence up the **left bank Arimu River** to a point near its **source**, having approximate UTM geographic coordinates of **02 47 222, 07 16 571 N;** thence by a **cut line** in a **South-easterly** direction for a distance of **1.75 km** to a point near the **source** of the **Mara-Mara River**, having approximate UTM geographic coordinates of **02 47 495 E, 07 14 853 N**; thence down the **right bank Mara-Mara River** to its **mouth** on the **left bank Puruni River**,

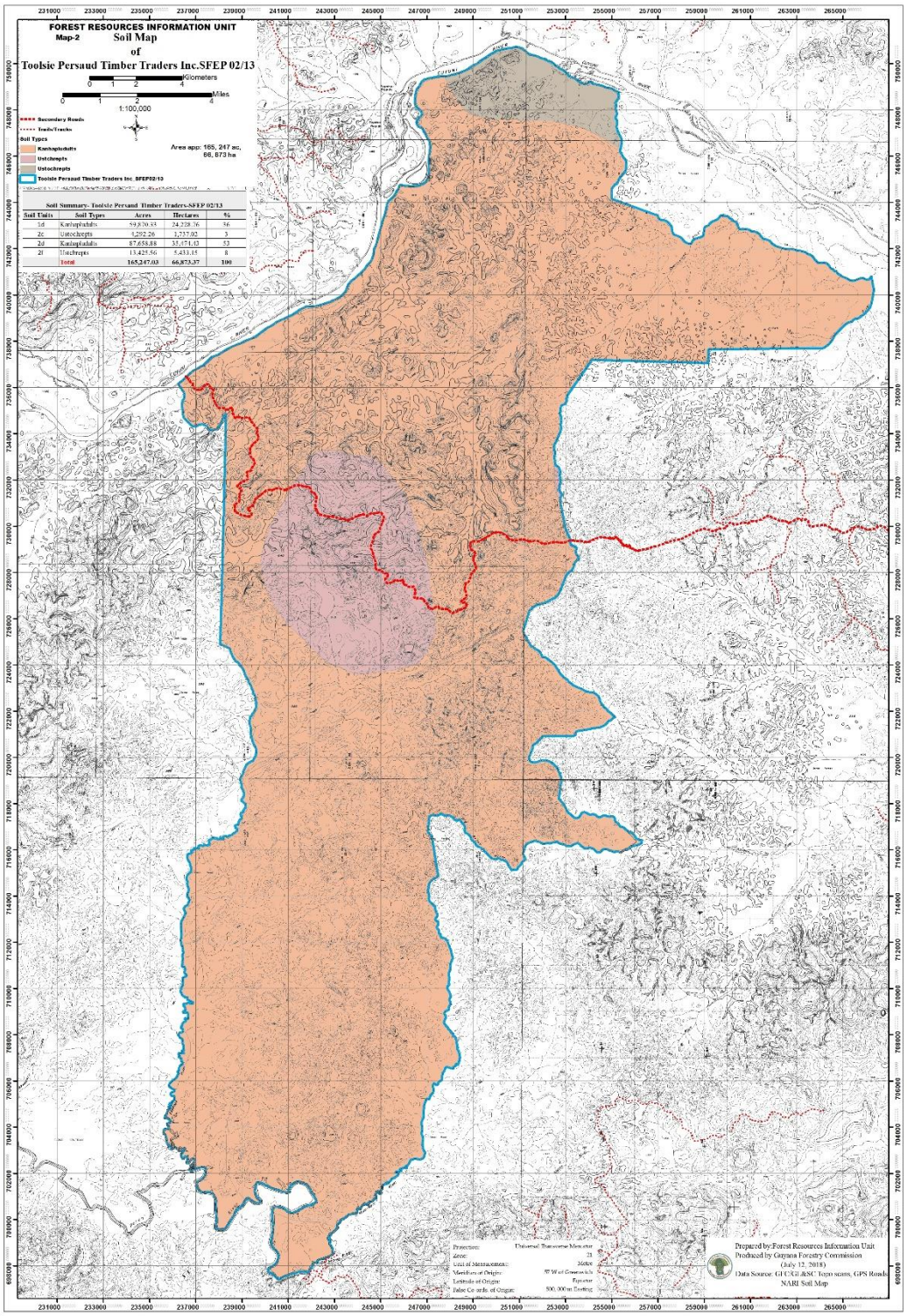
having approximate UTM geographic coordinates of **02 41 859 E, 06 97 676 N**; thence up the **left bank Puruni River** for approximately **17.75 km** to the **mouth** of the **Ekabago River**, having approximate UTM geographic coordinates of **02 36 733 E**, **07 02 154 N**; thence up the **left bank Ekabago River** for approximately **27.00 km** to the **mouth** of an **unnamed tributary**, having approximate UTM geographic coordinates of **02 39 628 E, 07 20 189 N**; thence up the **left bank Ekabago River** to a point having approximate UTM geographic coordinates of **02 38 063 E, 07 24 894** N; thence by a **cut line** in a **Northerly** direction for approximately **10.0 km** to a point near the **source** of a **small unnamed tributary** having approximate UTM geographic coordinates of **02 38 318 E, 07 34 843 N;** thence down the **right bank** of this **unnamed tributary** to its **mouth** on the **right bank Cuyuni River** having approximate UTM geographic coordinates of **02 36 265 E ,07 36 159 N;** thence down the **right bank Cuyuni River** to the **mouth** of an **unnamed tributary** opposite the **mouth** of the **Pairawa River** having approximate UTM geographic coordinates of **02 55 299 E**, **07 48 769 N;** thence up the **left bank** of this **unnamed tributary** for approximately **0.7 km** to a point opposite the **mouth** of another **unnamed tributary** having approximate UTM geographic coordinates of **02 55 178 E, 07 48 120 N;** thence across and up the **left bank** of this **unnamed tributary** to a point near its **source** having approximate UTM geographic coordinates of **02 54 999 E, 07 44 150 N;** thence by a **cut line** in a **South-easterly** direction for approximately **2.1 km** to the **source** of a small **unnamed tributary** of another **unnamed tributary** of the **Quartzstone River** having approximate UTM geographic coordinates of **02 56 991 E, 07 43 449 N;** thence down the **right bank** of this **small unnamed tributary** to its **mouth** on the **left bank** of the other **unnamed tributary** of **Quartzstone River** having approximate UTM geographic coordinates of **02 57 681 E, 07 42 636 N;** thence across and down the **right bank** of this **unnamed tributary** to its **mouth** on the **left bank Quartzstone River** having approximate UTM geographic coordinates of **02 58 418 E, 07 42 220 N;** thence down the **right bank Quartzstone River** to the **mouth** of the **Waiarimpo River,** this being the point of commencement.

Save and except all lands legally held.
Coordinates have not been field-tested.
Description subject to change upon verification.
Area approximately: 66, 873.36 ha, 165, 247.01 acres.
Map reference: 18 NE, NW, SE, SW, 26 NW, and NE.

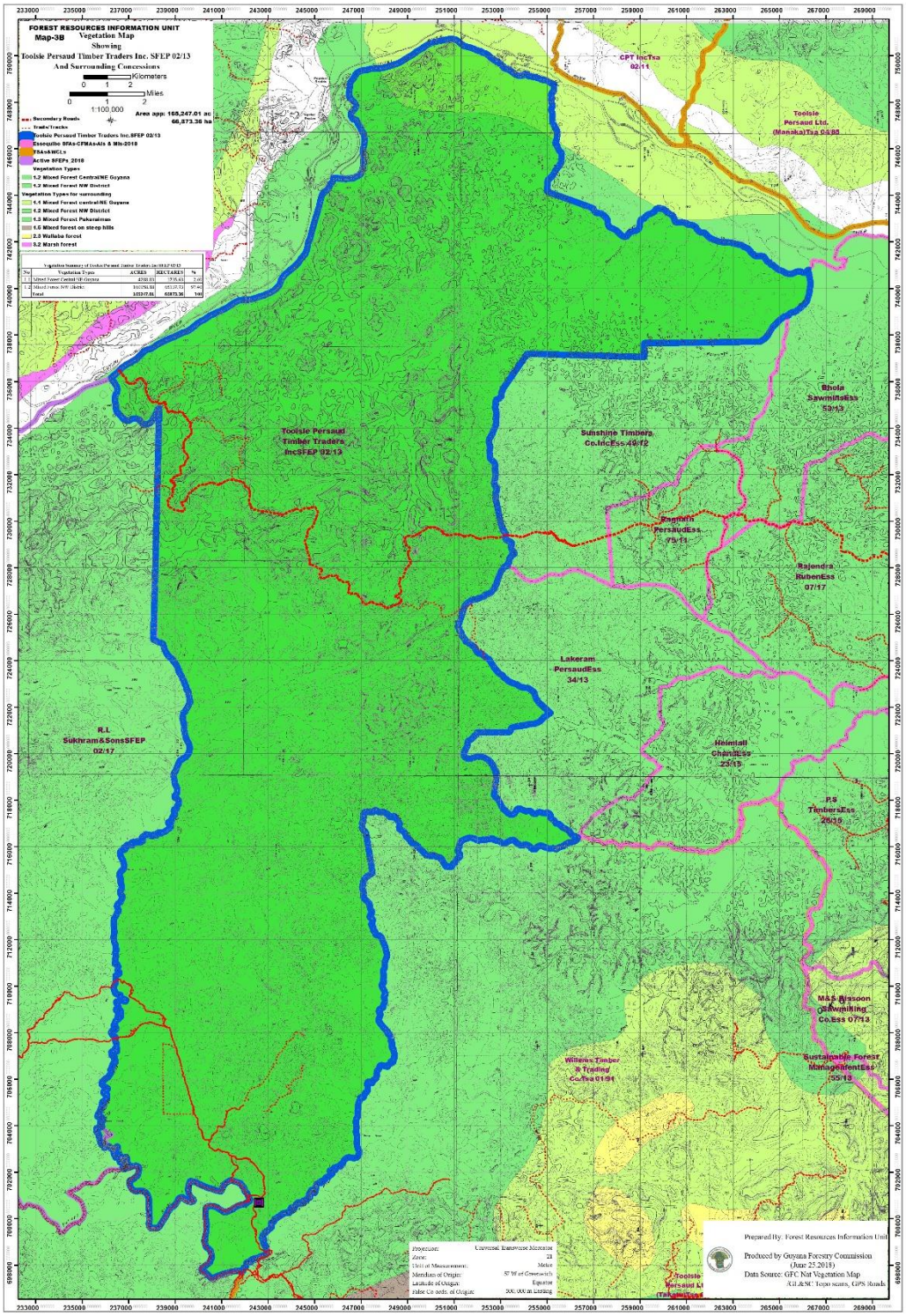
ANNEX VII: MAP 1: BASIC STOCK MAP OF SFEP 2/2013



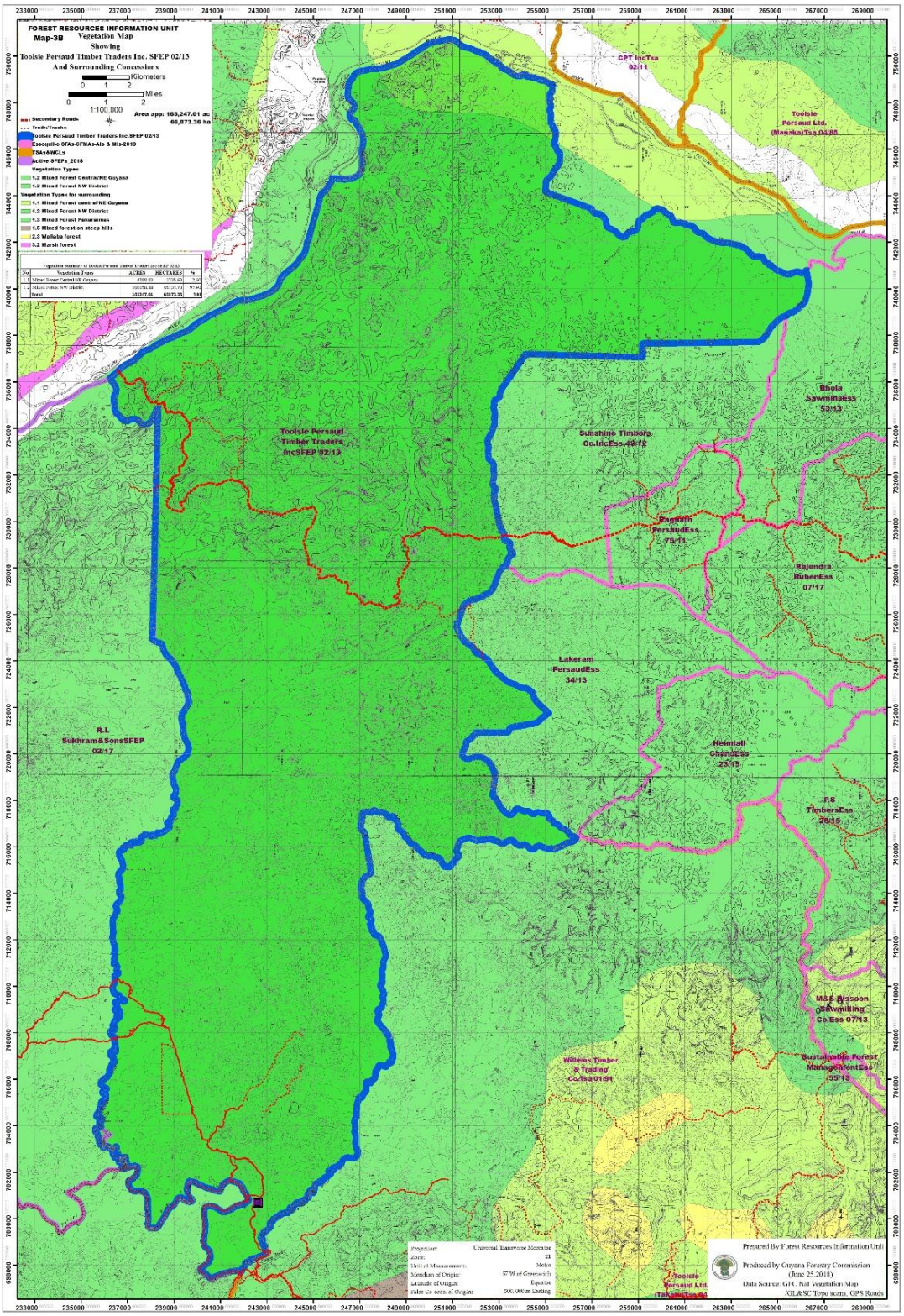
ANNEX VIII: MAP 2: SOIL MAP OF SFEP 2/2013



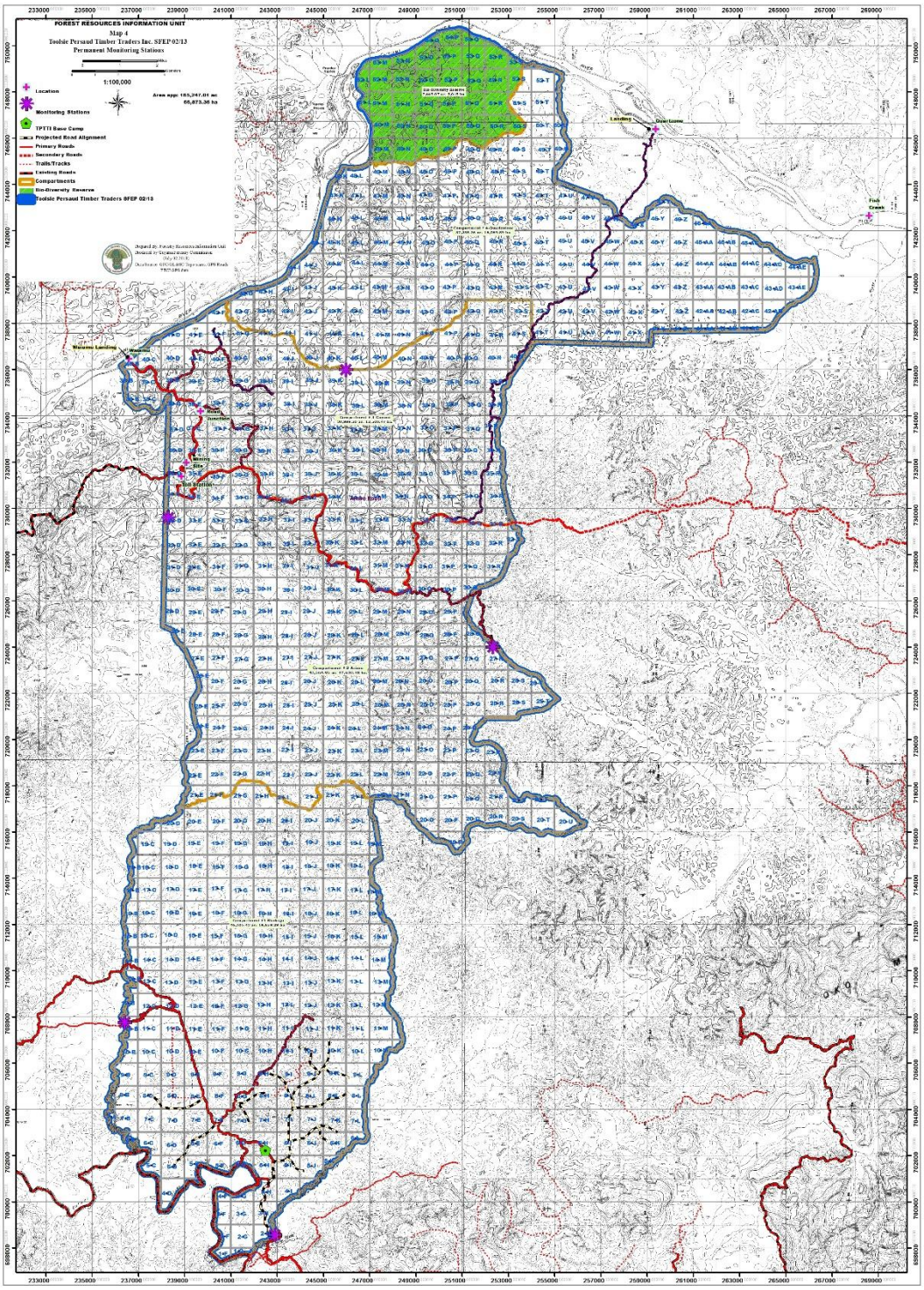
ANNEX IX: MAP 3A: VEGETATION MAP OF SFEP 2/2013



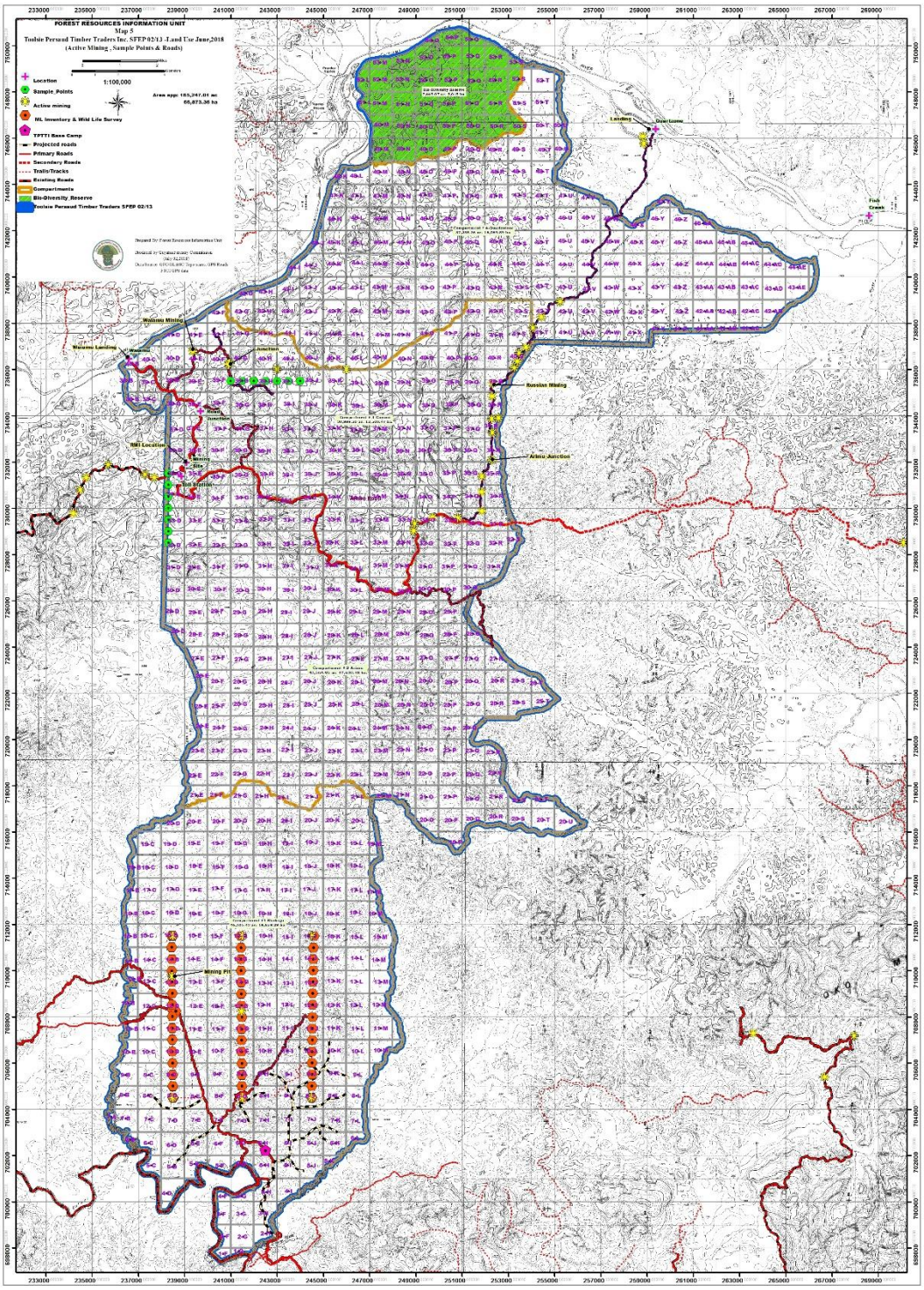
ANNEX X: MAP 3B: VEGETATION MAP OF SFEP 2/2013 AND SURROUNDING AREAS



ANNEX XI: MAP 4: MAP SHOWING THE 5 PERMANENT MONITORING STATIONS



ANNEX XII: MAP 5: MAP SHOWING PLOTS USED FOR ML INVENTORY 7 WILDLIFE CENSUS



ANNEX XIII: CVs OF CONSULTANTS

A. Environmental Engineering Solutions EES

ENVIRONMENTAL ENGINEERING SOLUTIONS (EES)

GENERAL INFORMATION

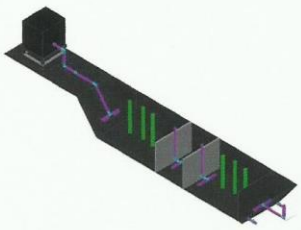
Business Name :	ENVIRONMENTAL ENGINEERING SOLUTIONS (EES)
Address (main office) :	356 Block B, Farm, East Bank Demarara. Georgetown. Georgetown, Guyana. Tel.: +(592) 6500373 E-Mail: isidro_eem@yahoo.com.mx E-Mail: eesguyana@gmail.com
Business No.:	Certificate 130433
Management Staff:	M. Sc. & Eng. Isidro Ubaldo Espinosa (Director) M. Sc. Env. Osbert Ellis (Project Manager)
Services Offered:	Environmental Engineering (Design and Supervision): • Air Pollution Control • Solid Waste Management • Wastewater Treatment • Contaminated sites: prevention, control and restoration Environmental Studies: • Environmental Impact Assessment • Environmental Management Plan • Environmental Annual Report • Environmental Planning • Project Development • Research /Training • Site Inspections

Fields of activity and services provided

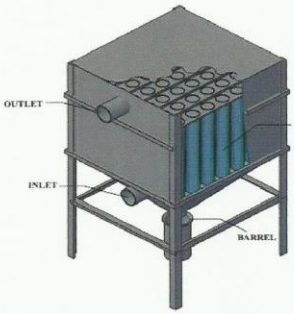
EES was founded in 2011. EES is the first consultant company in Guyana that offers environmental engineering based on demands in the engineering field. EES is rapidly gaining recognition as a technical qualified company by the Government of Guyana and the Private Sector. Projects developed for the private sector are examples of EES ability to provide local assessment, design and engineering that helps to prevent, control and mitigate the environmental impacts from the public, residential, commercial and Industrial sectors.

EES has carried out the following projects for the Private Sector and the Government of Guyana:

Constructed Wetland Design (2011).
The project implied a conceptual design of a wastewater treatment system – Subsurface Flow System type.
Project beneficiary: Beharry Company Limited.

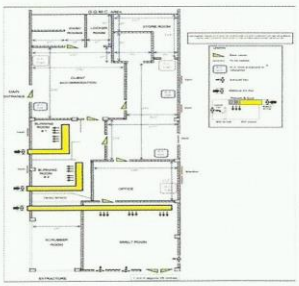


Dust Collector System Design (2011).
The project implied a conceptual design and supervision of a dust collector system, for the air pollution control.
Project beneficiary: A. Cayume Hakh & Sons, Rice Farmer's Millers & Exporters



Integrated Solid Waste Management Initiatives (2011).
The project also included the design of bins, containers and the routes collection for recyclable waste for the city of Georgetown. It is supported by the Ministry of Natural Resources and the Environment in collaboration of the University of Guyana and primary and secondary schools.

Preliminary Design, Fabrication and Installation of a Dilution Ventilation System to Remove Hot Air from Room Spaces and to Dilute Toxic Gases at the Guyana Gold Board Lab Facilities (2011).
Project beneficiary: The Geology and Mines Commission from Guyana.



"Converting Rice Husk Waste into Building Material (Particleboard)" using rice husk and styrofoam from the waste stream – 2012
Project beneficiary: University of Guyana.

"Environmental and Social Impact Assessment (ESIA) for Logging Concessions A, B & C- 2014 (in progress).
Project beneficiary: Baishanlin International Forest Development Inc.

Environmental Management Plan (EMP) for the Construction of a Septage Treatment Plant in Bartica- March 2015).
Project beneficiary: Countrywide Disposal Services (CDS).

Environmental and Social Impact Assessment (ESIA) Update for Sherwood Forrest Inc. Logging Concession (March, 2015).

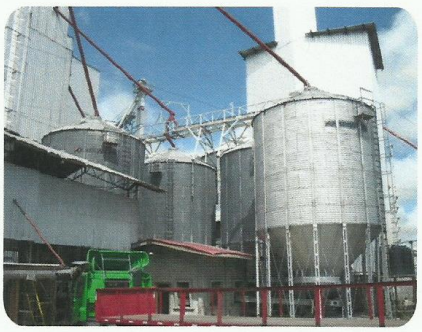
Project beneficiary: Baishanlin International Forest Development Inc.

Environmental and Social Management Plan (ESMP) for Sanitary Landfill Operation in Bartica (April, 2015).

Project beneficiary: General Sanitation Enterprise.

Consolidated Annual Report for Cayume Hakh and Son Cane Grove Rice Mill Operation (April, 2015).

Project beneficiary: A. Cayume Hakh & Sons, Rice Farmer's Millers & Exporters



Environmental Management Plan (EMP) for the Wood Processing and Ship Building Facility at Linden (June, 2015).

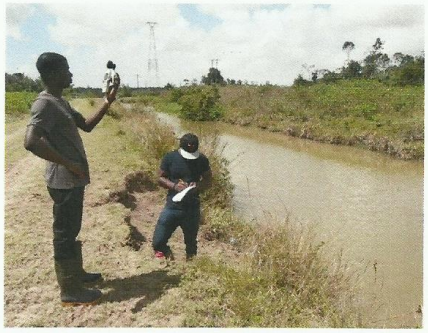
Project beneficiary: Baishanlin International Forest Development Inc.

Consolidated Annual Report for Golden Grove Rice Mill Operation (June, 2015).

Project beneficiary: A. Cayume Hakh & Sons, Rice Farmer's Millers & Exporters

Environmental and Social Management Plan (ESMP) for Sanitary Landfill Operation in East Berbice (June, 2015).

Project beneficiary: Advanced Environmental Solutions (AES)



Consolidated Annual Report for Service Station (Bartica) (July, 2015).
Project beneficiary: David Coates Service Station

Environmental Report for the Asphalt (Bitumen) Plant Project, Upper Demerara-Berbice (August 2015).

1. Project beneficiary: Region 10, Environmental Impact Assesment.

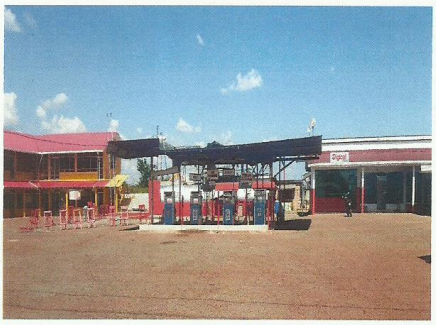
Environmental and Social Impact Assessment (ESIA) - Physical Environment Chapter Forest Concession (August 2015).
Project beneficiary: Rong-An Inc.

Environmental and Social Impact Assessment (ESIA) - Physical Environment Chapter for Forest Concession (August 2015).

Project beneficiary: Variety Woods and Greenheart Ltd.

Consolidated Annual Report for s Service Station (Lethem) (November, 2015).

Project beneficiary: David Coates Service Station



Environmental Engineering Solutions (EES) works in accordance with international specifications and the Environmental Protection Agency in Guyana to comply with the Environmental Standards and Regulations.

B. Eustace Alexander

EUSTACE EMERICK ALEXANDER
Home address: 3632 Christiani Street, North Ruimveldt. Georgetown. Guyana
Tel: (592) - 218 – 0098 (home)
(592) – 678-3859(cell)
Email: eustacealexander@gmail.com

PERSONAL PROFILE

I am a Sustainable Development Specialist with well-developed skills in project management and research. For almost fourteen (14) years I've been participating in field and community-based (indigenous) surveys while successfully managing projects aimed at maximizing the synergies between natural resources (including ecosystem services) management and sustainable development at both the national and rural community levels.

My academic training and overall professional experience allowed me to harness multi-disciplinary skills and knowledge, including:

- familiarity with international and national policies and programmes on sustainable development and the environment;
- a comprehensive understanding of socio-economic and cultural issues of indigenous Amerindian communities in Guyana;
- an awareness of the opportunities and challenges of sustainable natural resources management in indigenous Amerindian communities;
- the principles of strategic project planning and management;
- an understanding of the principles of Free Prior and Informed Consent (FPIC);
- an understanding of the effects of national developmental projects (e.g. the Georgetown-Lethem road and Amaila Falls Hydropower) on the peoples' culture and livelihoods (particularly indigenous communities) and the environment as a whole;
- forming and maintaining strategic partnerships and alliances at local-community, national and global scales;
- the reporting and other requirements of international donor organizations;
- to conceptualise and manage and research projects and;
- to prepare and publish scientific papers and reports.

I speak a little Spanish and possess very good computer, research, communication and report writing skills.

EXPERIENCE

INDIVIDUAL CONSULTANT – Preparation of Project Implementation Form (PIF) for GEF 6 Project: 7th March - 31st March 2016.

- Provided support to the UNDP Country Office and an International Consultant to develop a robust project concept proposal addressing drivers of deforestation and ecosystem degradation linked to the mining sector in Guyana.
- Coordinated the collection and organisation of inputs from national counterparts for the development of the PIF.

- Provided support to the development of the budget that includes a breakdown of co-financing.

STAKEHOLDER CONSULTATION FACILITATOR- Individual Contractor at UNDP on the GEF Project to Strengthen Technical Capacities to Mainstream and Monitor Rio Convention (UNFCC, UNCBD, UNCCD) Implementation through Policy Coordination.
15th September – 23rd November, 2015.

- Project Developer with sole responsibility for execution of the Social and Environmental Screening Procedures.
- Fully responsible for the stakeholder engagements and analysis process to receive inputs to guide design of the Project document.
- Collaborating with the Department of Governance, Natural Resources and the Environment (DGNRE) to host a focus group discussion on preparation of a Capacity Development scorecard for the Project.
- Collaborating with the UNDP and the DGNRE to host a national workshop for validation of the Project document.
- Collaborating with an international cross-cutting capacity development expert to draft Project proposal in-line with GEF's requirements for funding.

NATIONAL EXPERT - Sustainable development and the environment: Individual Contractor at UNDP for Elaboration and Validation of a Stocktaking Report on Sustainable Development for the Amazon Region in Guyana
1st – 30th June, 2015

- Developed the procedures for collecting relevant information.
- Fully responsible for analyses and composition of the stocktaking report.

SOCIAL SURVEY SPECIALIST: Independent Consultant for the Guyana Forestry Training Centre Incorporated (FTCI)
2nd – 9th March 2015

- Developed a questionnaire for the FTCI and the Guyana EPA to achieve the following:
  - Garner opinions on timber harvesting and ancillary activities in areas of interest to stakeholders.
  - Present clear ideas on interviewees' opinions on the project at hand.
  - Sufficiently simple (without compromising quality) to be executed by forest communities, and at the same be used for dealing with heads and employees of public agencies and NGOs.

FIELD SURVEYS AND ASSESSMENT COORDINATOR: Independent Consultant for CI-Guyana on IDB-funded Project - "Assessing the Social and Environmental Impacts of the Georgetown o Lethem Road".
2nd May 2014 - 15th August 2014

- Fully responsible for the development of project document (including procurement plan, communication plan, safety plan, M&E plan and budget) for the conduct of the survey.
- Coordinated logistics for all researchers involved in the surveys, including ensuring availability of required equipment and coordination of entry and exit of Guyana for international researchers.
- Fully responsible for assembling an appropriately capacitated team of Scientists and Field Assistants.
- Coordinated compliance with all permitting requirements for the surveys.
- Responsible for the revision and approval of reports by the Researchers on Birds and Herpeto-fauna, Fish, Aquatic Insects, Water Quality, and Village Surveys.

ECOSYSTEM SERVICES COORDINATOR: Conservation International Guyana
1st July 2009 – 31st December 2013

- Assisted in the preparation of Conservation International Guyana's strategic plans, annual work plans and budgets.
- Conceptualised and contributed to the development of strategy documents for incorporation of mining into the LCDS.
- Provided training for the implementation of community-based biodiversity and water quality monitoring programmes in Amerindian communities.
- Coordinated community consultations in indigenous Amerindian communities to enhance awareness on environmental management and protected areas.
- Participated in the initiation, planning and control phases of the Inter-American Development Bank (IADB) funded project to promote low carbon development livelihoods (based on agriculture and tourism) in the communities of the Rupununi Region, Guyana.
- Participated in an IDB funded programme to assess the application of REDD+ to the mitigation of environmental and social impacts with the upgrade of the Georgetown – Lethem- Manaus Transport Corridor i.e. the final component of plans for Integrated of Regional Infrastructure for South America (IIRSA) Project to link countries of the South American continent.
- Contributed to the preparation of winning proposals to international donors (e.g. KfW and Government of Norway) for funding to support Guyana's preparation for REDD+ including plans for an effective implementation of a national Monitoring, Review and Verification (MRV) programme.
- Co-authored Conservation International (CI) global strategy for Food Security.
- Overall responsibility for strategic planning, implementation, monitoring and evaluation of activities for the Upper Essequibo Conservation Concession (the World's first Conservation Concession) and the Wai-Wai Kanashen Community-Owned Conservation (first of its kind in the Guiana Shield Region).
- Prepared Scope of Work and Terms of References for hired consultants (local and international) and supervised their outputs.

MANAGER – CONSERVATION SCIENCE/Biodiversity Analyst: Conservation International Guyana

1st July 2006 – 30th June 2009

- Responsible for CI-Guyana's approach to scientific initiatives to inform plans for biodiversity conservation and socio-economic development.
- Coordinated the development and implementation of a sheep and mutton project in the village of Apoteri under the Voluntary Community Investment Fund (VCIF) supported by CI's Global Conservation Fund (GCF).
- Provided training to indigenous communities for enhanced capacity in ecosystem management and sustainable natural resource utilisation.
- Participated in the fish survey of BBC funded "*Expedition Guyana*" "in the Upper Essequibo Conservation Concession, Guyana and co-authoured the technical report.
- Participated in Rapid Biological Assessments of mammals (camera trapping), fishes and herpetofauna in the Wai-Wai Community Owned Conservation Area of the Konashen District and contributed to data analyses and technical report write-up.
- Managed the operations and equipment of a Field-Office at Apoteri Village with a staff of four persons.

MANAGER – PROTECTED AREAS PLANNING: Conservation International Guyana
1st July 2003 – 30th June 2006

- Participated in a process to form alliances with partner institutions to implement community development projects.
- Participated in a learning system to monitor, document and share lessons learned as part as an adaptive management strategy for protected area establishment and management in Guyana.
- Supervised the execution of social surveys in selected communities of the Rupununi Region.
- Collaborated with the Wai-Wai of Konashen District to collect baseline biological surveys at sites of resource extraction.

MANAGER – CONSERVATION CONCESSION & PROPOSED SOUTHERN GUYANA PROTECTED AREA: Conservation International Guyana
1st July 2002 – 30th June 2003

- Overall responsibility for strategic planning and implementation of field activities for the Conservation Concession and the proposed Southern Guyana Protected Areas.
- Negotiated an innovative 'Conservation Concession' Agreement under Guyana's Forest Act (1951);
- Prepared and monitor budgets for all projects in the Conservation Concession and Southern Guyana.
- Prepared and provided financial requests and reports.
- Formulated guidelines for the conduct of a timber inventory, supervised project progress and reviewed the Report prior to submission to the Guyana Forestry Commission.
- Documented and analysed lessons learned (Monitor and Evaluate project success) during project implementation as a part of CI's adaptive management strategy.

- Designed and managed the implementation of a Voluntary Community Investment Fund (VCIF) for the promotion of sustainable enterprises in three indigenous communities of the North Rupununi Region.
- Prepared Terms of References for hired contractors and supervised the successful delivery of project deliverables. .
- Coordinated community consultations on plans to establish a protected area in the Southern Guyana Region.
- Reviewed Consultant's Reports for endorsement.

PROGRAMME ASSOCIATE –BIODIVERSITY CORRIDOR PROGRAMME: Conservation International Guyana
3rd Jan. 2002 – 30th June2002

- Provided support to the Corridor Manager for project implementation and monitoring of the USAID-funded Biodiversity Corridor Conservation Programme.
- Coordinated the reproduction and distribution of reports on local and regional stakeholder meetings.
- Developed and coordinated reports for conferences and workshops associated with the biodiversity corridor programme.
- Provided support for planning and preparation of detail budgets for programme activities.
- Reviewed and provided inputs to technical documents developed under the Biodiversity Corridor Programme.
- Provided monthly updates on the status of project activities and budgets.

RAP COORDINATOR: Conservation International Guyana
15th June 2001 – 15th Oct. 2001

- Coordinated logistics for CI's Rapid Assessment expedition to the Eastern Kanuku Mountains and participated in the review process to document and share lessons learnt.
- Created and managed a database of biographic and other information of participants.
- Participated in the review process for the RAP Report and documented lesson learnt and submitted a report on RAP logistics.

RESEARCH SCIENTIST (intern): Tropenbos International-Guyana
10th Nov. 1999 – 13th June 2001

- Conducted studies to determine the fire susceptibility of a selectively logged tropical rainforest in Central Guyana.

LECTURER (full time): Guyana School of Agriculture

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1995 Nov. - 1996 Nov. and 1998 Nov - 1999 Sept.

- Designed, implemented and managed the School's first Crop Museum Project.
- Lectured in Soil Science, Forest Ecology, Agricultural Zoology and Agricultural Entomology.

PROJECT MANAGER/RESEARCH ASSISTANT: Nat'l Agricultural Research Institute (NARI)
Feb 1992 – Oct. 1995

- Conceptualised, implemented and monitored field-based rice research projects at the National Agricultural Research Institute.
- Head of Department – Agronomy Section – supervised and evaluated the outputs of staff and independent contractors.
- Managed and supervised 17 persons including one Research Technician.
- Prepared and submit budgets requests for the Agronomy Department.

QUALIFICATIONS AND EDUCATION

Master of Science in Forest Ecology (Plant Eco-physiology) – 2001: University of Guyana (UG), Turkeyen Campus in collaboration with Utrecht University, Netherlands. ***Thesis based on the regeneration and distribution of tropical rainforest seedlings in response to the solubility of toxic metals in soils of logged out sites***

Bachelor of Science: Agriculture – 1991: University of Guyana

Diploma in Agriculture – 1985: Guyana School of Agriculture, Mon Repos. Guyana

PROFESSIONAL COURSES ATTENDED

2013: **Advance Diploma in Project Management:** Project Management Institute. USA. PM Body of Knowledge (PMBOK).
2012: **Ecological Mangrove Restoration Training:** Guyana Mangrove Restoration Programme.
2010: **Standard Operation Procedures for Carbon Stock Assessment in Guyana's Rainforests –** by WinRock International of the USA and conducted in Guyana.
2008: **Climate Models: Scenarios of Future Climate Change for Impacts and Adaptation studies** – Environmental Canada and Smithsonian Institute. Panama City, Panama

2007: **Carbon Analyses Training Workshop** – CI Climate Change Initiative Programme. Quito, Ecuador

2007: **Principles of Environmental Law and Enforcement –** USEPA, USAID, GFC and the Guyana Ministry of Agriculture. Georgetown, Guyana

2007: **Human Health and Global Environmental Change** - Harvard University and University of Guyana. Georgetown, Guyana

2006: **Techniques for successful Proposal Writing and Resource Mobilisation** - Inter-American Development Bank (IADB) and Caribbean Policy Development Centre (CPDC):

2005 **Monitoring and Assessment of Biodiversity Projects** – Smithsonian Institute, Conservation and Research Centre, Front Royal, Virginia. USA (one month)

2003: **Amerindian Anthropology** – University of Guyana (two weeks).
2002: **Monitoring and Evaluation for Biodiversity Corridors in Practice** – CI's Biodiversity Corridor Planning and Implementation Programme (BCPIP) and USAID. Ben Lemond, California. USA (nine days).

1999: **Internship at Utrecht University, Utrecht, Holland (three months)**
Attended classes in Tropical Ecology and Conservation Biology. Participated in study-tours of reclaimed ecosystems, natural temperate forest ecosystems, nature based resorts and plant physiology laboratories at Utrecht and University of Wageningen. Attended workshops, academic lectures and participated in-group discussions.
1994: **Introduction to Geographic Information Systems** - University of Guyana, National Data Management Authority and University of West Indies (one week).
1992: **Technical Report Writing and Presentation** - NARI and the Caribbean Agricultural Research Institute (CARDI) – one week.

WORKSHOPS ATTENDED

2013: Iwokrama; COBRA and NRDDD: Discovering Innovative Methods for Local Community Engagement in Guyana.

2012: Ministry of Agriculture (Guyana) and UNFAO: Workshop to formulate National Policy and Strategic Plan for Inland Fisheries in Guyana.
2010: Conservation International: South America Workshop on Ecosystems Services.
2010: Iwokrama International Centre and indigenous communities: Development of Fisheries Management Plan for the communities of the North Rupununi Wetlands.

2010: GFC and the EU: Exploratory Workshop on the EU Forest Law Enforcement Governance and Trade Initiative.

2010: Ministry of Agriculture and IICA: Promoting Climate Smart Agriculture in Guyana.

2009: GFC: Developing a Monitoring Reporting and Verification System for Guyana2009: GOG/UNDP Enabling Activities for Preparation of Guyana's Second National Communication to the UNFCCC.

2009: CI, GFC and IDB: Options and recommendations for Guyana to pursue a REDD Programme.

2008: PAHO and MOH: Protecting Health from Climate Change.

2007: CARICOM, GOG, CREDP, IADB and IICA: Expanding Bio-energy Opportunities in the Caribbean
2007: Amazon Cooperation Treaty Organisation (ACTO) and the Guyana Environmental Protection Agency (EPA): Workshop on Management of Amazon Region Biodiversity in Guyana
2007: The Guyana Environmental Protection Agency (EPA) National Consultation Workshop on Guyana's Biodiversity Action Plan
2006: Inter-American Development Bank (IADB) and Caribbean Policy Development Centre (CPDC): Fundraising Training Seminar on Techniques for successful Proposal Writing and Resource Mobilisation.
2006: Inter-American Development Bank (IDB) and the Guyana Environmental Protection Agency (EPA): National Capacity Building Workshop for Key Stakeholders in Environmental Management
2006: UNDP, GEF and Guyana EPA: National Workshop for Capacity Self Assessment on Environmental Issues:
2006: ITTO Workshop on Guidelines for Restoration, Management and Rehabilitation of Degraded and Secondary Tropical Forests.
2006: UNESCO - Man and Biosphere (MAB) and University of Guyana (UG) National Workshop on Biosphere Management.
2005: UNDP/GOG Workshop to Design and Build Capacity for Community Based Natural Resources Management

COMMITTEE MEMBERSHIP

- Former Chairman, Faculty Committee, Faculty of Agriculture and Forestry, University of Guyana
- Previous Member of the National Committee for the Amazon Cooperation Treaty Organisation (ACTO) to Validate Priority Indicators for sustainable management of the Amazon Forest.
- Former Member of National Work Group of the Guyana National Initiative for Forest Certification (GNIFC).
- Former Member of National Committee for Sustainable Management of the North Rupununi Wetlands.
- Former Member National Climate Change Committee.

PUBLICATIONS

Alexander, E; Singh, D; Bernard, C; Laing, T; Balraj, D and S. Kandaswamy (unpubl.): Experiences and Impacts of the Conservation Concession Model in Guyana. Conservation International Guyana. Guyana.

Willink, P.W; Alexander, E & C.C.Jones. (2013). Using fish assemblages in different habitats to develop a management plan for the Upper Essequibo Conservation Concession, Guyana. Biotoa Neotrop.13 (4).

Weikel M, Alexander E, Savy CE, Bernard, C. 2012. Preliminary Assessment to Inform Amaila Falls Hydropower Project Biodiversity Offset Scoping. Conservation International, USA & Guyana.

Alexander, E.; Singh, D,; Shoch, D,; Killeen, T,; O'Sullivan, R,; James, D., *et al* (2009). Reducing Deforestation and Forest Degradation while promoting Sustainable Development. South American Regional Infrastructure Development, Forest and REDD: Implications for Guyana. Conservation International Guyana.

Alexander, E. (2008): Case Study of the Upper Essequibo Conservation Concession – as an innovative legal mechanism for biodiversity conservation and a viable option for avoiding degradation/deforestation. In Fenech, A.; D. MacIver and F. Dallmeier (eds.) ***Climate Change and Biodiversity in the Americas***. Environmental Canada, Ontario, Canada

Alonso, L.E.; J. McCullough; P. Naskrecki; E. Alexander and H.E. Wright (2008). A rapid biological assessment of the Kanashen Community Owned Conservation Area, Southern Guyana. RAP Bulletin of Biological Assessment 51. Conservation International, Arlington, VA. USA.

Lasso, C; J Hernandez-Acevedo; E. Alexander; J. C. Senaris; L. Mesa; H. Samudio; J. Mora-Day; C Magalhaes; A Shushu; E. Mauruwanaru and R. Shoni (2008). Aquatic Biota: Fishes, Decapods Crustaceans and Molluscs of the Upper Essequibo Basin (Konashen COCA), Southern Guyana. In L.E Alonso et al (2008). *A rapid biological assessment of the Konashen Community Owned Conservation Area, Southern Guyana. RAP Bulletin of Biological Assessment 51. Conservation International, Arlington, VA. USA.* Pp 43- 54.

Sanderson, J; E. Alexander; V. Antone, V and C. Yukuma (2008). Non-volant mammals of the Konashen COCA, Southern Guyana. In L.E Alonso et al (2008). *A rapid biological assessment of the Konashen Community Owned Conservation Area, Southern Guyana. RAP Bulletin of Biological Assessment 51. Conservation International, Arlington, VA. USA.* Pp 69-71.

Thijs, P., Alexander, E.E.; Houter, N.C.; Rose, S.A; and Toon Rijkers. (2005)
Ecophysiological Patterns of Guiana Rainforest Plants. In: *Tropical Forest of the Guiana Shield Ancient Forest in a Modern World* (Ed. David Hammond) CABI BioScience.

Alexander, E. E. and Roderick Zagt (in prep). Predicting the susceptibility of Guyana's Rainforest to fire.

REFERENCES

Prof George Mentore Associated Professor University of Virginia Charlottesville, Virginia. USA Email: gm3c@virginia.edu	**Dr. Patrick Chesney** Assistant Resident Representative Environment, Extractive Industry and Energy United Nations Development Programme 42 Brickdam and UN Place Georgetown Tele (work) : 592-223-6564 Mobile : 592- 623-3107 Email: patrick.chesney@undp.org	**Mr. Arnold D'Mendonca** Sustainable Development Specialist IICA Office Guyana Tele: 592-226-8347 (work) Email arnold.demendonca@iica.int

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C. Leon Moore

Leon Moore

485 Oronoque Drive, Mackenzie, Linden, Guyana. 596-655-9648.
Leonmoore40@yahoo.com
www.journeyguyana.com

Naturalist Guide & Wildlife Photographer

SUMMARY

* Enjoy working with people
* Experienced in the photography of birds and mammals
* Knowledgeable nature guide, especially in the field of bird watching
* Actively concerned about Guyana's ecosystem and the preservation of its wildlife

EDUCATION

1998 to 2002 Went to Linden Foundation Secondary School

RELEVANT COURSE WORK

Iwokrama Research Center for Rainforest Conservation and Development;

Jan, 2008-April, 2008 Best Graduated Student (General Tour Guide Training) – Certificate.

Nov,2008 Hospitality Training (THAG)-Certificate.

Jan, 2011 Emergency First Responders Training (Guyana School of Aviation)-Certificate.

Jan, 02nd to 26th 2014 Water Quality Testing Training (University of Missouri, St Louis/ Karanambu Lodge)

Jan, 02nd to 26th 2014 Research on Leaf Cutter Ants (University of Missouri, St Louis/ Karanambu Lodge)

April, 06th to 12th-2014 Emergency First Responders Training (Guyana School of Aviation)-Certificate.

Jan-12th to 28th Jan, 2017, Research assistant for R.S.D, (Road Island School of Design University/ Karanambu Lodge, Guyana)

WORK EXPERIENCE

2002-2006 - The Guyana Defense Force

2007 – 2008 Auto Mechanics

June 2008 - June 2009 Baganara Island Resort - Guest Service Officer, General Tour Guide, developed Bird List.

August 2008 involved in a Bird Censor as field officer for water birds with GATBS /Wetland International in the Essequibo River.

January 2008 - 2017 Bird Guided Tours and surveys in Regions 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10 Guyana.

Feb, 17th, 2009 involved in the identification of a new bird spotted 38 Miles up the Essequibo River for Guyana, Black- Legged Kittiwake *(Rissa tridactyly)*

September 2009 - 2012 Rock View Lodge –Tour Guiding, Appointed Team Leader, Assistant Tourism Manager, and General Assistant Manager.

March 2010, Developed the Rock View Lodge Bird List

Oct, 9th, 2011, spotted a new Bird for Guyana, Tawny Crowned-Pygmy Tyrant *(Euscarthmus meloryphus)*

January 2012- Feb, 28th, 2014, Tour Guide at Atta Rainforest Lodge & Iwokrama Canopy Walkway

Oct 2013, work with BBC team conducting a documentary in Guyana

November 2013, Awarded Tour Guide of the year (Guyana Tourism Authority)

April 6th 2014, Volunteer regional reviewer for www.ebirds.org (Guyana)

October 2014, Assistant Instructor bird and tour guide training for (Iwokrama international research center for rainforest conversation and development)

Aug 2015, Registered as a Tour Operator

November 2014, Conducted bird guide training for (Iwokrama international research center for rainforest conservation and development)

Aug-20th to 21st Sep, 2016, Conducted bird survey for Guyana GoldFields Inc.

Feb 6th to Feb 24th, 2017, Conducted bird survey for Guyana Goldfields Inc.

June 4th to June 13th, 2017. Conducted bird survey for Environmental Services & Support (ESS) in Suriname.

November 17th to 24th Nov, Conducted Coastal Mapping Sensitivity and bird survey for Environmental Resources Management (ERM)

Currently, in process, shorebirds survey along the coast of Guyana for (United States Shorebirds Consecration Plan)

Godfrey Emerson Marshall *Forester* *E-mail address: gemar@guyana.net.gy*

CURRICULUM VITAE: GODFREY EMERSON MARSHALL, FORESTER

45 years with the Guyana Forestry Commission, and exposure to forestry field tours in Brazil, Malaysia, Sweden, Trinidad & Tobago and the United Kingdom.

A. PERSONAL DETAILS:

Name:	Godfrey Emerson Marshall
Date of birth:	12 November, 1954
Place of birth:	Bartica, GUYANA
Nationality:	Guyanese
Address:	1393 Section A, Block X, Diamond Housing Scheme, East Bank Demerara, GUYANA
Email:	gemar@guyana.net.gy
Phone:	592-216-4602 (H); 592-642-1910 (Cell)

B. EDUCATION:

2000: Executive Diploma in Business, University of the West Indies School of Business (sponsored by Guyana Forestry Commission), Georgetown, Guyana.

1999: M.Sc. Forestry – Department of Plant Sciences, University of Oxford, United Kingdom.

1992: B. Sc. Forestry - Universidade Federal de Lavras (*formerly Escola Superior de Lavras),* Lavras, Minas Gerais, Brazil.

1982: Diploma in Forestry - Eastern Caribbean Institute of Agriculture & Forestry, Trinidad & Tobago.

C. PROFESSIONAL EXPERIENCE:

Appointed a Forest Officer, Guyana Forestry Commission on December 7, 1972 within the Guyana Forestry Commission and served in various positions (see below) before secondment to Forestry Training Centre Incorporated as a Project Coordinator in September, 2002 and as Director, 2005-2014. Formally retired from the Guyana Forestry Commission in December 2014 after 42 years.

Key positions held at the GFC are as follows:

2015+: ***Technical Adviser/Consultant*** with the GFC/FTCI; provide technical support to the FTCI, conduct land use studies, forestry extension services, etc.

2005 to 2014: ***Director, Forestry Training Centre Incorporated***: Managed two ITTO projects, while maintaining collaboration with several partners/donors including the Tropical Forest

Godfrey Emerson Marshall *Forester* *E-mail address: gemar@guyana.net.gy*

Foundation, Virginia (USA), Tropenbos International, WWF (Guyana), Iwokrama International Centre, Basic Needs Trust Fund (Guyana), and Board of Industrial Training (Guyana).

2002-2004: ***Project Coordinator***, Forestry Training Centre Incorporated: *understudied the Project Director, Peter van der Hout PhD.*

2001-2002: ***Head, Planning & Development Division***: *Assisted in identifying and developing strategic goals for the GFC. A strategy for managing research sites and a local forest zonation paper were produced during that period.*

1995-2001: **Deputy Commissioner of Forests**-Forest Resources Management Division: *Assisted with the development of forest management standards and practices, including leading a task force that prepared the first draft of GFC's Code of Practice and draft guidelines for the preparation of forest management plans and annual plans of operations.*

1992-1995: ***Senior Assistant Commissioner of Forests***-Field Operations. *Coordinated Guyana Forestry Commission's forestry extension, enforcement and monitoring functions.*

D. Field Tours

I have been exposed to field tours in various countries, including Malaysia, Sweden, Brazil and the United Kingdom.

E. Languages

I am fluent in English and Portuguese. I can interpret most *written* Spanish.

F. Recent Publication

Marshall, G. 2017. An evaluation of Forest Management and Biodiversity Conservation in Guyana. Prepared for ACTO re Project 'Building Capacities of ACT Member Countries for Ecologically Responsible Forest Management. ACTO Secretariat, Brazil. 114pp.

G. Projects/Consultancies

I have done consultancies for FAO and ITTO projects, respectively. Also, I have written a large number of Forest Management Plans and Annual Plans of Operations for logging companies in Guyana. I am currently engaged in the preparations of ESIAs for local developers in the forestry sector.

H. Other

Served for one year as a member of the Board of Directors, Guyana Mining School and Training Centre (January -December 2014).

Received a *national award*: Medal of Service: November 2015

TPTTI: SFEP 2/13

FORESTRY TRAINING CENTRE INCORPORATED
17 Access Road, Kingston, Georgetown, Guyana
Tel: 592-223-5061/5062

Q#:.....

Date:...../...../2018.

Objective: To document and characterize stakeholders' concerns about logging at or near their community or workplace.

A. Basic Information

1. Personal Information (Optional).

Name _____ Occupation _____ Gender _____ Age _____

2. What is the size of your household?

☐ ≤ 3 persons. ☐ 3-5 persons ☐ 5-7 persons ☐ >7 persons

3. How long have you been living or working in this area?

☐ < 1 yr. ☐ 1-5 yrs ☐ >5 yrs ☐ N/A (In transit)

B. Social Issues

4. What do you <u>like</u> most about this area? (You may choose more than one option)

☐ The people. ☐ Landscape ☐ Economic opportunities ☐ Other.....

5. What <u>features</u> do you <u>dislike</u> most about this community or neighbourhood or area?

☐ 6. Employment opportunities ☐ 5. Level of social services ☐ 4. Security Issues
☐ 3. Landscape/aesthetics/environment ☐ 2. People ☐ 1. Other:.....

6. Are you satisfied with the level of community developments in this area?

☐ Very satisfied ☐ Somewhat satisfied ☐ Neither satisfied or dissatisfied
☐ Somewhat dissatisfied ☐ Very dissatisfied ☐ N/A

C. Logging Activities

7. What aspects of logging are you most concerned about?

☐ Concession allocation? ☐ Expanded road networks? ☐ Timber harvesting/ timber transport
☐ Employment practices ☐ All of the foregoing ☐ Not sure/not interested

8. Is logging an important or significant contributor to livelihoods in this area?

☐ Strongly disagree ☐ Disagree ☐ Neutral/Neither agree nor disagree
☐ Agree ☐ Strongly agree

9. How would you rate the physical impacts of log transport or storage on this community or neighbourhood?

☐ Major irritant/disgusting ☐ Minor irritant/hardly noticeable ☐ No discernable impact

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TPTTI: SFEP 2/13

10. **Have you ever lodged a complaint about any aspect of logging in your neighbourhood to the CDC, GFC or any other agency?**

☐ Yes | ☐ No

11. **If your answer to Q10 is 'yes', how would you characterize the response to your complaint?**

☐ Very helpful. ☐ Somewhat helpful ☐ Not at all helpful ☐ No Response

12. **Do you think that *additional logging* activity in proximity to your community will bring benefits?**

☐ Yes ☐ No ☐ Not sure

13. **Do you think that *additional logging* activity in proximity to your community will affect you negatively in any way?**

☐ Yes ☐ No ☐ Not sure

CLIMATE CHANGE

14. **Do you think that our everyday actions and activities affect weather patterns in the long term (climate change?)**

☐ Yes ☐ No ☐ Not sure

15. **Do you think that there is a special link between logging and climate change?**

☐ Yes ☐ No ☐ Not sure

BIODIVERSITY

16. **Do you think that our livelihoods depend on plants and animals occurring naturally in our environment?**

☐ Yes ☐ No ☐ Not sure

17. **What potential environmental impacts of logging bothers you?**

☐ Forest degradation ☐ Alteration of habitats for fauna ☐ Pollution of fresh water supplies
☐ Scarcity of commercial species ☐ Forest roads ☐ Changes in the landscape

FUTURE

18. **In relation to logging activities, can you** think two (2) events **that you would not want to see happen in your area?**

1.
2.

19. **Additional Feedback: Please share any additional comments:**

Thank you for your time. Your input is highly appreciated. We rely on your feedback to help us manage our environment.

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Annex XV: LIST OF PERSONS FORMALLY INTERVIEWED VIA QUESTIONAIRES

Q#	Name	Age	Gender	Occupation	Location	Key concern	Date
1	ALLEN, Elvis	58	M	Businessman	Puruni L	Roads	24-Apr-18
2	OSELMO, Charles	20	M	Miner	Puruni L	CSR	24-Apr-18
3	THOMAS, Allan	42	M	Miner	Puruni L	Security	24-Apr-18
4	ELCOCK, Floyd	44	M	Businessman	Puruni L	Security	24-Apr-18
5	DECOSTA, David	55	M	Boat Captain	Puruni L	None	24-Apr-18
6	GRIFFITH, Rudolp	58	M	Boat Captain	Puruni L	Security	24-Apr-18
7	JANKI, Kudasi	27	M	Mines Officer	Puruni L	Security	24-Apr-18
8	BLONDT, William	28	M	Accountant	Puruni L	EMPLYMT	24-Apr-18
9	VELOSA, Xago Marcos	24	M	Businessman	Puruni L	Security	24-Apr-18
10	RAMSINGH, Andy	33	M	Businessman	Puruni L	Security	24-Apr-18
11	THOMPSON, Raphael	35	M	Security	Puruni L	Security	24-Apr-18
12	SEALLY, Kurdella	34	F	Internet Clerk	Puruni L	Security	24-Apr-18
13	JOHN, Royden	26	M	Forest Officer	Iteballi	CSR	25-Apr-18
14	VANLANGE, Wayne	59	M	Forest Officer	Iteballi	Env. Education	25-Apr-18
15	JAMES, Chris	30	M	Timber Grading Inspector	Iteballi	None	25-Apr-18
16	DANIELS, Theresa	44	F	Businesswoman	Iteballi	EMPLYMT	25-Apr-18
17	BROWN, Laureen	27	F	Sales person	Iteballi	CMNTY DEV	25-Apr-18
18	MOHAMMED, Bibi	43	F	Businesswoman	Iteballi	None	25-Apr-18
19	INNISS, Rickford	53	M	Forest Manager	Iteballi	Educational Fac	25-Apr-18
20	COLEEN	47	F	Pastor	Iteballi	CSR	25-Apr-18
21	GOODLUCK, Jonella	33	F	Businesswoman	Iteballi	EMPLYMT	25-Apr-18
22	SINGH, Rodwell	34	M	Businessman	Iteballi	CMNTY DEV	25-Apr-18
23	BHARAT, Tyrone	39	M	Boat Captain	Iteballi	EMPLYMT	25-Apr-18
24	GARY	49	M	Boat Captain	Iteballi	Security	25-Apr-18
25	SMITH, Emily	23	F	Sales person	Iteballi	Sawmill	25-Apr-18
26	JULIANNA	21	F	Sales person	Iteballi	CMNTY DEV	25-Apr-18
27	BAKSH, Mohammed	41	M	Driver	Iteballi	Educational Fac	25-Apr-18
28	BAGOT, Dillon	21	M	Police Officer	Iteballi	None	25-Apr-18
29	AKESHA	21	F	Sales person	Takutu	None	25-Apr-18
30	HUDSON, Johanna	33	F	Hair Dresser	Takutu	Sawmill	25-Apr-18
31	RAJESH	43	M	Welder	Takutu	Security	25-Apr-18
32	BACCHUS	29	M	Carpenter/Mason	Takutu	None	25-Apr-18
33	BARCLAY, Timolyn	34	F	Office Manager	Tiger Creek J	CMNTY DEV	26-Apr-18
34	DANIELS, Thomas	58	M	Sales person	Tiger Creek J	Evironment	26-Apr-18
35	WHITTER, Mark	46	M	Miner	Tiger Creek J	None	26-Apr-18

ANNEX XV: LIST OF PERSONS FORMALLY INTERVIEWED VIA QUESTIONAIRES

Q#	Name	Age	Gender	Occupation	Location	Key concern	Date
36	ANDRIES, Terry	60	M	Labourer	Tiger Creek J	CMNTY DEV	26-Apr-18
37	GILL, Augustus	62	M	Mechanic	Tiger Creek J	CMNTY DEV	26-Apr-18
38	OREALLA, Louis	51	M	Farmer	Tiger Creek J	None	26-Apr-18
39	RANDY	34	M	Miner	Tiger Creek J	EMPLYMT	26-Apr-18
40	BERETON, Ryan	30	M	Shop Keeper	Puruni L	EMPLYMT-FEMALES	27-Apr-18
41	MURPHY, Andy	20	M	Receptionist	Puruni L	EMPLYMT-FEMALES	27-Apr-18
42	KISANA	22	F	Chef	Puruni L	None	27-Apr-18
43	REYNOLDS, Gillana	24	F	Sales person	Puruni L	None	27-Apr-18
44	ABRAMS, Emery	45	M	Internet Clerk	Puruni L	Security	27-Apr-18
45	CHARLES, Errol	56	M	Self-employed	Puruni L	Security	27-Apr-18
46	BEARD, Terrence	37	M	Pontoon Operator	Puruni L	CMNTY DEV-Bridge	27-Apr-18
47	NURSE, Carl	56	M	Boat Captain	Puruni L	Security	27-Apr-18
48	HENRY, Conrad	31	M	Taxi Driver	Puruni L	Security	27-Apr-18
49	FRANCE, Fay	42	M	Self-employed	Puruni L	Security	27-Apr-18
50	NOT PROVIDED	26	M	GGMC Officer	Iteballi	None	25-Apr-18

ML Inventory Form

GFC's Booking Form for ML Sample Plots

Part 1: Plot Information

Team members' initials: Date: General Location:

Line number: Line bearing (true): Plot #:

GPS: Easting: Northing: EPE: Waypoint name:

Slope %: Slope Aspect: Soil Type:

Forest Type: Disturbance: Canopy Closure:

Main Plot Observations:

Part 2: Main Plot: **Plot Radius (m):**

(a) Trees (all species) Minimum dbh (cm):

Tree	Species	Dbh (cm)	Risk	Log length(m)	Tree	Species	Dbh (cm)	Risk	Log length(m)
1					22				
2					23				
3					24				
4					25				
5					26				
6					27				
7					28				
8					29				
9					30				
10					31				
11					32				
12					33				
13					34				
14					35				
15					36				
16					37				
17					38				
18					39				
19					40				
20					41				
21					42				

b) Stumps (minimum diameter (cm):

Stump	Species	Diameter	@Ht	Stump	Species	Diameter	@Ht
1				6			
2				7			
3				8			
4				9			
5				10			

Stump Logging Observations:

(c) Main Plot-NTFPS (Lianas, Orchids, Epiphytes)

#	SPECIES	Host tree	Harvestable Size? Y/N	#	SPECIES	Host tree	Harvestable Size? Y/N
1				10			
2				11			
3				12			
4				13			
5				14			
6				15			
7				16			
8				17			
9				18			

PART 3: SUB-PLOT (ALL TREE SPECIES) PLOT RADIUS: **MINIMUM DBH (CM):**

Tree	Species	Dbh	Risk	Log Length	Tree	Species	Dbh	Risk	Log Length
1					22				
2					23				
3					24				
4					25				
5					26				
6					27				
7					28				
8					29				
9					30				
10					31				
11					32				
12					33				
13					34				
14					35				
15					36				
16					37				
17					38				
18					39				
19					40				
20					41				
21					42				

PART 4: PRESENCE OF ANIMALS (MAMMALS, BIRDS, REPTILES, AMPHIBIANS AND FISHES

Type of Animal	Seen Y/N	No. of individuals	Other indication	Name of Animal
Arboreal				
Terrestrial				
Aquatic				

XVII: Examples of forms used for wildlife surveys

(i) Form A

FORESTRY TRAINING CENTRE INCORPORATED

FORM A: FORM FOR COLLECTING BIRD ENCOUNTER DATA				
Team members (3):				SHEET #.....
General Location:				Date (D/M/Y):
Vegetation type: ☐ Wallaba forest. ☐ Mixed forest ☐ Swamp/marsh forest ☐ Scrub				
Time: Start	Time: End		Understory Visibility: ☐ <10m ☐ 10-30m ☐ >30m	
Weather: ☐ Sunny/clear ☐ Overcast ☐ Raining ☐ Windy ☐ Other				
Transect # [ ]	Station # [ ]	Station Loc. Easting: 21N_____; Northing 21N_____		

#	Common Name	Count	Contact type: : ☐ Seen ☐ Heard ☐ Signs	If seen, Est. Distance (m)
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				

Notes:

(ii) Form B

FORESTRY TRAINING CENTRE INCORPORATED

FORM B: FORM FOR COLLECTING ANIMAL DATA: 100M X 100M			
Team members (3):			SHEET #.....
General Location:			Date (D/M/Y):
Vegetation type: ☐ Wallaba forest. ☐ Mixed forest ☐ Swamp/marsh forest ☐ Scrub			
Time: Start	Time: End	Understory Visibility: ☐ <10m ☐ 10-30m ☐ >30m	
Weather: ☐ Sunny/clear ☐ Overcast ☐ Raining ☐ Windy ☐ Other			
Transect # [ ]	Plot # [ ]	NW Pt.-Plot Loc. Easting: 21N_____; Northing 21N_____	

#	Kind of animal: ☐ 1. Mammal ☐ 2.Bird. ☐ 3.Amphibian ☐ 4. Reptile ☐ 5. Insect ☐ 6. Fish	Method of ID: ☐ 1. Live animal- seen. ☐ 2. Live animal –call. ☐ 3. Skeleton/body parts ☐ 4. Other Signs	Common Name
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			

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(iii) FORM C

FORESTRY TRAINING CENTRE INCORPORATED

FORM C: FORM FOR COLLECTING DATA ON FAUNA-TRANSECT

Team members (3): SHEET #.....

General Location: Date (D/M/Y):

Vegetation type: ☐ Wallaba forest. ☐ Mixed forest ☐ Swamp/marsh forest ☐ Scrub

Time: Start | Time: End | Understory Visibility: ☐ <10m ☐ 10-30m ☐ >30m

Weather: ☐ Sunny/clear ☐ Overcast ☐ Raining ☐ Windy ☐ Other

Transect # [ ] Position of start of transect: Easting: 21N_____; Northing 21N_____

#	Common Name	Count	Kind of animal (Chordata) 1-Mammal; 2 Reptile; 3 Bird 4 Amphibian; 5 Insect; 6-Other	Contact type: : 1. Seen 2. Heard 3. Signs	If seen or heard, Est. Perp. Distance (m) from transect
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					

Notes:

ANNEX XVIII: TPTTI ENVIRONMENTAL POLICY

1. Introduction

TPTTI recognizes that its timber harvesting and ancillary operations will generate negative impacts on the environment. Most of these negative impacts will arise from earthworks linked primarily to road construction and maintenance, including the installation of bridges and culverts. There will also be impacts from tree felling operations and skidding operations respectively and potential impacts from waste generated at the base camp. TPTTI recognizes its obligations to comply with all applicable legislation, policies, guidelines and standards with the aim of reducing and mitigating the environmental impacts of its field operations. This policy relates the main thrust to manage environmental matters.

2. Responsibility

This environmental policy applies to whole suite of works required for timber harvesting operations which together are probably responsible for 80% of environmental impacts. The Forest Manager is responsible for ensuring that environmental policies in respect of *logging operations* are implemented effectively.

3. Resources

TPTTI will ensure that resources are available to enable the effective implementation of this environmental policy.

4. Objectives

a) During 2018 (and beyond), TPTTI aims to:
b) Identify and gather all environmental based materials and standards relevant to logging in Guyana, including environmental legislation and Code of Practice 2018, and put these on display at its main base at Iteballi and at its base camp Ekabago.
c) Carry out quarterly briefing sessions with all operatives to make sure that they understand the various environmental prescriptions and TPTTI's practices for implementing them.
d) Developing and posting notices, signposts, and other aids to reinforce knowledge on prescribed environmental practices.
e) Develop and implement a system of incentives for corporate behaviour at all levels that fosters good environmental practices;
f) Strive to protect all waterways through observance of buffer zones, adequate drainage structures on roads and restrictions on the use of waterways at base camps and at forward camps.
g) Strive to keep the generation of hazardous wastes to the minimum levels possible
h) Inform stakeholders of TPTTI's commitment to environmental management.

5. Targets

To achieve its aims, TPTTI has set itself the following targets:

a) Inform stakeholders of the company's environmental policy by January 2019;
b) Ensure employees are trained in the implementation of the environmental policy and practices by June 2019

c) Formally implement domestic waste management practices for field operations by September 2018;
d) Develop and implement solid waste management practices by December 2019;

6. Monitoring and auditing

Progress against the aforementioned objectives will be monitored at monthly briefing meetings and at quarterly management meetings with field operatives.

7. Communication

A copy of the environmental policy will be available on request from the Forest Manager, the Forest monitoring officer, and the Chief Clerk during office hours. A copy will also available for viewing at each forward camp.

Signed----------

Name

Operations Manager

[Date]

Annex XIX: TPTTI OSH Policy

OVERVIEW

TPTTI **commits** to fostering a safe work environment for its employees and clients. TPTTI **believes** that a well-managed OSH programme will improve the performance of its employees. The Operations Manager will take personal responsibility for the management of the company's OSH programme and will rely on an OSH Committee-comprising management and workers- to ensure shared responsibility for OSH Practices. TPTTI commits to budgetary support for its OSH policy.

The primary means for communicating this policy will be via the OSH Committee and notices posted at worksites.

TPTTI commitment to OSH

In fulfilling its responsibilities, TPTTI will:

(a) Comply with all statutory rules set out in Act 32 of 1997, Occupational Safety and Health Act and accepted codes and practices relating to safety and health agreed with employees.

(b) Set short and long-term goals and specific responsibilities in the management of health and safety.

(c) Develop OH & S policies, procedures, and guidelines.

(d) Ensure all line managers understand and take responsibility for the safety and health practices in each work area.

(e) Provide information, instruction, training, and supervision to ensure that all employees are aware of safe work practices, emergency procedures and any risks to safety and health in their work environment.

(f) Consult with employees and OSH authorities on issues relating to occupational health and safety.

TPTTI will ensure that all supervisors have practical knowledge so as to take responsibility for:

(a) Hazard identification, risk assessment and risk control;

(b) Safety and health legislation, regulations and recognized standards;

(c) Specific safety and health issues within the workplace;

(d) Investigation of all diseases, injuries, near misses and accidents and formulate appropriate preventative action;

(e) Regularly monitor and review the implementation of, and compliance with, OSH practices.

TPTTI commits to providing:

Safety devices and equipment, adequate ventilation, safe electrical connections, fire- fighting equipment, personal safety gear and adequate washrooms.

GENERAL SAFETY POLICY

I. Introduction

TPTTI values all its employees and consequently will enforce a number of rules to protect everyone. Employees are reminded that it is incumbent on everyone to share responsibility for safety at the workplace.

II. Emergency Procedures

Emergency training will be conducted randomly conducted at each workspace. Upon the onset of an emergency, employees should follow the standard protocol developed for that workspace. In no case should employees attempt to alter the emergency procedure since this may cause additional injury or loss of life.

III. Housekeeping

a. Neatness and good housekeeping are indicators of efficiency. You are expected to keep your work area neat and orderly at all times.
b. Easily accessible trash receptacles and recycling containers are placed at designated points around the workspaces for your convenience.
c. Please report anything that needs repairing or replacing to your manager immediately.

IV. Lifting heavy objects

The following rules apply:

a. Store heavy items on lower shelves.
b. Use an approved sturdy ladder for reaching upper shelves.
c. Avoid strains when lifting by following the correct procedure which is: face item to be lifted; keep back straight; take a firm grip on the item and then push up with your leg muscles; do not lift with your back or in a twisted or awkward position.
d. Get help before lifting or moving heavy or awkward items.

V. Slips & Falls

Many times, accidents are the result of an employee not focusing on where he or she is walking or what he and she is doing.

The following rules apply:

a. Look where you walk.
b. Running increases the potential for falls and collision accidents; therefore, walk.
c. Wet floors and spills greatly increase the hazard of your slipping and falling. Clean up spills immediately. If you can't clean up a spill immediately, the minimum action an employee should take is to place a danger sign in or on the area.

VI. Collisions

Collisions may cause slips, falls, cuts, and burns.

The following rules apply:

a. When moving among the other employees let them know you are coming. Learn to anticipate the moves of your fellow workers and the areas they work in.

b. Turning too quickly, changing direction, stopping suddenly or entering/ exiting doorways could cause an accident. Be vocal and make your presence known by saying “excuse me”, “behind you”, “coming through” etc.
c. Do not grab or push other employees out of your way. Be efficient and courteous!

VII. Burns

Hot metals and chemicals will cause serious burns – USE CAUTION!
The following rules apply:

a. Operate machines with guides in place and wear all safety equipment.
b. Machine parts can be hot to the touch. Never lean on machines.

VIII. Cuts

Cuts at the workplace represent very traumatic experiences:
The following rules apply:

a. When opening boxes or cutting bands with razor knives, always direct the blade away from your fingers and body.
b. Broken glass or metal fragments should be cleaned up immediately. Pick up broken sharp objects with a broom and dustpan then dispose of all objects in a separate container.
c. Wear a protective glove when using or cleaning sharp-edged material

IX. Lock Out/Tag out

Lockout / Tag out is an additional means of preventing accidents. When electrical equipment and other services need to be repaired or serviced, their power source must be disconnected.

‘Lockout’ refers to using a locking device, usually a key or combination lock to secure a valve, lever, or electrical switch in the “OFF” position. **‘Tag out’** refers to placing a tag on a power source warning employees not to turn the power ON.

To prevent accidental energy releases to the equipment, the following lockout/tag out procedures apply:

a. Any time you clean, repair, service, inspect, or clear equipment, you must:

- Alert others that you are starting a lockout/tag out procedure.
- Turn off the equipment and disconnect the power supply.
- Test the “ON” switch to confirm the disconnect, then return switch to the “OFF” position.
- Release stored energy in springs, unsecured machine parts, air, gas, or water pressure.
- Lock or block out the energy sources with the required lock and/or tag.
- Retest the “ON” switch, then return it to the “OFF” position.

b. When cleaning, repairing, servicing, inspecting, or clearing of the equipment is completed, you must:

• Check the area to be sure all tools have been removed and guards are in place.
• Alert others that you are ready to start up the equipment.
• Remove locks/tags. Locks/tags must only be removed by the person who installed them.
• Connect the power supply and return the switch to the "ON" position.
• Turn the equipment on. Observe equipment in operation to be sure job was done correctly.

EMPLOYEES RESPONSIBILITIES AND INVOLVEMENT IN OH&S.

The Occupational Safety & Health Act (Act 32 of 1997) places obligations on employees to take care of their own health and the safety and health of others who may be affected by their acts or omissions at the workplace. It also provides for the involvement of employees in dealing with safety and health issues through the establishment of designated dork groups, the election of safety and health representative(s) and the establishment of safety and health committees. TPTTI encourages and supports employees' involvement through such mechanisms.

Employees will receive information, instruction, and ongoing supervision on likely hazards stresses of the job. If an employee is inexperienced in the use of a piece of equipment, training will be provided.

All employees are expected to:
(a) Practice safe working habits;

(b) Report unsafe working conditions or equipment;

(c) Keep their immediate work area in a safe and orderly condition;

(d) Take care of others;

(e) Cooperate with TPTTI in meeting the requirements of the OSH Act;

(f) Accord the safety and health of non- employees, visitors, etc. a high priority;

(g) Immediately report any hazards or faulty equipment to the section head.

Employees should discuss any OSH concerns with their line manager. The observations and suggestions of all employees will be valued. Every effort will be made to address all issues.

OH & S REPRESENTATIVE

TPTTI aims to support the functioning of the elected OSH representative. Employees are encouraged to elect a workplace OSH representative.

TPTTI commits to:

(a) Consulting with the OSH representative on all proposed changes to the workplace and equipment and practices used in the workplace that may affect safety and health and welfare of employees;

(b) Provide the safety and health representative with access to any information on actual or potential hazards and the health, safety and welfare of employees;

(c) Permit safety and health representative to take such time off work with pay as is necessary for performing their functions or taking part in approved training courses;

(d) Provide such facilities and assistance as are necessary.

TRAINING

TPTTI commits to providing training on a yearly basis for all employees in safe work practices. All team mangers will be trained in the principles of OSH management together with the appropriate hazard controls that are relevant to their area.

Such training and information may include, but not be limited to:

(a) The review of OSH legislation relevant to the workplace (including employer responsibility);

(b) Consultative processes and issue resolution.

(c) Hazard identification, risk assessment and risk control; and

(d) Incident and accident investigation.

The manuals for all equipment will be put in a designated place. All machine operators are required to read and apply the safety measures recommended by the manufacturers of devices, equipment, and tools.

All field operatives will be sent to the Forestry Training Centre Incorporated for training in RIL which emphasizes OSH practices.

WORKPLACE VIOLENCE

Violence in the workplace is *totally unacceptable*. All clients and employees have the right to feel safe and to participate in activities in a non-threatening environment.

A client who is violent will be asked to leave the workplace immediately. The incident may require making a report to the Police, if the act of violence amounted to a criminal offence.

An employee who is violent or abusive will be subject to disciplinary action. Further, ***any*** behaviour, which constitutes a crime, is subject to legal remedies and criminal or civil justice.

FIRST AID

The TPTTI recognizes that in accordance with Occupational Safety and Health Legislation it has a responsibility to provide first aid assistance to employees that sustain an injury while on TPTTI' premises.

To achieve these responsibilities, the TPTTI shall, as far as is reasonably practicable, provide services such as:

a) Trained and certificated first aiders (via MPH or the Red Cross);

b) First aid kits;

c) Emergency/evacuation procedures.

All workers will be required to:

(a) Learn the procedures to be followed when first aid is required

(b) Know the location of first aid kits and firefighting aids;

(b) Learn the names and work locations of **trained** first aiders;

(c) Study and apply basic first aid facilities at the workplace;

FIRST AID KIT

A First Aid Kit is kept at all workplaces.

Each departmental head is responsible for ensuring it the kit remains stocked and up to date. (Kit contents must be replenished as soon as possible after use). Monthly inventory checks should be made and recorded to determine if the contents are as listed and have not deteriorated. All first aid injuries and treatments must be recorded and reported immediately to the OSH Representative.

PERSONAL SAFETY GEAR

TPTTI will provide a helmet, safety boots and high visibility vest to all field crews. Truck drivers and operators of heavy equipment shall be provided goggles, ear protection devices and gloves.

All field operatives will be provided with a mosquito net tailored either for an ordinary bed or a hammock. *(At its discretion, TPTTI may ask field operatives to contribute to the cost of personal safety gear)*

ENVIRONMENTALLY SUSTAINABLE WORKPLACE

Sustaining the environment means organizing ways of working that minimize environmental damage. This includes minimizing the use of non-renewable energy and resources. Employees of TPTTI are encouraged to become actively involved in protecting their working environment and the health of the planet and to limit the use of resources such as paper, electricity and plastic in the workplace. Care should be taken that products used at TPTTI are, wherever possible, environmentally friendly. Chemical cleaners and insecticides should be avoided or used sparingly. Plastic containers and bags should be used sparingly. Employees are encouraged to minimize paper use through recycling paper in the workplace and using both sides of paper before disposal.

TPTTI will conserve energy through:
(a) Checking energy ratings before buying new equipment;

(b) Turning off lights and office equipment and generators when not in use (this also helps reduce greenhouse emissions);

FIRE EMERGENCY

Every employee must know the location of **fire extinguishers** and **sand buckets** and be familiar with the fire alarm system where applicable.

The first person to observe a fire should:

1. Immediately sound the fire alarm by activating nearest fire alarm bell;

2. Report fire to the nearest supervisor;

3. If possible, use available fire extinguishers to extinguish or contain the fire. If the fire is fuelled by a natural gas or LP gas leak, the gas supply should be shut off prior to extinguishing the fire;

4. Immediately evacuate area should initial firefighting attempts fail. Shut off gas

supplies, etc. Close door to area to contain fire.

At field camps, the use of fires to burn waste material is prohibited.

GENERAL EMERGENCY GUIDELINES

In the event of an emergency situation these two guidelines are as follows:

1. Assess Risk to Yourself and Others

2. Protect yourself and others

a) **THINK** *before* ACTING.

b) If necessary, remove yourself and others from the area.

c) Immediately remove any contaminated clothing and wash any part of body contaminated by chemicals or radioactive materials.

d) Do not spread the contamination to clean areas.
e) Attend to anyone injured.

f) Close off area to personnel (e.g. close doors, post warnings).

g) Turn off any potential ignition sources.

h) Cover spilled powders with suitable liquids to reduce dust.

EMPLOYEES MOVEMENT BOARD

Each TPTTI field site will have available an **Employees Movement Board**. All employees leaving forward camps by foot or vehicle are required to enter their intended destination estimated time of return to the field camp.

VIGILANCE

All employees must be **vigilant** always in order to detect or predict OSH issues

COVID-19 PANDEMICS & OTHER HEALTH ISSUES

TPTTI will comply at all times with national and regional programmes to combat the COVID-19 pandemic and other diseases including Malaria, HIV-AIDs, and DENGUE FEVER.

Specifically, TPTTI will implement proper sanitation measures at all its workplaces and afford workers the time to visit a medical facility at any time.

XX: TPTTI HR POLICY

TPTTI'S HUMAN RESOURCES POLICY

A. Introduction

TPTTI recognizes that its employees are vital for the accomplishment of its business objectives. Also, TPTTI believes that corporate discipline is vital for business success. Further, the company recognizes its obligations to comply with all applicable legislation, policies, and guidelines that impact on the management of a workforce.

B. Responsibility

The Operations manager is ultimately responsible for the implementation of this policy, while the Chief Clerk at Iteballi will address the elements of the policy on a day-to-day basis. **National level protocols regarding sanitization and vaccination requirements for all employees will be rigidly followed.**

C. Resources

TPTTI will ensure that resources are available to enable the effective implementation of this environmental policy.

D. Communications

Copies of this policy will be posted at all workplaces, including field camps.

E. Elements of the Policy

1. Accidents

It is TPTTI's policy to develop a safe work environment for all its employees. All health and safety policies follow Occupational Safety & Health Act. It is the obligation of TPTTI to make sure that all employees are aware of its OSH policies and each employee will be required to learn and implement these policies always. All accidents and 'near-misses' should be reported to management promptly.

The failure to report an accident or injury could result in disciplinary action for all involved.

1. Business hours

Normally works starts at Iteballi at 07:00-17:00hrs Monday through Friday and 07:00-11:00 hrs. on Saturday. There will be scheduled lunch and break periods. For drivers and field operatives, the start and end time for work varies with one's classification and the task at hand, but generally field operatives are expected to work 44 hours per week.

2. Company Property

All employees are expected to take care of the company's property. If your employment with the company terminates, for any reason, you must *promptly* return to the Company all of the company's keys and other materials that you have in your possession.

3. Customer/stakeholder relations.

Employees are reminded to promote the company just as they would represent their families. This means being friendly and courteous on the company's property.

4. Dress Code

All employees must use any personal safety gear provided while at work or on the company's premises.

5. Drug Free Workplace

TPTTI prohibits the use of drugs on its premises. The following prescriptions apply to all workers:

a) Employees are prohibited from using or distributing alcohol and/or illegal drugs while on the Company's property. Employees who violate the policy are subject to disciplinary action up to and including termination.

b) Any employee arrested by the police must notify the Company within one week of the reasons for his/her arrest, the nature of the conviction and indicate and law that has been violated.

c) The company reserves the right to search any employee's property-including their vehicle where illegal drugs are believed to be present. The search shall be made in the presence of the employee or his representative.

6. Email/Wi-Fi

TPTTI provides employees with electronic technologies and services, including computers, E-Mail, Voice Mail and Internet services for business purposes only and are meant to assist employees in completing job responsibilities as effectively as possible. Employees are strictly prohibited from using any technology to view, listen to or communicate offensive, defamatory or disruptive content. Employees who abuse or misuse any of TPTTI's technology will be disciplined, up to and including immediate termination.

7. Employee benefits

TPTTI will, at its own discretion, provide Group Life Insurance for all its employees. It is not compulsory for the company to offer such insurance to anyone. Group medical benefits are available for all eligible employees. Unless previous agreements exist, ***full time*** employees may enrol in medical benefits on the first day of the month following a 30-calendar day waiting period. Part time employees will have a 90-day waiting period.

8. Employee Categories

The company categorizes workers in the following categories: **Contractor, In-house or Casual.**

Contractors: These are **NOT** employees but rather individuals who are hired for a fee to perform various duties. Contractors are generally self-employed or employed elsewhere and are not entitled to the benefits afforded fulltime employees.

In-House Employees**:** Employees may be either full time or part time- based on actual average hours worked. ***Full time*** employees work more than 44 hours per week and are eligible for all employee benefits. ***Casuals*** work less than 44 hours per week and are not eligible for employee benefits.

9. Employee classification

Employees hired on either a full-time or part-time basis, and may be categorized as follows:

'On Probation': the first 90 days of employment are considered an introductory period during which time the Company evaluates you to see if you are suited to the job. Benefits, where applicable, are accrued and may not be paid during this period.

'**Full-Time Regular Employees':** any employee who has completed his or her probationary period, who regularly works at least 44 hours per week.

Full time regular employees are further classified as either N***on-exempt (hourly***) or **Exempt (salary).** Non-exempt employees are entitled to receive overtime pay.

10. Employee conduct

Every employee must act in a professional, responsible, and courteous manner at all times in order to foster a positive and productive working environment. Conversely, inappropriate or unprofessional behaviour is disruptive and unproductive. Moreover, inappropriate conduct is cause for discipline, up to and including immediate termination. The decision as to what is ***inappropriate*** is left in the company's hands and sole discretion.

11. Employee discipline

The company has adopted a progressive discipline policy to identify and address employee and employment related problems. The Company will normally adhere to the following progressive disciplinary process:

Verbal Warning: An employee will be given a verbal warning when he or she engages in problematic behaviour. As the first step in the progressive discipline policy, a verbal warning is meant to alert the employee that a problem may exist or that one has been identified, which must be addressed. Verbal cautions will be documented and remains in effect for up to three months. .

Written Warning: A written warning is more serious than a verbal warning and will be given when an employee engages in unacceptable behaviour during the period that a verbal warning is in effect. Written warnings are maintained in an employee's personnel file and remains in effect for three months.

Suspension: A suspension without pay is more serious than a written warning. An employee will be suspended when he or she engages in conduct that justifies a suspension or the employee engages in unacceptable behaviour during the period that a written warning is in effect. An employee's suspension will be documented and, regardless of the length of the suspension issued, will remain in effect for a time to be specified.

Termination: An employee will be terminated when he or she engages in conduct that justifies termination or does not correct the matter that resulted in less severe discipline.

Again, while the Company will generally take disciplinary action in a progressive manner, it reserves the right, in its sole discretion, to decide whether and what disciplinary action will be taken in any given situation.

12. Equal employment opportunity

It is the continuing policy of TPTTI to provide equal-opportunity employment to all employees and applicants, without regard to race, creed, colour, sex, religion, national origin. The Company condemns and will not tolerate any conduct calculated to intimidate, harass, or otherwise discriminate against any employees on the grounds listed above.

Any employee who feels that his or her rights have been violated under this policy should MAKE A WRITTEN COMPLAINT to the Operations Manager.

13. Expectation of Employees

TPTTI expects no less than one hundred percent of your loyalty, effort, and responsibility to help us achieve Company objectives

14. Expectation of Employers

In return for your effort, employees should expect no less than 100 percent effort from TPTTI's directors and managers. The Company will provide tools necessary for safely performing your job, work environments which are safe and friendly, a business culture that allows individuals to contribute and gain from their efforts and most importantly continued employment through our marketing and sales efforts to sustain the operation in the long term.

TPTTI assures that it will act responsibly to our employees and shareholders in the following ways:

- The Company will not discriminate and will respect rights of individuals
- We will fill job openings from the inside with current employees whenever possible
- Promote drug free and a safety conscious work environment
- Promote a business culture to support our company's mission statement
- Take immediate action to investigate adverse claims, problems, and concerns
- Provide compensation plans that are above the industry norm
- Acknowledge the importance of time away from work and family values

15. General worker safety (see safety policy)

The safety of our employees is very important. We expect all employees to be safety-conscious, follow safety rules, and to immediately alert management to any conditions in the workplace that are believed to be unsafe or unhealthy.

16. Grievance procedure

The Company's grievance procedure is as follows:

a. If you have a problem, notify your supervisor immediately. Most difficulties can be settled promptly at this point. The supervisor shall respond in writing within five (5) days of meeting with you.

b. If the problem is not resolved to your satisfaction you (and a co-worker of your choice, if you wish) may go to the Operations manager and verbally explain the problem to him/her; or you may instead submit the problem to him/her in writing. This step should be taken within five (5) working days after your supervisor has given his/her decision or after the incident

giving rise to your grievance, whichever is later. If the circumstances require it, the [previously identified official] will investigate.

c. Following his/her investigation, the Operations manager will respond in writing to your grievance. The decision shall be final.

17. Hiring protocol

All applicants must complete an employment application. Following the Company's review of all completed applications, the employer will begin interviewing the most qualified candidates. Those who do not meet our employment requirements for whatever reason will remain classified as applicants.

The Company will make conditional offers of employment to those candidates selected during the interview process. The conditional aspect of the job offer depends on the employee's agreeing to acknowledge company policies in writing, consenting, and passing all necessary drug, background, and reference checks and finally any other condition that should be met before the candidate may consider themselves an employee.

Following an acceptance of an offer of employment, all new employees will be given a start date and location to report for an orientation session. Orientation is paid. During the orientation, the new employees will be given workplace rules, policies and other information about their positions. Authorization forms and policies must be signed at this time BEFORE actual work is performed and before they are sent for a meeting with their new department manager.

18. Holidays

The Company normally celebrates all public holidays in Guyana. The list of recognized holidays for a calendar year will be distributed in December of each year. To receive pay for a holiday, you must work the scheduled day before the holiday and the scheduled day after the holiday. The only exception to this rule is if you submit a note from your physician requiring you not to work on that day. A full day is a minimum of four (4) hours. Regular part-time employees with benefits are paid for holidays on a pro-rata basis at their regular rate of pay and no more than their regularly scheduled hours per day. Part-time pay base is on scheduled part-time hours worked, not work hours of the past week. Should you be required to work on a paid holiday, you will be entitled to an additional day off with pay.

19. Hours worked

All full-time employees are paid at the regular rate for hours worked up to 40 hours a week. Employees are not paid for lunch and therefore must clock out before dining and clock in upon return to the work area. All employees -- full-time and part-time -- will be furnished with a daily or weekly work schedule. For field operatives daily starting times, lunch period and leaving times may vary from day to day.

Employees will be expected to work on Saturdays, Sundays and holidays if required to address time sensitive tasks, but it shall not be compulsory for anyone to work on Sundays and holidays.

20. Job description

Job descriptions for each department are available and updated as needed to reflect business needs. Job descriptions are floating guidelines only; due to the production oriented, time

sensitive nature of logging, job descriptions are not to be considered comprehensive and absolute.

21. Job training

Every employee has room to expand upon their skills by learning from their co-workers, training programs and other independent means. During the first few weeks of your employment with us, you will be trained by one or more peers in the daily requirements of your position. We will expect you to learn the training materials and policies given to you during this time.

22. Meal & Break Periods

Employees may take two scheduled fifteen (15) minute breaks each workday. Breaks will be designated by the supervisor as the daily schedule and situations allow.

23. Overtime

The Company will also try to give you as much notice as possible when overtime will be mandated. All overtime designated by your manager is approved overtime.

25. Payment/Pay slip

Direct deposit into a bank account is the preferred method by which employees are paid and each employee is required to have a bank account. Otherwise, cheques will be distributed by the manager of each department on payday. Checks will not be released to any person other than the employee unless there the employee signs an authorization to release their check to another person -- including a spouse.

Every month you will be given a **pay slip** that shows you how your salary was computed. It shows your regular pay, overtime pay (if any), gross pay, each payroll deduction for that pay period and year-to-date totals for earnings.

At its own discretion, management may maintain small amounts of cash onsite at Iteballi for the convenience of workers.

26. Payroll advances

The Company will not authorize salary advances for any reason at any time.

27. Payroll cycle

TPTTI strives to pay wages that are competitive in the forest industry. The Company payroll month runs from 27th day of one month to the 26th day of the following month. Both management and non-management employees receive salary cheques monthly. Bonuses or any incentive awarded will also be paid monthly.

28. Payroll deductions

The Company is required by law to make certain mandatory deductions from employee salaries. The standard deductions we withhold are NIS and PAYE. All deductions are shown on the employee's pay slip.

29. Performance evaluation

Managers must formally record in writing an opinion of each employee under their direct supervision who has been with the company for more than 90 days and at least once every

six months thereafter. Upon conclusion of the evaluations, each employee will have time to read the evaluation and respond for the permanent record. Following the employee's review process, they will have an opportunity to formally critique their direct supervisor with the Operations Manager present. This bottom-up evaluation will also be recorded in the manager's file.

30. Personal days

The Company provides its staff with personal days to meet personal and individual needs. Full-time and part-time employees with benefits may take three personal days per calendar year. Personal days must be approved in advance, except in cases of emergency. Days taken off the day before or the day after paid holidays will not be recognized as personal days and no payment will be made for them. No personal days may be taken during the first six (6) months of employment. You may not carry over personal days into the next calendar year. Employees are not paid for unused personal days. Personal days may not be taken in units of less than one-half of a day. (See also 'sick leave' & 'vacation leave').

31. Personal use of company's properties

Employees may use certain tools and equipment for their own personal use while on our premises. Under no circumstances may this be done off our premises, or without prior management approval. In addition, employees may only use our property when they are on a non-paid break or during a scheduled time when the employee is not actively working such as a day off or after returning to work from home.

32. Possession of stolen property

At times, the Company may become aware of situations reported by employees when co-workers may possess or take ownership of unapproved or unlawful materials. The Company reserves the right to search the possessions of employees including their person, lockers, automobiles, or other items located on Company property. An employee may refuse a search; however this may result in termination.

33. Probationary period

On the first day you report to work, you will begin an Introductory Period to last 90 calendar days. This Introductory Period will be a time for learning about your fellow employees, your manager and the tasks involved in your job position. We expect you will also become familiar with other relevant information about the Company and our rules or regulations.

Your department manager will work closely with you on all aspects of your training, understanding and responsibilities during this introductory period. We encourage new employees to get to know their fellow co-workers and managers quickly as this tends to help you succeed with our Company.

The Introductory Period is 90 calendar days for all new employees. By completing this introductory period, an employee is not guaranteed continued employment for any term as it is always "at-will" and subject to various conditions.

34. Punctuality

Reporting for work regularly and on time is essential since lateness or absence interferes with the daily running of Company and places an extra workload on your fellow employees. Please use your personal days to schedule business, medical, dental, and other appointments which

conflict with your work schedule. Failure to report to work on time is cause for discipline, up to and including discharge.

35. Reasonable accommodation

TPTTI will provide basic accommodation for workers on the forest concession

Recording your time

Law requires accurate recording of time worked by all hourly non-exempt employees. Your recorded time is a legal record of the hours you are at work and your pay cheque is based on the time you record. You are required to clock in for your scheduled start time and clock out at the end of your scheduled shift.

36. Resignation

If you decide to leave the company, we ask that you give your manager at least two weeks' courtesy notice. Providing adequate notice allows your manager to arrange for an exit interview if needed, your final payments and to include any unused vacation hours you may be eligible for. Resigning without notice means you will not be entitled to receive unused vacation or personal time.

Please keep in mind that as an "employee at will" once you give notice, the company may decide it is not necessary for you to work out the entire duration of your notice.

37. Safety (see OHS Policy)

38. Sick leave

The Company provides paid sick leave in the form of vacation days. Sick leave may be taken when an employee is unable to report for work due to illness. The Company may request that the employee furnish a doctor's certificate or other reasonable proof when absent for three (3) days.

39. Vacation

The Company provides each eligible employee with vacation days. All employees are expected to use their vacation days within the year they were earned. Take a short trip, an extended weekend or pursue personal interests with the time you have earned. The Company feels this rest period will benefit you and your co-workers. Vacation days are awarded at the beginning of each person's own hire anniversary date. The number of vacation days each employee earns depends on their own hire date, length of service and employment status.

40. Teamwork

Our success begins and ends with teamwork. It is expected that each person will do their part to avoid situations that disrupt or promote others in their group to act in ill-will, to be insubordinate to a supervisor or to intentionally sabotaging the efforts of other employee teams or departments.

41. Weapons

The Company believes it is important to establish a clear policy that addresses weapons in the workplace. All persons who enter Company property are prohibited from carrying a handgun, firearm, knife, or other weapon of any kind regardless of whether the person is licensed to carry the weapon or not.

The only exception to this policy will be police officers, security guards or other persons who have been given written consent by the Company to carry a weapon on the property. Any employee disregarding this policy will be subject to immediate termination.

42. Work schedule

Briefing notes posted notices to communicate scheduling of tasks, deployment of persons, vehicle, other assets

43. Workplace violence

Our Company strictly prohibits workplace violence. Consistent with this policy and others supported by the Company, any act of intimidation, harassment, harm, violence, aggression, coercion or any other physical or psychological acts will be addressed as a disciplinary action up to and including termination.

Creating a hostile or stressful environment by abusing or intimidating co-workers or subordinates will be dealt with swiftly. All threats or acts of violence should be reported immediately to the human resource manager. Examples would further include:

a. Hitting and shoving or caging in another person
b. Making threats against a person, their family, friends, property, etc.
c. Making phone calls inside or outside of the work environment
d. Harassing by stalking or surveillance
e. Carrying, pointing, or using firearms and weapons against another

Annex XXI: Surface Water Analysis Report from KAIZEN ENVIRONMENTAL SERVICES

(GUYANA) INC.

Page 1 OF 2

KAIZEN
Environmental Services (Guyana) Inc.

58 High Street
Kingston
Georgetown, Guyana
Tel: (592) 231-0346/ (592) 231-0348
Email: inquiries@kaizen-guy.com

ANALYSIS DATA REPORT

Customer: Toolsie Persaud Ltd
Customer's Address: 356 Farm East Bank, Demerara
Customer Contact: Mr. Isidro Ubaldo Espinosa
Client Job #: 17-1112
Item(s) Analyzed: Water Sample

Lab File #: 000348-1-4

Date of Sampling: 18-Oct-17
Sampled By: Sampled by the Client

Date of Receipt: 19-Oct-17
Report Date: 10-Nov-17

ANALYSIS RESULTS

Parameter Name	Units	Results			
		000348-1 Sample 1	000348-2 Sample 2	000348-3 Sample 3	000348-4 Sample 4
Biochemical Oxygen Demand	$mg.L^{-1}$	<1.78	<1.78	<1.78	<1.78
Chemical Oxygen Demand	$mg.L^{-1}$	9	22	26	19
Oil and Grease	$mg.L^{-1}$	2.84	6.40	17.1	5.20

** Detailed Test Methodologies and QA/QC data available upon request.*

Test Methodologies: Biochemical Oxygen Demand: SMEWW 5210 B
Chemical Oxygen Demand: SMEWW 5220 D
Oil and Grease: USEPA 1664

Comments: Dissolved Oxygen under-depleted in the BOD test for samples #000348-1-4, so a qualitative assessment was made. Oil and Grease samples were submitted in 1000mL Nalgene Bottles.

Report Authorized by: Meera Mirie
Laboratory Manager

KAIZEN
Environmental Services (Guyana) Inc.

58 High Street
Kingston
Georgetown, Guyana
Tel: (592) 231-0346/ (592) 231-0348
Email: inquiries@kaizen-guy.com

ANALYSIS DATA REPORT

Customer: Toolsie Persaud Limited
Customer's Address: 356 Farm, East Bank Demerara
Customer Contact: Mr. Isidro Ubaldo Espinosa
Client Job #: 18-1076
Item(s) Analyzed: Surface Water
Date of Sampling: 11th & 12th May, 2018
Sampled By: Client
Date of Receipt: 14-May-18
Report Date: 4-Jun-18

Lab File #: 000474-1-3

ANALYSIS RESULTS

Parameter Name	Units	Results		
		000474-1 Sample 1	000474-2 Sample 2	000474-3 Sample 3
pH	pH Units	6.28	6.08	6.27
Biological Oxygen Demand	$mg.L^{-1}$	Not Detected	Not Detected	18.45
Total Suspended Solids	$mg.L^{-1}$	30.0	27.7	69.3
Chemical Oxygen Demand	$mg.L^{-1}$	42	51	53
Oil & Grease	$mg.L^{-1}$	7.80	10.0	8.80
Total Nitrogen	$mg.L^{-1}$	Not Detected	Not Detected	Not Detected
Phosphate	$mg.L^{-1}$	<0.54	<0.54	<0.54

* Detailed Test Methodologies and QA/QC data available upon request.

Test Methodologies:
pH: SWEWW 4500 -H+B
Biological Oxygen Demand: SMEWW 5210 B
Total Suspended Solids: SMEWW 2540 D
Chemical Oxygen Demand: SMEWW 5220 D
Oil & Grease: USEPA 1664
Total Nitrogen: SMEWW 4500-N-C, HACH METHOD 10071
Phosphate: SMEWW 4500-P B, E

Comments: Phosphate , Total Nitrogen & Chemical Oxygen Demand were subcontracted.

Report Authorized by: Meera Missire -Divisional Manager

Annex XXII: Summary of Impacts Projected for TPTTI's Operations

Environmental Component	Nature of Impact
Physical Environment	
1. Earth works	• Removal of protective vegetative layer of soil surface, sub-soil exposure, erosion, soil compaction
2. Air quality	• Dust and smoke (especially along roads), minor changes in microclimate, temporary obstruction of visibility
3. Water resources	• Excessive sediments in waterways, decreased infiltration rates, modifications in water temperature, turbidity, soil ph.; • Pollution with oil and other contaminants
4. Soil	• Modification of soil biology due to alterations of soil structure, vibration, compaction and modification water infiltration capacity • Pollution with oil, other contaminants may alter soil ph. which affects nutrient exchange processes
Biological/ecological environment	
5. Timber harvesting	• Alteration of forest structure, destruction of juvenile trees, modification of understory microclimate • potential loss of genetic materials; decline in soil fertility due to removal of biomass (nutrient pools);
6. Wildlife	• Modification, destruction of habitats (especially in terms of cover and food sources); changes in predators-prey relationships • Stress from noise and vibration, approximation to humans
7. Ecological relationships	• Major modifications of prevailing ecological relationships: plant-plant, plant-animal and animal-animal
Socio-economic Environment	
8. Conflicts	• Restriction of access, alienation of (perceived?) rights, unplanned changes in life style (restrictions on hunting for example)
9. Employment	• Skills transfer; new training opportunities; job creation, higher volume of incomes and improved cash flows, more regional business
10. Social problems	• Potential for and increase crime; use of alcohol; health risks, disagreeable behaviour
11. Road hazards	• Probability of (fatal) road accidents
12. Waste	• Pollution of the air and water sources; the accelerated proliferation of vectors for various diseases such as malaria, typhoid and dengue fever
13. Regional Development	• Improvement of physical infrastructure, higher demand for social services/social infrastructure
14. Indigenous, archaeological assets	• Loss, destruction or modification of the assets

Annex XXIII: Matrix of Projected Impacts Generated by TPPTI And Their Ranking…

Impact Significance (parameters): **Lo-*localised*, Ex-*Extensive*/ Rev-*Reversible*, Ir-*reversible*/St-*short term*, Lt-*long term*/ Av-*Avoidable*, Un-*Unavoidable*; M-*Mitigable*, Im-*Immitigable*/ Sig-*Significant*, *In*- Insignificant/Hp-*High probability*, Lp-*Low probability:* Note: The management of all Extensive, Mitigable, Long term, and Significant impacts will have to be prioritized.**

Envisaged Environmental Impacts		PROJECT ACTIVITIES								
		Planning Phase				Operations Phase				
		Const. of forward camps	*Const. of primary access roads*	*100% Pre-harvest Inventories*	*Tree marking operations*	*Construction of secondary roads*	*Constr. of Skid trails, Log markets*	*Felling trees & skidding logs*	*Log market operations*	*Log haul to Iteballi Landing by trucks*
Physical Environment	Earth Works	Lo: Ir: Lt: Un: Im: Sig: Hp	Ext: Ir: Lt: Un: Im: Sig: Hp	Lo: Rev: St: Un: M: In: Lp	Lo: Rev: St: Un: M: In: Lp	Ext: Ir: Lt: Un: Im: Sig: Hp	Lo: Rev: St: Un: M: In: Lp	Lo: Ir: Lt: Un: Im: Sig: Hp	Ex: Rev: St: Un: M: Sig: Hp	Ex: Ir: Lt: Un: M: Sig: Hp
	Air quality	Lo: R: St: Un: M: In: Lp	Lo: R: St: Un: M: In: Hp	Lo: Rev: St: Un: M: In: Lp	Lo: Rev: St: Un: M: In: Lp	Lo: R: St: Un: M: In: Hp	Ext: Ir: Lt: Un: Im: Sig: Hp	Lo: Ir: Lt: Un: M: Sig: Hp	Lo: R: St: Un: M: In: Hp	Ex: Ir: Lt: Un: M: Sig: Hp
	Noise	Lo: Ir: St: Un: M: Sig: Hp	Lo: Ir: St: Un: M: In: Hp	Lo: Rev: St: Un: M: In: Lp	Lo: Rev: St: Un: M: In: Lp	Lo: Ir: St: Un: M: In: Hp	Ext: Ir: Lt: Un: Im: Sig: Hp	Lo: Ir: Lt: Un: M: Sig: Hp	Lo: R: St: Un: M: In: Hp	Ex: Ir: Lt: Un: M: Sig: Hp
	Water resources	Lo: Rev: St: Un: M: Sig: Hp	Ext: Rv: St: Un: M: Sig: Hp:	Lo: Rev: St: Un: M: In: Lp	Lo: Rev: St: Un: M: In: Lp	Ext: Rv: Lt: Un: M: Sig: Hp:	Ext: Ir: Lt: Un: Im: Sig: Hp	Lo: Ir: Lt: Un: M Sig: Hp	Ex: R: St: Un: M: In: Hp	Lo: Ir: Lt: Un: Im: Sig: Hp:
	Soil	Lo: Ir: Lt: Un: Im: Sig: Hp	Lo: Ir: Lt: Un: Im: Sig: Hp:	Ext: Rev: St: Un: M: In: Lp	Lo: Rev: St: Un: M: In: Lp	Lo: Ir: Lt: Un: Im: Sig: Hp:	Ext: Ir: Lt: Un: M: Sig: Hp	Ex: Ir: Lt: Un: Im: Sig: Hp	Ex: R: St: Un: M: In: Hp	Lo: R: St: Av: M: In: Lp
Biological Environment	Forest Degradation	Lo: Ir: St: Un: Im: In: Hp	Ex: Ir: Lt: Un: Im Sig: Hp:	Lo: Rev: St: Un: M: In: Lp	Lo: Rev: St: Un: M: In: Lp	Ex: Ir: Lt: Un: Im Sig: Hp:	Ex: Ir: Lt: Un: Im Sig: Hp:	Ex: Ir: Lt: Un: Im: Sig: Hp	Ex: R: St: Un: M: In: Hp	Ext: Re: St: Un: M: Sig: Hp
	Habitat modification	Lo: Ir: Lt: St: Un: M: In: Hp:	Ext: Ir: Lt: Un: Im: Sig: Hp:	Lo: Rev: St: Un: M: In: Lp	Lo: Rev: St: Un: M: In: Lp	Ext: Ir: Lt: Un: Im: Sig: Hp:	Ex: Ir: Lt: Un: Im Sig: Hp:	Ex: Ir: Lt: Un: Im: Sig: Hp	Ex: R: St: Un: M: In: Hp	Lo: Ir: Lt: Un: Im: Sig: Hp
	Loss or migration of Wildlife	Lo: Rv: St: Un: Im: In: Hp:	Ex: Rv: St: Un: Im: In: Hp:	Lo: Rev: St: Un: M: In: Lp	Lo: Rev: St: Un: M: In: Lp	Ex: Rv: St: Un: Im: In: Hp:	Ex: Rv: St: Un: Im: In: Hp:	Ex: Rv: St: Un: Im: In: Hp:	Ex: R: St: Un: M: In: Hp	Lo: R: St: Av: M: In: Lp
	Ecological relationships	Lo: Rev: St: Un M: In: Hp	Lo: Rev: St: Un: Im: Sig: Hp	Lo: Rev: St: Un: M: In: Lp	Lo: Rev: St: Un: M: In: Lp	Lo: Rev: St: Un Im: Sig: Hp	Lo: Rev: St: Un Im: Sig: Hp	Ex: Rv: St: Un: Im: In: Hp	Ex: R: St: Un: M: In: Hp	Lo: Rev: Lt: Un M: Sig: Hp

Envisaged Environmental Impacts		PROJECT ACTIVITIES								
		Planning Phase				Operations Phase				
		Const. of forward camps	*Const. of primary access roads*	*100% Pre-harvest Inventories*	*Tree marking operations*	*Construction of secondary roads*	*Constr. of Skid trails, Log markets*	*Felling trees & skidding logs*	*Log market operations*	*Log haul to Iteballi Landing by trucks*
Socio-economic Environment	Conflicts	Lo: Rev: St: Av: M: In: Lp	Ex: Rev: Lt: Av: M: Sig: Hp	Lo: Rev: St: Un: M: In: Lp	Lo: Rev: St: Un: M: In: Lp	Ex: Rev: Lt: Av: M: Sig: Hp	Ex: Rev: Lt: Av: M: Sig: Hp	Lo: Rev: St: Av: M: Sig: Hp	Lo: Rev: St: Av: M: Sig: Hp	Ex: Rev: Lt: Av: M: Sig: Hp
	Employment	Lo: Rv: St: Av: Im: In: Lp	Ex: Rev: St: Un: M: Sig: Hp	Lo: Rev: St: Un: M: In: Lp	Lo: Rev: St: Un: M: In: Lp	Ex: Rev: St: Un: M: Sig: Hp	Ex: Rev: St: Un: M: Sig: Hp	Ex: Rev: Lt: Un: Im: Sig: Hp	Lo: Rev: St: Av: M: Sig: Hp	Ex: Ir: Lt: Un: Im: Sig: Hp
	Social problems	Ex: Rv: St: Un: M: Sig: Hp	Ex: Ir: Lt: Un: M: Sig: Hp	Lo: Rev: St: Un: M: In: Lp	Lo: Rev: St: Un: M: In: Lp	Ex: Ir: Lt: Un: M: Sig: Hp	Ex: Rev: St: Un: M: Sig: Hp	Ex: Ir: Lt: Un: M: Sig: Hp	Lo: Rev: St: Av: M: Sig: Hp	Ex: Rev: Lt: Un: M: Sig: Hp
	Road hazards	Lo: Rev: Lt: Un M: Sig: Hp	Lo: Rev: Lt: Un M: Sig: Hp	Lo: Rev: St: Un: M: In: Lp	Lo: Rev: St: Un: M: In: Lp	Lo: Rev: Lt: Un M: Sig: Hp	Lo: Rev: Lt: Un M: Sig: Hp	Ext: Rev: Lt: Un M: Sig: Hp	Lo: Rev: Lt: Un M: Sig: Hp	Lo: Rev: Lt: Un M: Sig: Hp
	Waste	Lo: Ir: Lt: Un: Im: Sig: Hp	Ex: Ir: Lt: Un: Im: Sig: Hp	Lo: Rev: St: Un: M: In: Lp	Lo: Rev: St: Un: M: In: Lp	Ex: Ir: Lt: Un: Im: Sig: Hp	Ex: Ir: Lt: Un: Im: Sig: Hp	Ex: Ir: Lt: Un: Im: Sig: Hp	Lo: Rev: St: Av: M: Sig: Hp	Ex: Rev: Lt: Un: M: Sig: Lp
	Regional Development	Ex: Irr: Lt Un: M: Sig: Hp	Ex: Irr: Lt Un: M: Sig: Hp	Ex: Irr: Lt Un: Sig: Hp	Lo: Rev: St: Un: M: In: Lp	Ex: Irr: Lt Un: Sig: Hp	Ex: Irr: Lt Un: Sig: Hp	Ex: Irr: Lt Un: Sig: Hp	Lo: Rev: St: Av: M: Sig: Hp	Ex: Irr: Lt Im: Un: Sig: Hp
	Modifications to Landscape	Lo Irr: Lt Un: Im: Sig: Hp	Ex: Irr: Lt Un: Im: Sig: Hp	Lo: Rev: St: Un: M: In: Lp	Lo: Rev: St: Un: M: In: Lp	Ex: Irr: Lt Un: Sig: Hp	Ex: Irr: Lt Un: M: Sig: Hp	Ex: Irr: Lt Un: Im: Sig: Hp	Ex: Irr: Lt Un: M; Sig: Hp	Ex: Irr: Lt Un: Im: : Sig: Hp
	Indigenous, l assets	Lo: Rev: S: Av: M: In: Lp	Lo: Rev: Lt: Av: M: In: Lp	Lo: Rev: St: Un: M: In: Lp	Lo: Rev: St: Un: M: In: Lp	Lo: Rev: Lt: Av: M: In: Lp	Lo: Rev: Lt: Un M: Sig: Hp	Lo: Rev: Lt: Un M: Sig: Hp	Lo: Rev: St: Av: M: In: Lp	Lo: Rev: Lt: Av: M: In: Lp

Impact Significance (parameters): **Lo-*localised*, Ex-*Extensive*/ Rev-*Reversible*, Ir-*reversible*/St-*short term*, Lt-*long term*/ Av-*Avoidable*, Un-*Unavoidable*; M-*Mitigable*, Im-*Immitigable*/ Sig-*Significant*, *In*- Insignificant/Hp-*High probability*, Lp-*Low probability:* Note: The management of all Extensive**, Mitigable, Long term, and Significant impacts will have to be prioritized.**

Annex XXIV: Summary of Core Environmental Management Goals and Practices

The following practices will underlie every action taken by TPTTI in the management of the concession.

I. TPTTI commits to ensuring the highest standards of environmental management generally, occupational safety & health and waste management in particular.

II. Follow all prescriptions set out in the Environmental Authorization, State Forest Authorization, and other prescriptions that emerge during the project.

III. Develop the company's own environmental policy and ensure it is compatible with the terms and conditions of the environmental authorization and the State Forest Authorization.

IV. Ensure sound Occupational safety & health practices, including the obligatory use of personal safety gear for all field operatives, compliance with national guidelines for combatting the COVID-19 pandemic and all applicable health directives on mosquito borne diseases originating from the MOH.

V. Set up mechanisms to obtain and address stakeholders' concerns in a timely manner; special measures will be taken to engage miners on the concession area; commit to execute actions and practices agreed with stakeholders, especially at Iteballi and on the concession area.

VI. Continually brief company employees about the need for environmental conservation generally and sustainable forest management in particular; tailgate meetings and briefing sessions will be conducted at least once per week.

VII. Discourage hunting on the concession area.

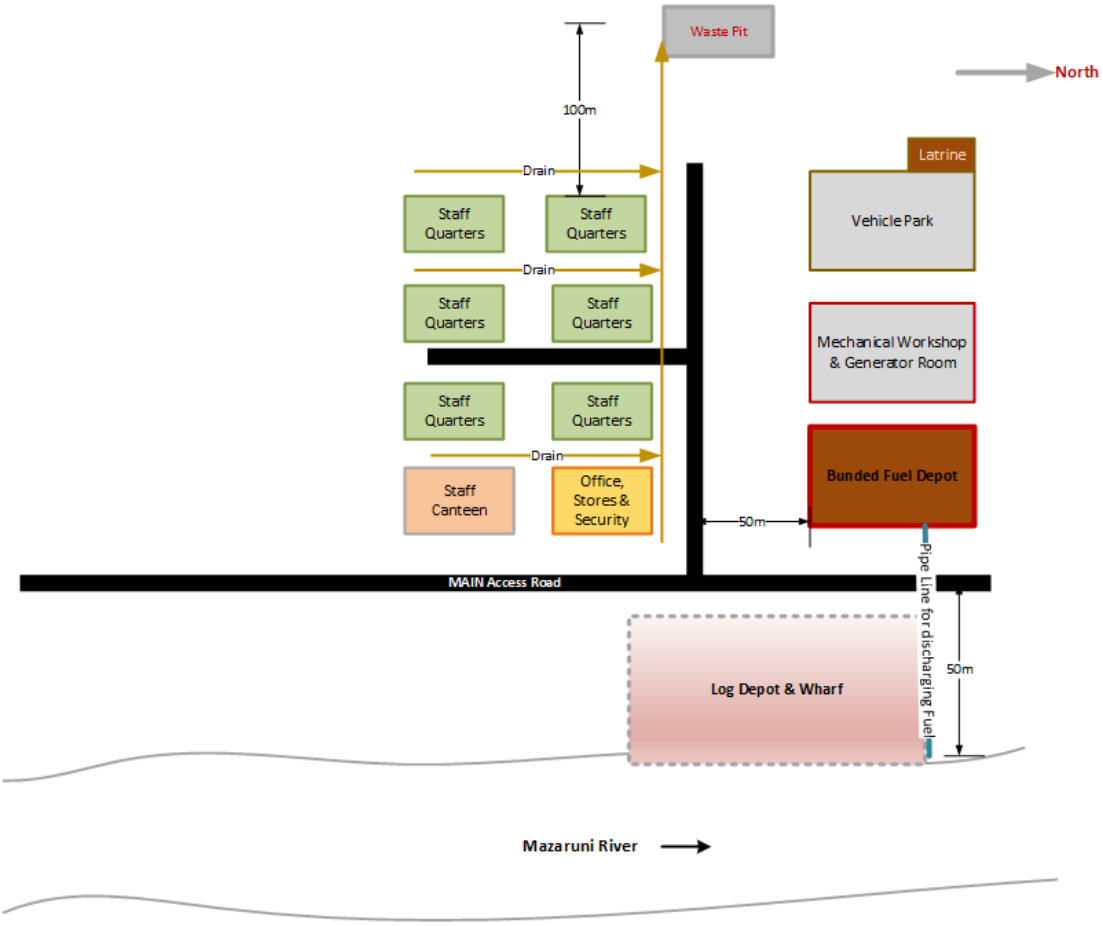
VIII. Discourage the setting up of any 'businesses' on the concession area; TPTTI will not sanction the use, sale or distribution of alcoholic beverages on the concession area;

IX. Plan every intervention in the forest resource.

X. Attempt to rehabilitate ex-mining sites wherever stagnant ponds of water are encountered: this also involves the removal of any barriers or structures deliberately placed in waterways to harness water for mining purposes; and

XI. Commit to provide an annual budget environmental management costs, including costs for:
   a) monitoring data from the five permanent stations identified;
   b) minor interventions to drain ponds or otherwise rehabilitate selected ex-mining sites;
   c) maintaining a register of sightings of wildlife.

(a) Indicative Layout of Iteballi Administrative Centre



Notes:

a. The Administrative Base is expected to accommodate about 20 people; all accommodation will carry plumbed toilets.

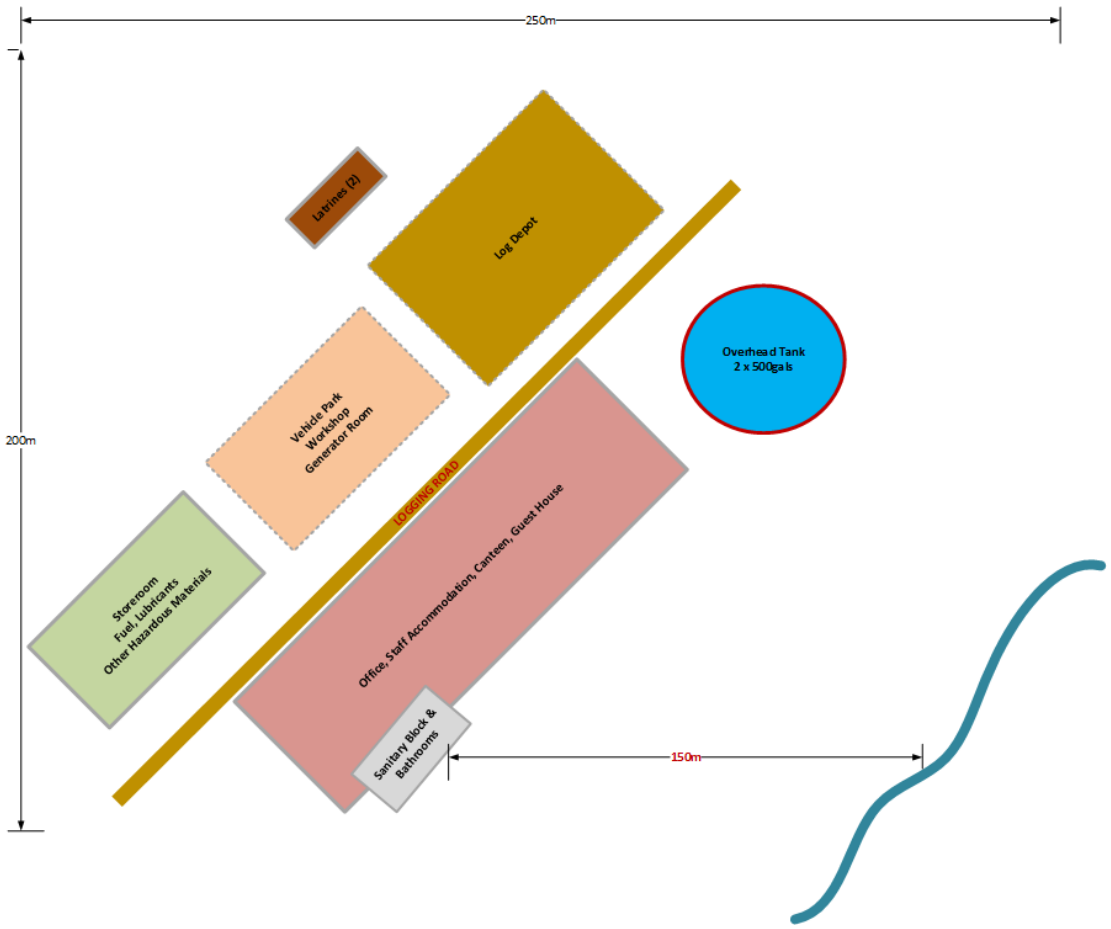
b. Potable water will be sourced from the public system based on a well in the southwestern part of Iteballi Village

c. TPTTI will run a generator in the day and utilise solar powered systems for lighting at night.

d. TPTTI will consult the EPA, the GEA, the regional Fire Service (Bartica) and the Iteballi Local Authority on the location and use of the Fuel Depot. The **maximum** volume of fuel stored at any time will be 8,000 litres (2,114 gals).

e. TPTTI will support Iteballi's water distribution system

(b) Provisional Layout Base Camp-Concession Area, LB Puruni River



Notes:

This concession based base camp is based on the site identified for the base camp. TPTTI is reviewing its options in view of the existence of a new (logging road) built by RL Sukhram & Sons with the approval of the GFC, traversing the southern side of SFEP 2/2013.

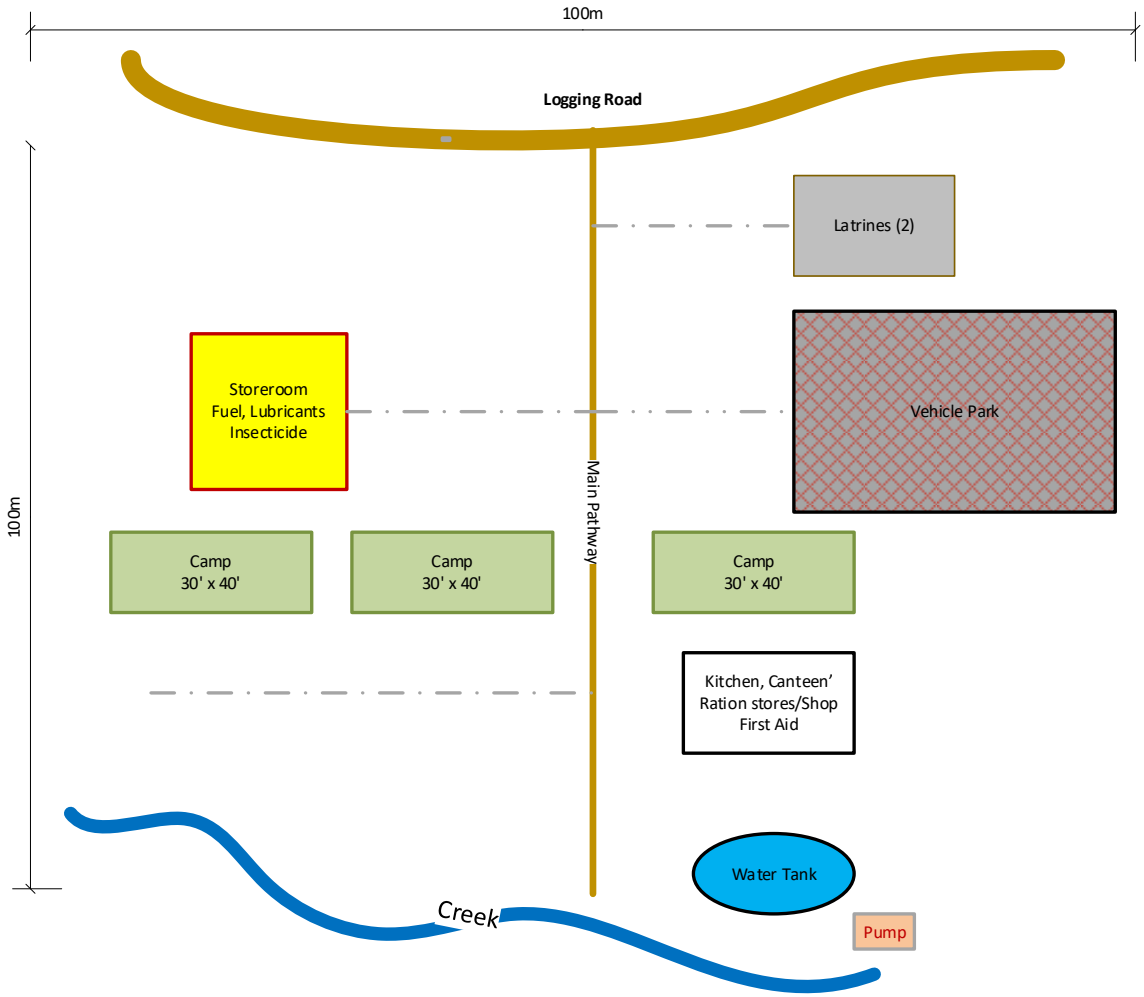
The camp is expected to accommodate about 15 persons. Water will be sourced from a suitable stream, filtered, and treated with a suitable disinfecting agent before distribution to employees. 18l (~5 gal) bottled water will be available for sale at subsidised prices.

There will be a mixture of plumbed toilets and latrines. Pits will be constructed to accommodate normal household waste, including liquid waste generated in cooking and washing areas.

TPTTI does not intend to store fuel at base camps, mostly for security reasons. [*If such storage becomes necessary*, TPTTI will set up a 1500 litre (400 gal) emergency stock of fuel at the base camp; at least two 4.5kg fire extinguishers and a sand bucket will be on hand at all times. The 1500 litre tanks will be constructed on a concrete bunded base to prevent leaking fuel from spilling onto nearby areas].

Locked used shipping containers will be used to secure any hazardous materials.

(c) Generic Forward Camp



Notes:

Forward Camps accommodate 4-15 persons engaged in roadworks, forest surveys, forest inventory, roadworks, tree marking or felling & skidding operations, and such camps are not expected to remain in place for more than six (6) months.

Water will be sourced from creeks nearby or harvested from rainfall: the water will be filtered, stored in 500 gal tanks, and disinfected with an approved chemical. TPTTI will provide 1500 litre (5 gal) bottled water at subsidised prices to workers.

Pits will be to accommodate solid and liquid domestic waste. One or two latrines will be constructed at each camp. The number will depend on the number of people at the camp: <7 persons, one latrine; ≥7 persons, two latrines.