Assessment Summaries and Management Plans for Proposed New Development at Umi Bridge, Morobe, Papua New Guinea

Umi Bridge the proposed new development area

Contents

Overview and background

1.1 Description of location

The area proposed for oil palm conversion, hereafter referred as Umi Bridge, is located on flat land adjacent to the Umi River; in the upper reaches of the Markham valley in Morobe Province. The centre point of the proposed development area is at 6° 11' 40.6"S 146° 10'50.48"E.

The baseline assessments (LUCA, HCV)have indicated that there was no primary forest existing within the proposed development area at November 1, 2005. The soil suitability study has indicated the absence of any peat. The SEIA has verified that the proposed development is on a state lease and that there are no local communities on this land or have any rights on this land. Multiple consultations with neighboring communities have verified this.

1.2 Topography and landform

The overall topography of Umi Bridge and its surroundings are flat, with a predominant land cover of grasslands. Umi Bridge is situated at the head of the Markham Valley which drains the watersheds originating from the Eastern Highlands to the south and the Finisterre Range to the north. The Markham Valley drains into Markham River and its tributaries flow about 110km southeast to the Huon Gulf of the Solomon Sea near Lae. Umi River, which borders Umi Bridge, is one of many tributaries draining the Finisterre range. It crosses the valley floor, and in the process, cuts deep gullies with near-vertical banks in the soft soils of the valley bottom.

1.3 Property description

The overall Umi Bridge area which the landowners have secured a land title is 361.8ha. The whole title (361.8ha) was assessed for the NPP criteria: i.e. High Conservation Value, High Carbon Stock, etc. There was no HCS identified within the original 361.8 ha of land. The HCV assessors did find 30.5 ha of riparian buffer zone as HCV. Due to management considerations only 245 hectares of this original 361.8 hectares originally assessed are to be leased and converted to oil palm. The 30.5 ha of riparian buffer HCV is to be protected as illustrated below:

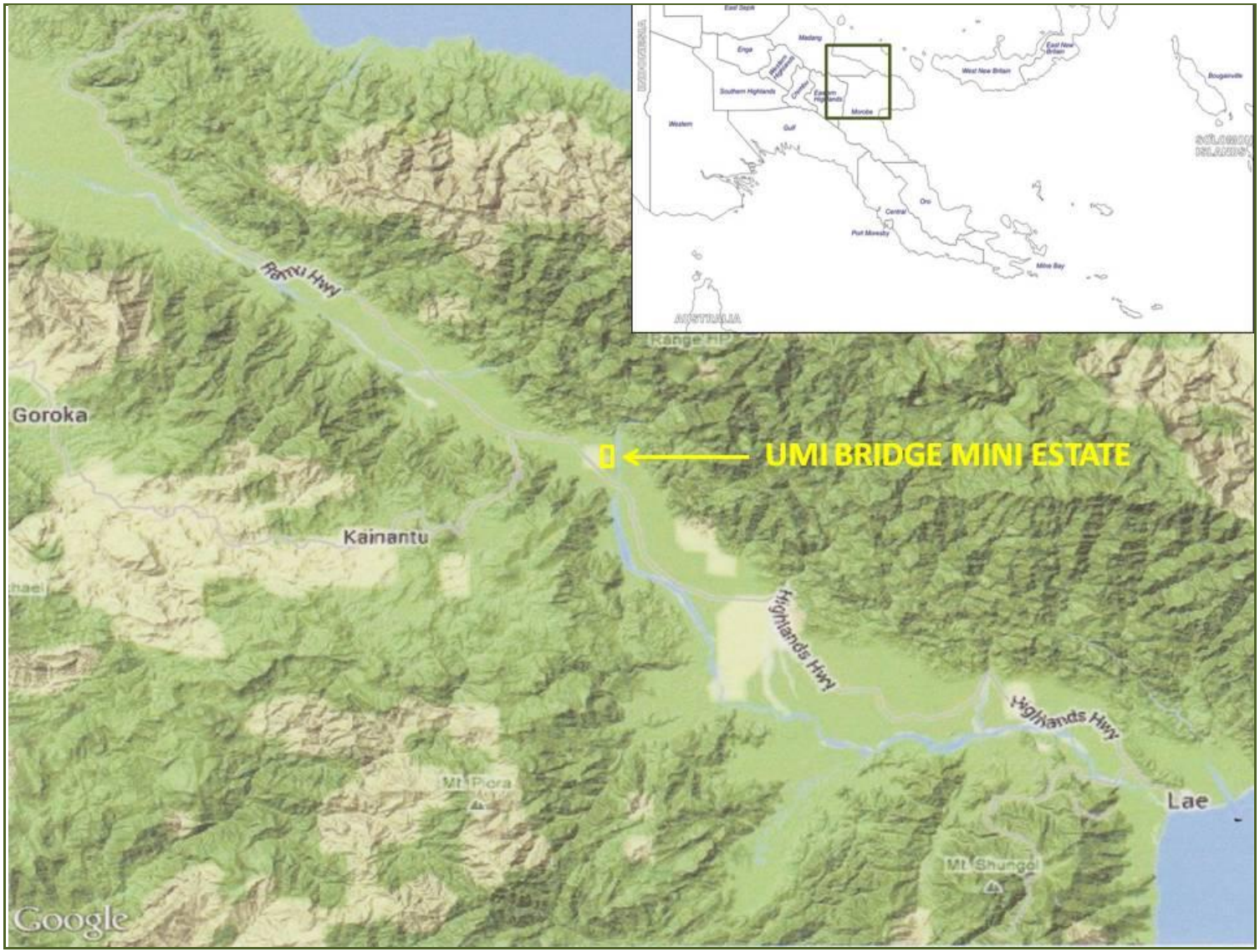


Figure 1; Location of the Umi Bridge Area of Interest in the broader landscape.

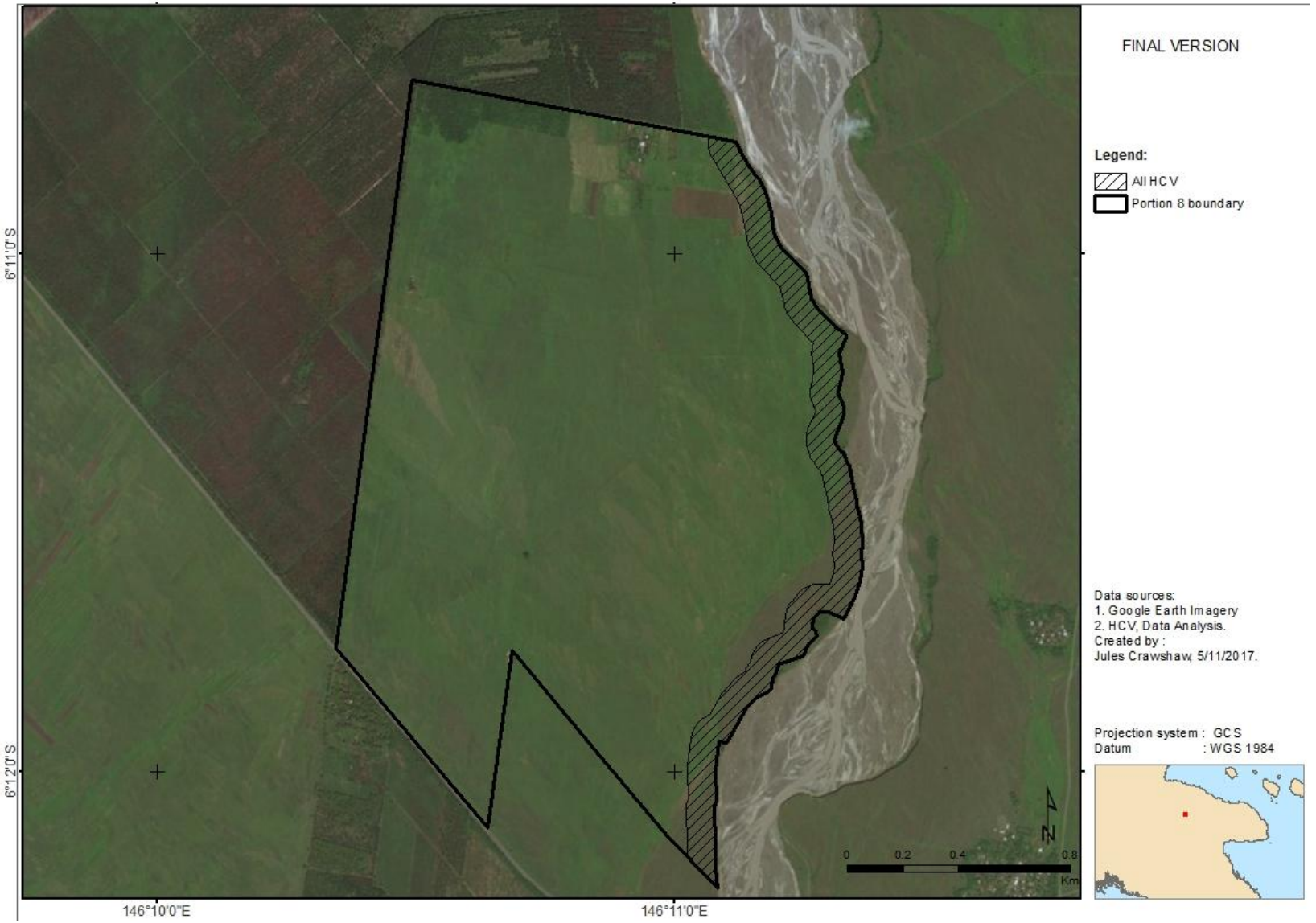


Figure 2; The boundaries of the Umi Bridge Area, of which 245ha will be developed and 30.5 ha of HCV (100m buffer on the Umi Rver) will be managed.

Note that the HCV identified was outside of the project area but due to the concern of project impact on the area the HCV management recommendation has been accepted. In summary the following are the areas to be developed and managed under this proposed new development:

In summary:
Area to be planted: 245ha
Area to be conserved HCV: 30.5 ha
Area not to be leased/ planted: 86.5
Area to be conserved HCS: 0 ha
Total Development Area: 275.5 ha

The timeline for development is pending only for RSPO NPP approvals. Given the small size of the site and the close proximity to existing operations, all work is anticipated to be completed by mid March 2018.

Boundary Survey – 20th - 22nd February 2018
Spray-off of grass and site preparation – 21st – 27th February 2018
Road Lining and Traces – 22nd – 23rd February 2018
Planting commences – 24th February 2018
Planting completed – 15th March 2018

2. Assessment process and methods

2.1 HCV Assessment process and methods

Dates HCV assessments were conducted

Douglas Environmental Services was contracted in 2016 to carry out the HCV assessment. The HCV assessment team was on site from 21st – 28th May, 2016. Stakeholder consultation of the HCV assessment results was conducted on 6 April 2015. The peer review completed on 31st August 2017, and Public Summary posted on the HCV Network on 6th December 2017.

HCV Assessors and their credentials

Table 1; Douglas Environmental Services HCV Team Composition

Name	ALS License	Organisation	Role	Expertise
John Douglas	Provisional License No: ALS15040JD	Douglas Environmental Services Consulting	Team Leader	40 plus years' of experience in Environmental and Sustainable Natural Resource Management in the Pacific at both a practical level and a strategic level as Manager of Douglas Environmental Services PNG. Contact Information; John Douglas Douglas Environmental

				Service Phone:+ (675) 735 56 616 Email: douglasjohnv5@gmail.com
Ellie Paon		Douglas Environmental Services Consulting	HCV Assessment Coordinator / Social and Stakeholder Consultation	4 years' experience in soil surveys, physical environment baseline surveys, weeds identification survey, social mapping and landowner consultation. Recent studies include conducting HCV of two oil palm project areas in different provinces in Papua New Guinea.
Simeon Daple		Douglas Environmental Services Consulting	Aquatic Biology Specialist	Over ten plus years' experience in aquatic biology including freshwater flora and fauna survey, monitoring. Recent studies include: freshwater fish and water quality HCV survey for Silovuti Oil Palm Project, Abau Oil Palm Project, Konoagil Oil Palm Project and Integrated HCS and HCV Assessment for Hargy Oil Palm.
Ishmael Hinae		Douglas Environmental Services Consulting	Aquatic Specialist	3 years field experience, Specializes in conducting assessments on aquatic macro-invertebrates and indicator species. Has experience in Konoagil Oil Palm Project, mangrove and sea grass assessments for Napa Napa Refinery.
Mellie Musonera		Consultant	Terrestrial Fauna Expert	10 years experience in working with Wildlife Conservation Society (WCS) – The site selection of incubated burrows by Melanesian Megapode (*Megapodius eremite*), Tree Kangaroo Conservation Program – Matschie's Tree Kangaroo in the Huon Peninsula, and Marine Program – Marine Invertebrates. He has also worked on HCV Assessments in for Hargy Oil Palm Limited leading the Terrestrial Fauna Survey.
Hans Nuwato		Consultant	Terrestrial	4 years experience working as a Para

			Flora Expert	Ecologist for the New Guinea Binatang Research Centre. He has worked on the Establishment of first permanent 50 ha forest research plot in Oceania located in Wanang Conservation Area, Usino-Bundi District, 1 ha insect plant relationship study plot in Saruwaged Range - YUS Conservation area, and, Pro Natural planet discovery expedition along 8 altitudinal gradients sites from Mt Wilhelm to Brahman in the Madang Province. He has also worked on HCV Assessments for Hargy Oil Palm Limited working as the Aquatic flora specialist.
Jules Crawshaw	Full ALS license ALS14006JC	Consultant	*Assistance with report writing*	

Besides HCV team assessment, there were also additional support and senior advisors involved.

HCV Assessment Methods used

Methods included collection of both primary and secondary data. Secondary data was mostly collected prior to the survey and used to guide the field assessment (which involved the collection of primary data).

Secondary Data Collection

The secondary data was collected and analysed during the planning phase of the assessment, it included the following:

Flora Desktop Study

Data from the IUCN website was augmented with existing information on the vegetation and flora of the study area and its conservation significance. The following data sources were used:

- Flora databases for PNG (IUCN, 2016) (UNEP-WCMC, 2016);
- Published literature on classification and values of PNG vegetation (PNGFSC, 2008);
- John. S. Womersely, 1978, Handbook of the Flora of Papua New Guinea, Volume 1, Melbourne University Press, Australia.
- E. E. Henty, 1983, Handbook of the Flora of Papua New Guinea, Volume II, Melbourne University Press, Australia.
- Barry. J. Conn, 1995, Handbook of the Flora of Papua New Guinea, Volume III, Melbourne University Press, Australia.

Fauna Desktop Assessment

The following data source was used to augment data from the IUCN website:

- Standard texts available for PNG fauna including the CSIRO Land Resource Study (Lands of the Ramu-Madang Area, Papua New Guinea).

Land cover mapping

The land cover mapping was based on a LandSat satellite image of the assessment area dated 22/11/2016. Classification from the image to the land cover categories was by using training samples to classify the image. The training samples are areas of vegetation where the land cover is "known" and this is then extrapolated onto the whole image. This uses the "Maximum Likelihood Classification" tool in ArcMap. LandSat bands 6, 5 and 4 were used – these are the normal bands selected for vegetation classification. When undertaking this task the assessor compared the results with a high quality image from Google Earth (dated 2010) to ensure the classification was correct.

Primary Data Collection

The field survey focussed on:

- Vegetation
- Mammals
- Birds
- Aquatic Biology

These were the main species groups known in the area. The population of amphibians has been devastated by the introduction of cane toads. There are no known reptiles in the area and with respect to insects the area is dry cracked soil for six months of the year without ponds or wet areas where a range of insects are likely to be able to survive.

Flora Field Survey

A Flora survey was carried out at Portion 8. Plots were established and 30m transects were plotted across opposite ends of a 50m transect line. Flora species within the plots were identified with a description of whether the vegetation is pioneer, secondary or primary. In this case there was almost no vegetation to describe. If one looks at the cover photo of the area, it is basically bare earth and a couple of introduced species (rain trees).

Fauna Field Survey

Three terrestrial fauna survey methods were established within the proposed project site to obtain on site fauna assessment which involved:

- Trapping and Mist Netting. For the mammal survey wire traps were placed along 500m transects established within the Project sites. Mist nets were also placed at different locations to capture bird species. Bird surveys were carried out early in the morning using Nikon Binoculars (8 x 40 8.2^{o}) and sound recorders to record bird calls.

- Casual and indirect observation. During field surveys with help from local field assistants, the presence of fauna was recorded from direct sightings, bird call identification, animal tracks, feeding remains etc.

- Village interviews. Used only for easily identifiable species by locals to identify fauna they knew were found in the project area (e.g. from observation and hunting) using fauna images of mammals, birds.

Identification of High Conservation Value fauna species was based on cross referencing identified species with those in the IUCN and Redlist 2016.

Aquatic Biology Field Survey

The aquatic survey was conducted in two parts;

- Aquatic Fauna Survey and
- Macro-ınvertebrates Survey.

Seine Netting

A seine net of 10m long by 2m deep with 13mm mesh with a cod end in the middle section of the net was used where there was suitable habitat. The net is manually pulled perpendicular to the bank and hauled in the direction of the flow of the water body on the same bank. How many hauls, the time, the number of catch and the number of species was to be recorded to determine species diversity and catch per unit effort.

Underwater Visual Assessment

Targeted searches for potential significant fauna species were undertaken throughout the survey period. Searches focused on faunal communities likely to be habitats for significant species identified from the desktop study. Timed swims were performed with snorkels and an underwater camera (GoPro Hero 2). Videos and pictures were taken of aquatic fauna species observed for ease of identification during cross referencing with identification guides and the fishbase web site

All aquatic fauna were identified using *Field Guide to The Freshwater Fishes of New Guinea* (Allen, 1990) as the main guide. Taxonomy and scientific names were also derived from this book.

While these field methodologies mentioned were attempted, due to unfavourable weather conditions associated with the nature/characteristics of the river (i.e. continuously flooded and fast flows with high turbidity) the outcome was not good and secondary sources had to be relied upon.

Social Field Survey

The social survey was done concurrently with data collection for a social impact assessment. The following methods were utilized**:**

Site visits - each village nearby the assessment area was visited; in this case it was six villages surrounding the area and a group of houses owned by Mr Andrew Baing's family. The villages were Tumua, Mitzing, Marafu, Zumra, Tzakarak and Ragiampun. These villages were selected because they are near the development area. As the assessor could not *force* anyone to come to the interview, the people that were interviewed were anyone that cared to show up. However, one can see from the attendance records that a total of 64 people were interviewed.

- Awareness- social awareness was carried out about the negative and positive implications about the project. There is a lot of oil palm in the area, so oil palm development is a familiar thing to these people. A map of the location was shown to the people, so they knew the area in question.
- Questionnaire - a questionnaire was conducted on the usage of natural resources in the area (a copy of the questionnaire is provided in the **Annexure 9**). This was filled in by the social assessor during a face to face meeting in the village. This method of meeting the people in the villages and talking with them directly was thought to be the most efficient and accurate method of obtaining the information. The people from the villages were contacted a few days before and village leaders were asked that the assessment team could meet with a cross-section of the community. As such the assessment team came and spent an hour or two going through the questionnaire
- Literature Review- literature reviews were sourced on previous studies being carried out in the project area (see references).
- Participatory Mapping – this was not undertaken because the people in the surrounding villages recognised the assessment area as freehold land. Furthermore, all the villagers' activities (e.g. growing crops) were undertaken nearby their villages and there was no overlap with the assessment area. The only exception was gathering poles for their houses. These were cut in the foothills of the mountains, which are some distance from the assessment area. Consequently, participatory mapping was considered not relevant in this instance.

2.2 Social Environmental Impact Assessment

Dates SEIA assessments were conducted

The SEIA stakeholder engagement was conducted from 30th November to 5th December, 2015. An exchange of information and draft reports preceded the final report which was submitted August 2016.

SEIA Assessors and FPIC experts and their credentials

Narua Lovai is a Freelance Environment Management and Technical Writing Consultant.

Mr. Lovai has extensive experience as an environmental management consultant to the private industry and the PNG Government. His expertise and skills include strategic planning, organizational, personnel and financial management, outcomes-based project management, policy formulation and revision, natural resources legislation compilation and revision, baseline environmental data collection, waste management and cleaner technology, water pollution assessment and mitigation, hydrological data acquisition and analysis, integrated catchment management, biophysical environment impact assessment, socio-economic impact assessment, environmental compliance and audit monitoring, stakeholder engagement for community development, and professional writing and editing.

SEIA Methods

Secondary Data

The data collection, analysis and report writing was entirely carried out by Narua Lovai a social scientist with many years of experience carrying out assessments for the mining and oil palm industry both for government and the private sector. Preliminary preparation for this study was based on secondary data, and the consultant's accumulated knowledge and experience with social and environmental issues typically related to the development of oil palm in PNG. Literature searches were conducted to collate material relating to the biophysical and human environment of the location, latest RSPO information on new plantings and Ramu Agri Industries operations in Morobe.

Primary Data

Questionnaires were prepared to obtain environmental and socio-economic data from landowners and other stakeholders. The questionnaires were primarily designed to assemble a basic outline of the predevelopment situation which both RAI and the respective landowners intend to improve over time. In preparation for the fieldtrip the RAI Lands Unit sent out formal notification on the SEIA to all the relevant landowners and Provincial Government officials. After the fieldtrip, the data acquired was processed with relevant information from literature searches, Inputs from consultation with stakeholders as well as the knowledge and experience of the consultant in the oil palm industry to compile the SEIA report.

2.3 Soil Suitability Assessment

Dates Soil Suitability Assessments were conducted

A soil suitability assessment was carried out on the land on 13th-14th August 2016. Due to the size of the site and the proximity of existing RAIL operations with similar soil characteristics, field sampling and reporting was carried out by RAIL's internal Sustainability Section team.

Soil Suitability Assessment expert and credentials

Will Unsworth conducted the soil suitability analysis.

William Unsworth has a BSc, Biology and Geography (1998-2001) from the University of Exeter. He has been the Sustainability Manager for NBPOL at Ramu since 2011, Mr Unsworth and is responsible for maintaining Roundtable on Sustainable Palm Oil (RSPO) compliance, as well as improving sustainability performance across Sugar Cane and Cattle operations, and through all of the support services.

Core sustainability tasks include enhancing environmental performance, developing OHS procedures, and better structuring stakeholder engagement. Part of the environmental theme relates to the operation of the Forestry Section to manage and enhance riparian buffers, conservation areas, and HCV areas. This has seen success through the development of partnerships with third parties; undertaking research related to biomass production, reforestation using native species, and

community forestry for neighbouring villages.

Mr Unsworth is currently pursuing a part time PhD candidate looking at local forest ecology; developing an understanding of community interest in, and value of, trees and forests; and identifying potential mixed species planting/agroforestry systems to achieve multiple forestry goals for community forestry and natural reforestation in the Ramu Markham Valley (lowland PNG).

Mr Unsworth holds a current pilot license for Trimble UX5 fixed wing drones and has experience in drone based remote sensing for vegetation assessments. Mr Unsworth has past experience in satellite based remote sensing in Malaysia and Brunei in relation to landuse mapping, drainage assessments, and protected areas management planning.

Soil Suitability Assessment Methods

Secondary Data

The in-field data collection, mapping, analysis and report writing was carried out by the Sustainability Section of RAIL, under the oversight of William Unsworth. The main sources of information used were (Bleeker, 1981) (Loffler, 1977) (Murdoch, 1987).

Primary Data

The proposed area was visited and inspected for soil types. The overall landform was inspected to concur with the literature description of the area. The soil was inspected physically by transects of soil cores using a hand auger.

Figure 3; Samson Nabura taking a soil sample at Umi Bridge

2.4 High Carbon Stock Assessment

Dates High Carbon Stock Assessment was conducted

The High Carbon Stock field assessment was carried out on 30th November, 2015.

High Carbon Stock Assessment expert and credentials

The High Carbon Stock Assessment was lead by William Unsworth (see above) and assisted by NBPOL staff Joshua Ombo, Peter Konia and Lumai Kaya

Mr Joshua Ombo is a Forestry Trainee at Ramu Agri Industries, Sustainability Section. Mr. Ombo holds a Papua New Guinea Diploma in Forestry (2011-2013) from the Papua New Guinea. University of Technology

Mr Peter Konia and Lumai Kaya are junior assistants working for the Sustainability Section at Ramu Agri Industries.

High Carbon Stock Assessment Methods

Secondary Data

The assessment used landcover data from the HCV Assessment.

Primary Data

Primary data was collected through locating representative sample plots within the proposed area. The sample locations were defined in 2 parallel transects designed to give a range of samples across the site. The 37 sample sites provide a total sample area of 1.85ha (0.05 x 37 sites) on a site of 361.8 ha representing 5% of the total area.

2.5 Land Use Change Assessment

Dates Land Use Change assessments were conducted

The land use change assessment was carried out in June 2017. Additional maps were prepared in January 2018.

Land Use Change Assessors and their credentials

The Land Use Change Assessment was carried out by Masamichi Haraguchi. Mr Haraguchi is a Senior Engineer at Kokusai Kogyo Co., Ltd. (KKC) GeoSpatial Information Technology Division, Oversea Spatial Information Group. Mr. Haraguchi has extensive knowledge of GIS and in particular land use classification within PNG.

Additional maps were prepared by Will Unsworth (See Soil Suitability section for expertise)

Land Use Change Assessment Methods

The LUCA consists of a systematic land use change analysis utilizing satellite imagery which shows the land use of the proposed area before and after November 2005.

The LUCA utilized a hybrid analysis with local ground data from NBPOL and Global Dataset, e.g. Hansen data; this involved the development of two LandSat Cloud Free

Mosaics (Annual Greenest Pixel data generated from Google Earth Engine) and a supervised landuse classification to identify landuse in year 2000 and 2015. Year 2000 was chosen as a baseline year as it predates all cutoff dates and correlates with the Hansen dataset, though the relevant cutoff date for this assessment is November 2005.

This generated landuse classification was verified through confirmation with available vector data (FIMS - Forestry Information Management System) and discussion with on-site personnel and the landowner for a history of landuse.

In addition to the satellite image, the Hansen data set was used to assess annual tree cover loss from 2000 to 2015.

The additional maps were prepared to show landuse in the 4 time periods indicated in the "RSPO Guidance for Land Use Change Analysis" (March 2017). Due to the small size of the site compared to the pixel size, an automated classification was not carrie out and instead the classification is based on visual inference with notes on the images and commentary on changes indicated on each map. The percentages of various landcover are also presented on each map.

Stated Time Period	Cutoff dates	Actual Date of Satellite Image	Satellite Platform used and source
Period 1	Nov 2005-Nov 2007	23rd February, 2004 (*N. B. available images for 2005, 2006 or 2007 all affected by cloud cover*)	LandSat 5 downloaded from USGS
Period 2	Dec 2007-Dec 2009	28th June 2009	LandSat 5 downloaded from USGS
Period 3	1st Jan 2010 - 9th May 2014	30th May, 2010	LandSat 5 downloaded from USGS
Period 4	after 9th May 2014	1st November 2014	LandSat 8 downloaded from USGS

2.6 Greenhouse Gas Analysis

Dates Greenhouse Gas Analysis was conducted

The Greenhouse Gas Analysis was conducted in July 2017 based on the findings of all assessment reports.

Greenhouse Gas Analyst credentials

The Greenhouse Gas Analysis was carried out by William Unsworth, see above for credential.

Greenhouse Gas Analysis Methods

The GHG emissions were calculated using the RSPO GHG calculator provided for this purpose https://www.rspo.org/certification/GHG-assessment-procedure. The

calculator was populated with previous years data for the mill to which the proposed crop will be delivered to. It was assumed that the entire development will take place within one year.

Three scenarios were tested to better understand the implications of development scenarios on the GHG budget of the site.

3. Summary of findings

3.1 SEIA Summary of findings

The SEIA utilized a risk ranking methodology to analyse the positive and negative impacts of all the aspects and activities and associated with the implementation of the project. The inputs to the risk ranking were obtained through an expert driven outreach process which captured the stakeholder perception of environmental risks. These were then analysed by the expert and reported in a matrix with the associated impacts to the phase of the project, the potential impacts and the medium to which the impacts are ascribed as summarized in the table below:

Table 2; Nature and level of risk of each potential impacts of the Project

No:	Impact	Likelihood Rating	Consequence Rating	Risk Ranking
Phase 1	**Site preparation**			
a	Acquisition of the land and FPIC	1	1	Low (1)
b	Involvement of nearby villagers	2	1	Low (2)
c	Allocation and management of buffer zones	1	1	Low (1)
d	Soil, water and air quality	2	1	Low (2)
e	Noise level	1	1	Low (1)
f	Socio-economic status - negative	2	2	Medium (8)
Phase 2	**Initial round of oil palm planting**			
a	Involvement of nearby villagers	2	1	Low (2)
b	Management of buffer zones	1	1	Low (1)
c	Soil, water and air quality	2	1	Low (2)
d	Noise level	1	1	Low (1)
e	Socio-economic status - negative	2	2	Medium (8)
Phase 3	**Routine operation**			
a	Involvement of nearby villagers	2	1	Low (2)
b	Management of buffer zones	1	1	Low (1)
c	Soil, water and air quality	2	1	Low (2)
d	Noise level	1	1	Low (1)
e	Socio-economic status - negative	3	2	Medium (9)

Positive and negative environmental effects

The implementation of this project will result in at least 245ha of area to be converted plus 30.5 ha of adjacent riparian zone (HCV4) to be protected from annual fires to which it has historically been subjected. The impact of fire on soil and vegetation ecology is well known and need no further description.

There will be a net gain in carbon storage of the entire area due to the average carbon stored in the oil palm stand as well as the carbon sequestered in the protected riparian zone. The protection and assisted restoration of the riparian zone will increase wildlife habitat.

Socio-economic impacts to country, region and local communities

The small size of this project makes the potential socio economic impacts fairly minor. Staffing will only amount to about 20-30 additional employees who will be housed in the adjacent Ngaru compound (not on site). Any social issues related to the labour force will be managed through existing policies and agreements. Local recruitment and economic outputs will be beneficial given the lack of significant new economic development in recent decades.

Socio-economic impacts in respect of emergent communities (workers, suppliers etc.)

While in general the project is assessed as having positive socio-economic impact there were several potential negative impacts identified. The potential negative impacts include: possible missed opportunities to locals for work opportunities, lack of understanding by local employees of terms and conditions of employment and opportunities, generation of noise and air pollution due to land clearing activities.

Issues raised by stakeholders and assessors comments

All of the above issues were raised in consultation with the SEIA assessor and through his own expert analysis. In particular there was a concern with regards to achieving the full economical potential of the project.

List of legal documents, regulatory permits and property deeds related to the areas assessed

List of Reports

- Notification for Environmental Permits for the new plantings submitted to CEPA.
- Local stakeholders including ILG's have been informed and included in discussions.
- Land Title
- Kundu Investment Ltd IPA Registration documents

List of Legal Documents

Table 3; List of Legal Documents consulted

No	Legal Document	Issuing Authority	Year
1	Environment Act	Conservation & Environment Protection Authority	2000
2	Environment (Prescribe Activities) Regulation	Conservation & Environment Protection Authority	2002
3	Land Registration Act	Lands Department	1981
4	Fauna (Protection & Control) Act	Conservation & Environment Protection Authority	2014
5	Papua New Guinea Logging Code of Practice	Forestry Authority	1996
6	Papua New Guinea Lands Act	Lands Department	1996

3.2 HCV assessment summary of findings

National / Regional Context

Papua New Guinea occupies the eastern half of the island of New Guinea, just north of Australia, and many outlying islands to the north and east, with a land area of about 462,243 sq. km. Lying at the collision line of the Australian and Pacific tectonic plates, Papua New Guinea is remarkably diverse in terms of species, landscapes and ecosystems. Rainforests cover 28.2 million hectares of Papua New Guinea and comprise 80% of the forest area.

The total number of different plants and animals in Papua New Guinea is not accurately known but almost certainly exceeds 200,000 species and thus is far higher than the 26,318 total reported by IUCN

Palm oil has been PNG's most valuable agricultural export since 2000. Palm oil exports about K420 million per year from which 30% makes up the value of agricultural exports. The base of the Markham Valley has been developed for agriculture and is an environment that has been heavily modified.

Scope

RAIL is now in the process of securing a new planting site under consideration of a lease agreement area located at Portion 8, Umi Bridge. The Umi Bridge site has a total of 361.8 ha. Once planted this site will add approximately 1.5% to RAIL's current planted area.

Demographic and Socioeconomic Context

Land use surrounding the assessment area

There are no regional Land Use Plans in PNG. However, there are land use maps provided by PNGRIS[1] which were developed in 1975 and updated in 1996.
The area is primarily an agricultural area. There is a wide range in productivity of agriculture from low level subsistence agriculture that involves moving gardens from place to place (no commercially produced fertiliser is applied) through to intensively managed industrial agriculture. The major agricultural activities in the area include; Sugarcane, Oil Palm and Cattle Production.

Subsistence Agriculture

Subsistence agricultural systems are quite extensive in Middle Ramu and upper Markham River Valleys. They extend from the plains onto steep hill country, most of which is forested, but some of which is grass covered. For the entire system, the most important crops are banana and sweet potato; yam (*Dioscorea alata*) is an important crop; coconuts are an important food; other crops are taro, cassava, yam (*D. esculenta*) and Chinese taro. In this subsystem, short grass fallows, 5-6 years old, are cleared, the grass dug up and burnt. Two plantings are made before fallowing, but up to 3 plantings may be made. Sweet potato and sometimes small amounts of yam (*D. alata*) are planted first. Triploid banana is the second and only subsequent planting, but continues to produce for 7-10 years before fallowing. Sweet

[1] GIS software based on air photographs in various provinces of PNG.

potato is also grown in separate gardens on well drained alluvial flats and river terraces. Sweet potato is planted in small mounds. Peanuts are planted as a cash crop and between sweet potato plantings. Tractors are used to prepare land before planting banana, sweet potato and peanuts. (Bourke et al 2002)

Demographic and Socio-economic Context

According to the 2011 National Census –Umi/Atzera LLG has the highest number of households and persons within the district but is still relatively low compared to other districts in Morobe Province (PNG National Census, 2011).

Presence and condition of protected areas in the landscape

There are no formally protected areas in the project area.

Key Biodiversity Areas in the Landscape

There are no key biodiversity areas in the landscape.

Landforms, Rivers and Land Cover

Major Landforms, Watershed and Rivers

Portion 8 is located on braided floodplains or bar plains and dissected relict alluvial, colluvial mudflow and fans. The Umi River runs from north to south of the boundary discharging into the Markham River. Both the Ramu and Umi Rivers are known to flood their banks during the rainy season. Erosion risks are high on the banks of these main rivers.

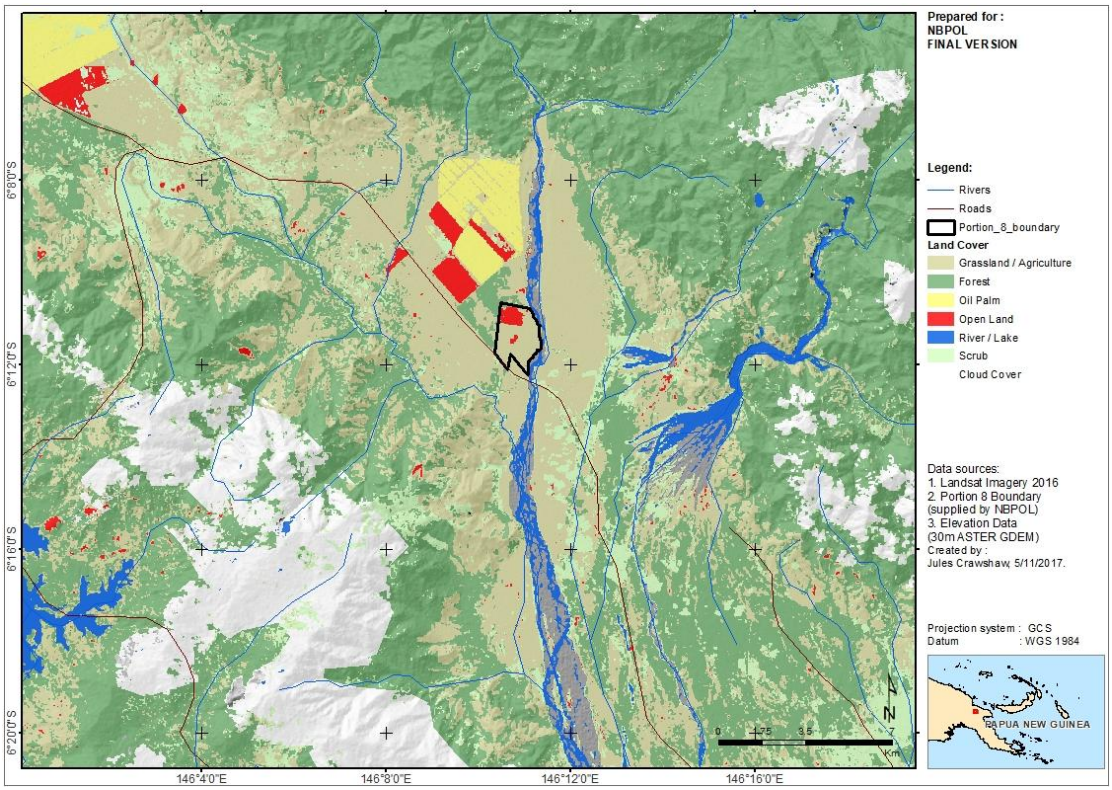


Figure 4; The wider landscape.

The main focus of this is the plains on the valley bottom surrounding the assessment area (labelled "portion 8 boundary"). The brown areas are the grasslands on the flat valley bottom, there are also grasslands on the foothills that flank the valley. Far away from the valley bottom is forest (NE and SW in this image). Oil palm is already present in the wider landscape (yellow). Of interest, also is the Umi River that originates in the hills (flowing north to south). Also in the east of the image is an outwash fan that comes out of the mountains as a river and then spreads, the water sinking to underground aquifers

Land Cover

Vegetation Classification

All the area on the flat valley bottoms (where the assessment area is located) is grassland. The foothills which flank the valley are predominantly grasslands. It is only in the mountains away from the man-made disturbance that there are forests.

Vegetation in the project area is categorized as grassland in terms of the Forest Inventory Mapping System (FIMS)[2]. The vegetation descriptions in this study have been developed primarily from actual field reconnaissance and matched to FIMS categories.

HCV Outcomes and Justification

Table 4; HCV Identification Summary

		Description		
HCV	Definition	Present	Potentially Present	Absent
1	Species Diversity			
2	Landscape-level ecosystems and mosaics			
3	Ecosystem and habitats			
4	Ecosystem Services	**Buffer beside Umi River**		
5	Community Needs			
6	Cultural Values			

1.1 HCV 1: Species Diversity

Table 5: HCV 1 Findings Summary

Definition	Result of HCV Assessment
Concentrations of biological diversity including endemic	Not Present

[2] FIMS provides maps and information on the whole of PNG. Amongst other things it provides information on forest and non-forest vegetation type as well as land use. Mapping is done at the 1:100,000 scale.

species, and rare, threatened or endangered (RTE) species that are significant at global, regional or national levels.	

Indicator

Table 6. HCV1 Indicators

Indicator	Comments
The presence of a recognized biodiversity priority area (IUCN, Ramsar, UNESCO World Heritage Site, Key Biodiversity area, etc)	There are no such sites in the project area.
A designation by national authorities, or by reputable conservation organizations, recognizing concentration of biodiversity	Not found in project area. At least four PA's are located in the wider project area. These are located at higher elevations. Due to the distance and difference in elevations; any change in the, the project is not likely to affect or impact these protected areas.
The presence of natural habitat in good condition within such designation is a strong indicator (but not a guarantee) of the presence of HCV 1.	Not found in the project area. The project area is flat with 100 % grassland cover and no forest cover. This type of vegetation is found throughout the Markham valley. There was no sighting or recording of any IUCN Red List Species or CITES species within the assessment area. However, for the sake of potential occurrence, endemicity and distribution range, the species shown in Annexure 11 identified under the IUCN red list have been identified as species of interest to the HCV assessment area.

Table 7. HCV 1 Interpretation for Grasslands

Key Terms - Interpretation for Grasslands	Indicator	Comment
(RTE) species	Presence of RTE species (several RTE species, a substantial population of one RTE species, refugia). Presence of recognised protected areas Unprotected grasslands identified as IBAs or KBAs	There are no RTE species on this site. It is a ploughed agricultural field where such crops as rice and corn have been grown for years. The surrounding grasslands are dominated by *Imperata cylindrica* – which is a very common grassland species. There are no Key Biodiversity Areas nearby and PNG has not been assessed for Important

		Bird areas
Endemic species	• Presence of endemic (ecoregion or country level) or highly range-limited species • Presence of recognised protected areas • Unprotected grasslands identified as IBAs or KBAs	• Endemic Bird Areas are confined to the mountains. • The World Database on Protected Areas does not include any areas nearby the Umi Bridge Site
Concentrations - Critical temporal use (e.g. for migration)	• Mammal migration routes or flyways for birds & insects • Presence of recognised protected areas • Unprotected grasslands identified as IBAs or KBAs	• There are really no significant mammals in the area. The birds that are present in the area were checked against species lists of migratory birds from the Birdlife International website. None were listed as being migratory. • The World Database on Protected Areas does not include any areas nearby the Umi Bridge Site

Justification

Vegetation

In Portion 8, the assessment area was all cropland. At the time of the survey dry rice was growing on some sections while other sections were fallow. There was evidence of regular cultivation and fires over the whole area. There were some trees, which were introduced species and which were used as shade trees e.g. rain trees *(Samanea saman).*

The surrounding area is mainly grassland and there were very few trees. A list of flora species identified is attached to **Annexure 6**. No species that were recorded known to have any HCV significance.

Figure 5. View across the assessment area. It is cultivated land with the occasional tree.

Mammals and Birds

A total of 21 species were recorded for the proposed oil palm development area during the HCV assessment of which included only one mammal species (family: Peramelidae scientific name: *Echymipera kalubu)* or common spiny bandicoot (IUCN status of least concern). Three species were classified as CITES appendix 2. These were all scavenger species (kites and buzzards) that appear to be quite common in this area, in fact seem to thrive in oil palm landscapes. These birds nest in forested areas, of which there are none in the assessment area.

There were 20 bird species identified in the oil palm development site. A list of identified bird species is attached to **Annexure 4**. Common families of species in the Umi project site included *Accipitridae* (kite and buzzard) and *Meropodae* (bee-eater), *Turdidae* (pied chat), *Columidae* (dove), *Rhipiduridae* (wagtail), and *Alaudidae* (bushlark).

Freshwater / Aquatic Species

The HCV assessment identified a total of 8 freshwater species in the Umi River during the HCV assessment. This was based on both aquatic survey and interviews with people seen fishing. A list of freshwater species identified in Umi River is provided in **Annexure 5**. None of the species recorded are of HCV significance (i.e. they are not RTE species).

Findings in the Assessment Area
There are no Protected Areas in or near the assessment area nor are there any RTE species found in the assessment area, therefore **HCV 1 was deemed not present.**

1.2 HCV 2: Landscape-level ecosystems and mosaics

Table 8: HCV 2 Findings Summary

Definition	Result of HCV Assessment
Intact forest landscapes and large landscape-level ecosystems and ecosystem mosaics that are significant at global, regional or national levels, and that contain viable populations of the great majority of the naturally occurring species in natural patterns of distribution and abundance.	**Not Present**

Table 9. HCV 2 Indicators

Indicator	Comments
Conservation landscapes (recognised landscapes i.e. Ramsar sites, CARPE landscapes, Intact Forest landscapes, valuable Grassland Areas and Priority Conservation Landscapes or unrecognised landscapes i.e. areas with low levels of disturbance and high connectivity, habitat structure, condition, composition, connectivity, and intensity of human presence)	There were no areas identified within the assessment area that were found to be sufficiently large and relatively undisturbed enough to support viable populations of the great majority of the naturally occurring species and (implicitly) the great majority of other environmental values occurring in such ecosystems.
Areas with low levels of overall disturbance and high connectivity.	This is a highly disturbed area and there is no connectivity to any relatively undisturbed areas in this landscape.
Intact forest landscape (IFL)	There are no IFLs in or near the assessment area. (**Error! Reference source not found.**).

Table 10 HCV 2 Interpretation for Grasslands

Key Terms - Interpretation for Grasslands	Indicator	Comment

Large, mainly native and/or long-established grasslands and grassland mosaics containing the great majority of expected species	Large size: probably >50,000 ha although needs to be set regionally Predominantly native species composition Continuity in ecological history	While this area has been an anthropologically maintained grassland for some time and it is a large size. It has been used for village scale and industrial agriculture for hundreds of years. It has many introduced species.

Justification

The project area and the rest of the Markham valley have been highly disturbed through continuous agricultural practices since colonial days. Prior to this and continuous anthropogenic burning activities (perhaps dating back over 1000 years), resulting in the area being converted to grassland and remaining as such. There were no areas identified within the project sites that were found to have sufficiently large and relatively undisturbed enough to support viable populations of the great majority of the naturally occurring species and (implicitly) the great majority of other environment values occurring in such ecosystems.

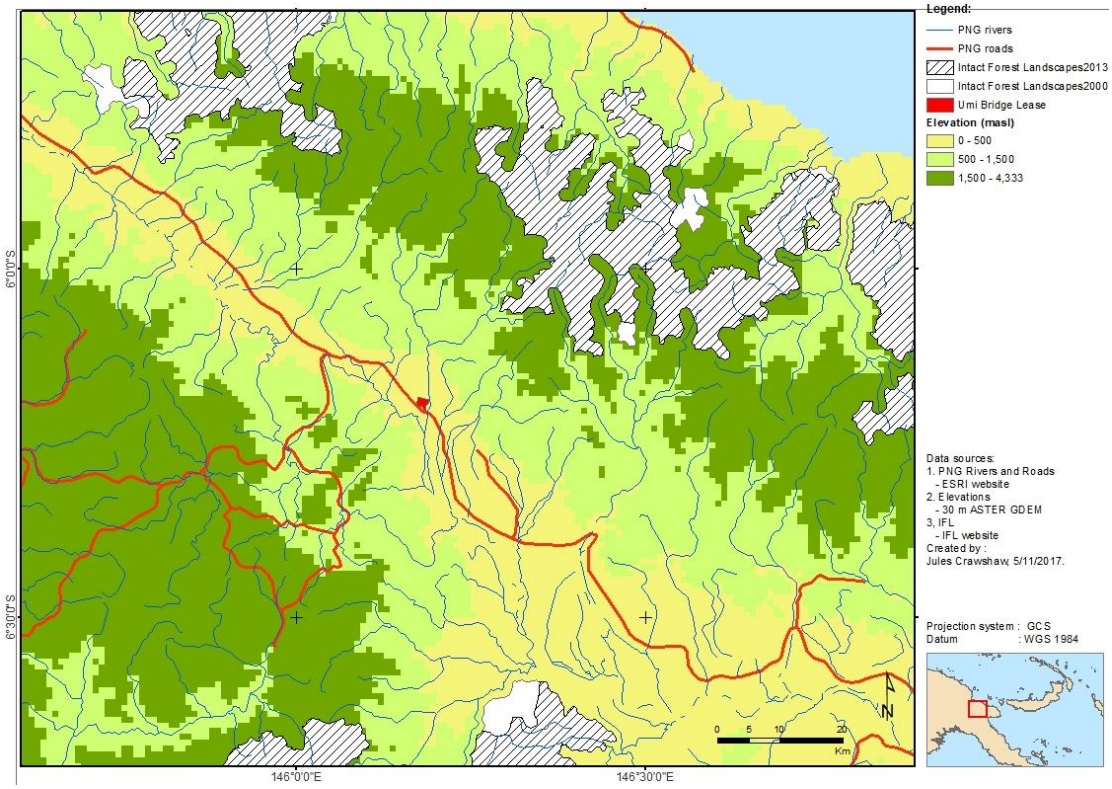


Figure 6; Lease area with IFL in the landscape. The closest IFLs are 20 km away and confined to high elevations. Degraded IFL (reduction in extent 2000-2013) is also displayed.

Findings in the Assessment Area

There are no forests of any type in the assessment area nor are there any IFLs nearby, therefore **HCV 2 was deemed not present.**

1.3 HCV 3: Ecosystem and habitats

Table 11: HCV 3 Findings Summary

Definition	Result of HCV Assessment
Rare, threatened, or endangered ecosystems, habitats of refugia.	**Not Present**

Table 12. HCV 3 Indicators

Indicator	Comments
Ecosystems that is naturally rare because of its dependents on highly localised soil types, location, hydrology or other climatic or physical features.	No HCV areas were found within the project areas to have ecosystems, habitat or refugia that provided special importance because of their rarity or the level of threat that they face or their rare unique species composition or other characteristics.
Ecosystems that are anthropogenically rare, because the extent of the ecosystem has been greatly reduced by human activities compared to their historic extent.	
Threatened or endangered ecosystems.	
Ecosystems that are classified as threatened in national or international systems	

Table 13. HCV 3 Interpretation for Grasslands

Key Terms - Interpretation for Grasslands	Indicator	Comment
Rare, threatened or endangered grassland ecosystems	• Presence of rare grassland ecosystems: including both natural rare ecosystems and those that are rare because of conversion and degradation	• There are other areas within the Markham Valley that *could* fall into this category. Bearing in mind though that none of the descriptions of the vegetation in this valley have paid more than scant attention to the grasslands. Bear in mind that the assessment area is a field that has been ploughed and cropped annually so couldn't be classified as an RTE ecosystem.
Remnant ecosystems or habitats contained within otherwise modified grasslands	• Presence of rare ecosystems within the grassland (e.g. fragments of native grassland in a predominantly converted area; lakes, streams or other inland waters, riparian woodland)	

Justification

The CSIRO Land Resource Study (Lands of the Ramu-Madang Area, Papua New Guinea) (1976) maps land systems in the Ramu Valley. These land systems are very useful proxies for ecosystems. The use of these land systems is advocated in other national interpretations (e.g. Indonesia). Unfortunately, land system mapping has not been comprehensively undertaken throughout PNG. The Land Resource Study maps land systems in the Ramu Valley from Gusap Downs and to the west. Consequently, the assessment area is not covered (the border of the map is about 20 km to the west). However, the "Ramu" land system appears to closely describe the geography of the assessment area. This land system is common in the valley so cannot be classified as rare. Nor can it be classified as endangered because it was an anthropogenic grassland ecosystem in 1976 when it was first described. It remains as such today.

Paijmans (1976) remains the definitive source of information on the vegetation of New Guinea, though is particularly focused on forests and again pays only limited attention to the grasslands associations of the valley, though the patches of forest present are referred to as 'gallery woodland'. None of the references consulted considers these grasslands as being an RTE ecosystem.

Findings in the Assessment Area

The assessment area would most likely be part of the "Ramu" land system (a proxy for an ecosystem). It was an anthropogenic grassland ecosystem in 1976 when it was first described. It remains as such today. Therefore **HCV 3 was deemed not present.**

1.4 HCV 4: Ecosystem Services

Table 14: HCV 4 Findings Summary

Definition	Result of HCV Assessment
Basic ecosystem services in critical situations including protection of water catchments and control of erosion of vulnerable soils and slopes.	**Present**

Table 15.HCV 4 Indicators

Indicator	Comments
Remote and/or poor rural areas where people rely directly on natural resources to supply most of their needs, including water	Use other means of collecting water such as drilling and use of water pumps as well as tank supply.
Upstream of extensive or important wetlands, fish nurseries and spawning grounds, or sensitive coastal ecosystems	Not applicable in this HCV area.
Upstream of municipal water sources	Not applicable in this HCV area.
Steep or mountainous areas, or areas of high rainfall, where the risk of catastrophic erosion is high	Not applicable in this HCV area. The project area is located on flat land.
Where there is naturally low soil fertility, especially on sandy, peaty or fragile soils, where land clearance, drainage, use of heavy machinery or other intensive land use might affect soil structure and fertility	There is low risk that this would occur as the project area has been used extensively for agricultural practices both in the past and present.
Arid or dryland areas particularly susceptible to erosion and desertification.	The main vegetation is grassland which protects the soil from erosion and/or desertification. The area is also relatively flat thus the likely risk of this occurring is limited.

Table 16. HCV 4 Interpretation for Grasslands

Key Terms - Interpretation for Grasslands	Indicator	Comment
Grasslands critical to	• Native grassland that	• This area would provide a

water catchments and aquifers	provides a filtering and purifying role for recharge of aquifers and/or surface water catchments	filtering and purifying role. This is the reason why a 100m buffer from the Umi River is proposed
Grasslands critical to erosion and desertification control	• Native vegetation that help to prevent erosion, landslip, gullying, dust storms and desertification	• No vegetation cover would prevent erosion if the Umi River changes course. However the buffer with the river is recommended to prevent erosion caused by surface runoff.
Grasslands providing buffering against flooding	• Wet, seasonally-flooded grassland areas that can absorb sudden influxes of floodwater	• The assessment area is located on a terrace about 10m above the level of the river, so the river would never flood into this area.
Grassland providing critical habitat for pollinating species.	• Healthy populations of pollinating animals (bees, butterflies, moths, some birds etc)	• Given that this area is a ploughed field with a few trees on it. It would not provide a habitat for pollinating species such as bees.

Justification

The Umi River is several hundred metres wide and flows along the eastern border of the assessment area.

Figure 7; View across the umi river (taken from the assessment area).

In the case of HCV 4 riparian buffers are applied using RSPO guidance. This is to stop the runoff of agricultural chemicals into the river. It should be noted that there

are no streams on site and the soil is highly permeable (so any rainfall quickly seeps down rather than forming surface runoff).

Given the nature of the terrain there is little that can be done to stabilise the banks against erosion. The banks are sheer cliffs (approximately 10m high) dropping to the river base. It is likely as the course of the river moves across the river bed it will erode the assessment area. Intuitively planting should be set back some distance from the edges; otherwise the crop will drop into the river. So the 100m buffer is necessary to maintain a buffer over the lifetime of the crop. The length of riverbank affected is extremely small compared to the total length of the river. Even a complete collapse of the river bank adjacent to the project site would have a negligible impact on the water quality of the whole river; especially given the frequency of naturally occurring landslides in the headwaters of the Umi River.

Findings in the Assessment Area

The assessment area has the Umi River flowing along its eastern border. This is a major river – several hundred metres wide. The river bank is extremely susceptible to erosion and a significant buffer is required; especially given that the river bank will likely erode over the life of the crop. Therefore **HCV 4 was deemed to be present.**

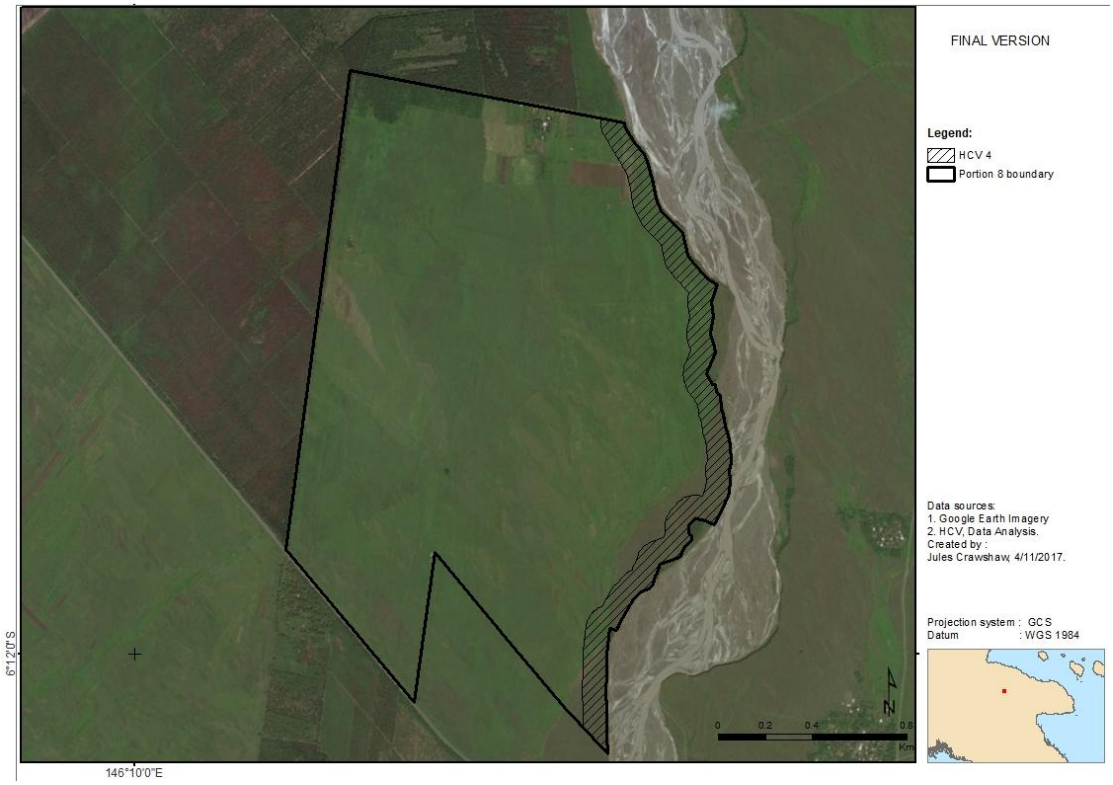


Figure 8; The HCV4 area is a 100 m buffer of the Umi River (in the east of the assessment area); the total area is 30.5 ha.

1.5 HCV 5: Community Needs

Table 17: HCV 5 Findings Summary

Definition	Result of HCV Assessment
Sites and resources fundamental for satisfying the basic necessities of local communities or indigenous peoples (for example for livelihoods, health, nutrition, water), identified through engagement with these communities or indigenous.	Not Present

Table 18. HCV 5 Indicators

Indicator	Comments
Access to health centres or hospitals is difficult	Site is next to the main Lae-Madang Highway and accessibility to the main health centre in Mutzing or Angau General Hospital is very good.
Most houses are built from, and households tools made from, locally available traditional/natural materials	Most houses are built using permanent to semi-permanent materials.
There is little or no water and electricity infrastructure	Electricity and water resources are available in very good condition
People have a low capacity to accumulate wealth	Most villagers have other options of available to earn a cash income. People have bank accounts.
Farming and livestock raising are done on a small or subsistence scale	Most villagers are subsistence farmers however they also have other options of earning an income
Indigenous hunter-gatherers are present	Not present
There is presence of permanent or nomadic pastoralists	Not present
Hunting and/or fishing is an important source of protein and income	Hunting and fishing is now uncommon in the area
A wild food resource constitutes a significant part of the diet, either throughout the year or only during critical seasons	Not present

Table 19. HCV 5 Interpretation for Grasslands

Key Terms - Interpretation for	Indicator	Comment

Grasslands		
Grasslands providing permanent or seasonal grazing to local communities and/or indigenous peoples	• Presence of permanent or nomadic pastoralists	• There are no nomadic pastoralists present in the area
Grasslands providing wild products (game, food plants, livestock fodder, medicines, materials etc)	• Evidence of regular or critical irregular use of resources from grasslands	• Local communities do get poles for their houses and grass for the roofs of their houses from the grassland area. However, these resources are sourced from land owned by the clans. Not from the assessment area (which is devoid of trees).

Justification

In the HCV 5 survey 6 villages around the area were surveyed based in their resource use. As well as the family that has the lease on the assessment area.

The assessment is essentially private land, so anyone walking onto the land or taking anything from this land could be considered trespassing or stealing respectively. This could be prosecuted under the Summary Offences Act 1977. To determine the presence or absence of HCV 5 the assessor refers to the methodology described in the PNG toolkit (PNGFSC. (2006)). The results of the resources use interviews are summarised in Table 20. This shows that although natural resources are used by people living in the area, these resources are not taken from within the assessment area.

The main resources that are taken from the local environment are kunai grass and sak-sak (sago) leaves; these are taken from the grassland and swamps respectively. These are taken from outside the assessment area. Other resources are water which is piped into the village. A few herbs for medicine are taken from the local area, but this level of resource extraction in the area is very low. It is important to note that with the advent of oil palm these communities are moving away from subsistence farming towards a cash economy. Their main sources of income are:

- Crops grown and sold (20% of income)
- Store goods bought and sold (20% of income)
- Members with a regular income (e.g. RAIL employees) (40% of income)
- Land rentals from development (20% of income)*

Findings in the Assessment Area

The assessment area is an area of farm land that the owner of the lease currently farms to generate an income. Planting oil palm on the area is merely changing from one crop to another. Therefore **HCV 5 was deemed not present.**

**Table 20. Summary of natural resource use by both the owner of the lease on the assessment area and the villages surrounding the assessment area. **

Village Group	Carbohydrate	Fish	Meats	Vegetables	Fruits	Water	Timber as construction material	Fuel wood	Medicines	Fodder
Tumua Village	90% cultivated, 10% purchased [0]	100% purchased [0]	20% domestic, 80% purchased [0]	80% cultivated, 10% gathered, 10% purchased [1]	90% cultivated, 10% purchased [0]	100% river / taps [4]	50% natural areas, 50% bought [3]	100% gathered / ex-garden, 0% purchased [4]	5% bush medicine, 95% modern medicines [1]	100% leftovers [0]
Mitzing, Marafu and Zumra Villages	90% cultivated, 10% purchased [0]	10% caught, 90% purchased [1]	10% caught, 90% purchased [1]	95% cultivated, 5% purchased [0]	5% cultivated, 95% purchased [0]	100% river [4]	95% natural areas, 5% bought [3]	100% gathered / ex-garden, 0% purchased [4]	0% bush medicine, 100% modern medicines [0]	100% leftovers / kunai grass [0]
Ragiampun Village	70% cultivated, 30% purchased [0]	80% caught, 20% purchased [3]	20% caught, 80% purchased [1]	80% cultivated, 20% purchased [0]	20% cultivated, 80% purchased [0]	100% river [4]	60% natural areas, 40% bought [3]	100% gathered / ex-garden, 0% purchased [4]	15% bush medicine, 85% modern medicines [1]	100% leftovers / kunai grass [0]
Tzakarak Village	80% cultivated, 20% purchased [0]	5% caught, 95% purchased [3]	20% domestic, 80% purchased [1]	95% cultivated, 5% purchased [0]	95% cultivated, 5% purchased [0]	100% spring [4]	90% natural areas, 10% bought [3]	100% gathered / ex-garden, 0% purchased [4]	5% bush medicine, 95% modern medicines [1]	100% leftovers / kunai grass [0]
Umi (assessment area land owner)	5% cultivated, 95% purchased [0]	5% caught, 95% purchased [1]	10% caught, 10% domestic, 80% purchased [1]	5% cultivated, 95% purchased [0]	3% cultivated, 97% purchased [0]	100% well and rain water tanks [4]	100% bought [0]	100% gathered / ex-garden, 0% purchased [4]	5% bush medicine, 95% modern medicines [1]	100% leftovers / kunai grass /sago leaves [0]

Note on ranking[3]:

100% *If all needs are met by a single resource, the resource is regarded as extremely important, with a **score of 4.***
50-99% *If most needs are met by a single resource and few by others, the resource is regarding as very important, with a **score of 3.***
25-49% *If needs are met by several resources, each below 50%, the resources are regarded as important, with a **score of 2.***
10-24% *If needs are met from many sources, an individual source is considered of minor importance, with a **score of 1.***
0-9% *If needs are not met by the forest or other ecosystems, these sources are considered unimportant, with a **score of 0.***

The ranking is used for describing the importance of a source to provide resources for meeting the basic needs of local people. When there are not any natural forests or natural ecosystems that become sources for the communities, the score of 0 applies, meaning that they do not depend on the natural forests or ecosystems for meeting their basic needs

[3] Percentages taken from the PNG toolkit, PNGFSC. (2006).

1.6 HCV 6: Cultural Values

Table 21: HCV 6 Findings Summary

Definition	Result of HCV Assessment
Sites, resources, habitats and landscapes of global or national cultural, archaeological or historical significance, and/or of critical cultural, ecological, economic or religious/sacred importance for the traditional cultures of local communities or indigenous peoples.	Not Present

Table 22. HCV 6 Indicators

Indicator	Comments
UNESCO World Heritage Sites	Not present
Museums, heritage lists, national data sets, authorities and any organizations which specialize in particular geographic areas or cultures	
National directives concerning archaeological sites and resources	
Consultation with anthropologists, historian, archaeologists, museums and databases for identification of "sites of global or national significance"	

Table 23. HCV 6 Interpretation for Grasslands

Key Terms - Interpretation for Grasslands	Indicator	Comment
Grasslands supporting important traditional lifestyles and subsistence values dependent on the ecosystem	• Traditional communities with lifestyles dependent on particular grassland habitats	• The local communities are mostly subsistence farmers, but they don't take anything from the grassland itself (i.e. the land has to be cleared and planted with food crops).
Grasslands where the traditional management system itself has cultural	• Existence of culturally-significant management systems (i.e. cultural values that	• The management system in the surrounding area is basically that of subsistence agriculture. It has no "far reaching" cultural

value beyond the immediate community	transcend questions of livelihoods or subsistence)	values. Within the assessment area the agricultural system is that of industrial agriculture
Grasslands supporting important sacred or faith-based values	• Presence of sacred natural sites or sacred landscapes	• There are no such sites in the assessment area nor the surrounding landscape.
Grasslands important to national cultural identity	• Presence of iconic sites or landscapes	• There are no such sites in the assessment area nor the surrounding landscape.

Justification:
Through consultations and one-on-one interviews of the landowners and local villagers it was found that no sites of cultural importance were found within the assessment area. There were a total of six local villages consulted on this issue as well as the owner of the Umi Bridge lease.

Findings in the Assessment Area
There is nothing of cultural importance found in the assessment area. Therefore **HCV 6 was deemed not present.**

Stakeholder Consultation

During the HCV Assessment, consultation was carried out with stakeholders who will be directly or indirectly affected by the proposed project. Consultation focused on opinions and concerns about the proposed oil palm project. This included discussions on current and potential environmental issues that affect local communities. As well as potential benefits the local communities were likely to receive as a result of the project.

At the Umi Bridge project site one-on-one interviews were conducted with Baing family members who are the sole owners of the lease to Portion 8.

A series of one-on-one interviews were also conducted with:

- respective District Administrators (DA) discussing environmental issues facing the District. In the case of Umi Bridge, the sitting DA for Markham District was consulted at the DA office in Mutzing.
- the Council Manager was consulted for the Umi Local Level Government. A letter is provided in Annexure 16.
- CEPA (Conservation and Environmental Protection Authority). A letter is provided in Annexure 17. The main focus of this was discussing threats caused by this development and associated management and monitoring required.

Additionally, environmental NGOs were sought for comment and input, however there are no environmental NGOs operating in this area. Save PNG, an NGO that makes videos about cultural related issues was asked to contribute. They supported this development from the point of view of additional employment and economic opportunity. (See email Annexure 15).Table 24 shows a list of people / organisations consulted.
Combined with the social surveys, people in the local villages were surveyed also. The results are presented in Table 25.

Table 24: List of Stakeholder Consultation

Organization / Date	Name	Recommendations/Concerns	Responses to HCV related concerns
Markham District Administrator / May 2016	Mr. John Orebut	- Welcomed project and highlighted spin-off benefits that locals can receive as a result. - Concerned about the area surrounding project area being prone to flooding causing effects destruction of gardens. - Concerned about the Dumpu area being entirely owned by the state leaving limited land for local villagers to utilize. Also making it hard for villagers to engage in VOPs. - Concerned about fire and burning of dry grass and bush area.	- A general figure for subsistence agriculture is 0.5 ha / person. In actual fact the Markham Valley is very sparsely populated and the utilisation of land is still very low. So the concept of scarcity of land is not true. - NBPOL is also concerned about the constant use of fire by local people and is undertaking awareness raising to try to discourage burning.
Portion 8 (Umi Bridge) / May 2016	Mrs Jennifer Waiko (from the family that own the lease over the land)	- Concerned that there might not be enough land for family to use - Concerned that oil palm may not give the same income as other agriculture projects	-
Save PNG Inc (local NGO) 21/11/17	Bao Waiko (See email Annex 15)	- Felt that expansion of oil palm onto this area would provide much needed employment in the area. - The developer would undertake development in a sustainable manner. - The grassland landscape of Portion 8 with well drained soils, minimal wildlife and no native forest vegetation make the area an ideal environment to develop a responsible and sustainable Oil Palm plantation.	- No concerns expressed. - (see full email in Annexure 15)
23/11/17 Council	Aporo Nainan	- Stated that he could see no environmental consequences	- Minutes of Meeting are in Annexure 16

Manager Umi Local Level Govt.		of the project. He pointed out that Ngaru, further upstream, was operated by NBPOL. Ngaru was a much larger scale project and there had been no problems. - He could see no social consequences of this project and hoped it would offer local employment.	
Conservation and Environmental Protection Authority	Michael Wau	- Michael stated that he felt from his observation of the Ngaru block upstream that the environmental impacts would be negligible based on a 100m buffer. - CEPA would not require water testing.	- Discussed the possible impacts of the Umi Bridge development. - Asked what water monitoring was required. - (See letter in Annexure 18)

Table 25. Stakeholder consultations were carried out at these villages. Attendance lists are provided in Annexure 7.

Village Name	Date	No. Attendees	Concerns / Comments
Mitzing, Marafau, Zuma	4.8.17	24	These 3 villages moved to the Umi market area in 1988. This is government land. They were forced to move after landslides destroyed their villages in the mountains. They grow crops on areas around the village. A map of the assessment area (with the proposed HCV area) was shown to the people. There are oil palm plantations in the area (so all people know about oil palm). There were no questions or comments about changing the assessment area to oil palm.
Ragiampun	3.8.17	17	These people described their life which involves subsistence farming and catching fish in the river. There are plenty of fish in the river. A map of the assessment area (with the proposed HCV area) was shown to the people. There are oil palm plantations in the

			area (so all people know about oil palm). There were no questions or comments about changing the assessment area to oil palm.
Tzakarak	3.8.17	18	These people described their life which involves subsistence farming. They do not eat pigs or bandicoots (because they are Seventh Day Adventists), only chickens. The chickens are raised in the village. A map of the assessment area (with the proposed HCV area) was shown to the people. There are oil palm plantations in the area (so all people know about oil palm). There were no questions or comments about changing the assessment area to oil palm.
Baing Family	2.8.17	5	These people own the assessment area and employ 6 people to run the land. They want it changed to oil palm. They have already looked at it thoroughly and just want it to go ahead now.

Additionally, 2nd August 2017 a public consultation was held with the family that own the lease. A map of the potential HCV area was shown (**Error! Reference source not found.**). o objection to this was raised.

3.3 Soil and Topography

The parent material of the soils in the Ramu-Markham valley intersection area is alluvium.

Hapludolls were previously grouped as young alluvial soils, well drained old alluvial soils, moderately well drained alluvial soils, brown forest soils and immature soils on sedimentary rocks. These are slightly to moderately weathered soils common in the lowlands below 1000m. They are the most common types of soils in flat to very gently undulating terrain such as plains, fans and ridge crests. Their single largest occurrence is on the more stable surfaces of the Markham Valley and Upper Ramu Valley (Bleeker, 1983). Current landuse includes well suited for arable crops, tree crops, pastures and wetland rice cultivation. In the Markham Valley these soils are being extensively used for grazing, while in the Upper Ramu Valley much of the Gusap Sugar estate is developed on this type of soils.

Table 26; Soil Classification of Umi Bridge

Soil classification	Description	Area
Gusap Series	Less than 30cm of black to dark brown loam over gravely alluvium (aka Gusap series)	54
Shallow loam	30-55cm of black to dark brown loam over gravely alluvium (aka Sankian Series)	189
Deep loam	About 40cm of loam to clay loam over typically 60-70cm of brown or pale sandy or clay loam (with occasional gravely layers). Underlain by gravely alluvium (aka Dumpu and Damil Series)	120

Marginal or Fragile Soils

There were no marginal or fragile soils identified within the area to be converted to oil palm.

Identification of all areas of excessive gradients

There were no areas of excessive gradients identified within the area to be converted to oil palm.

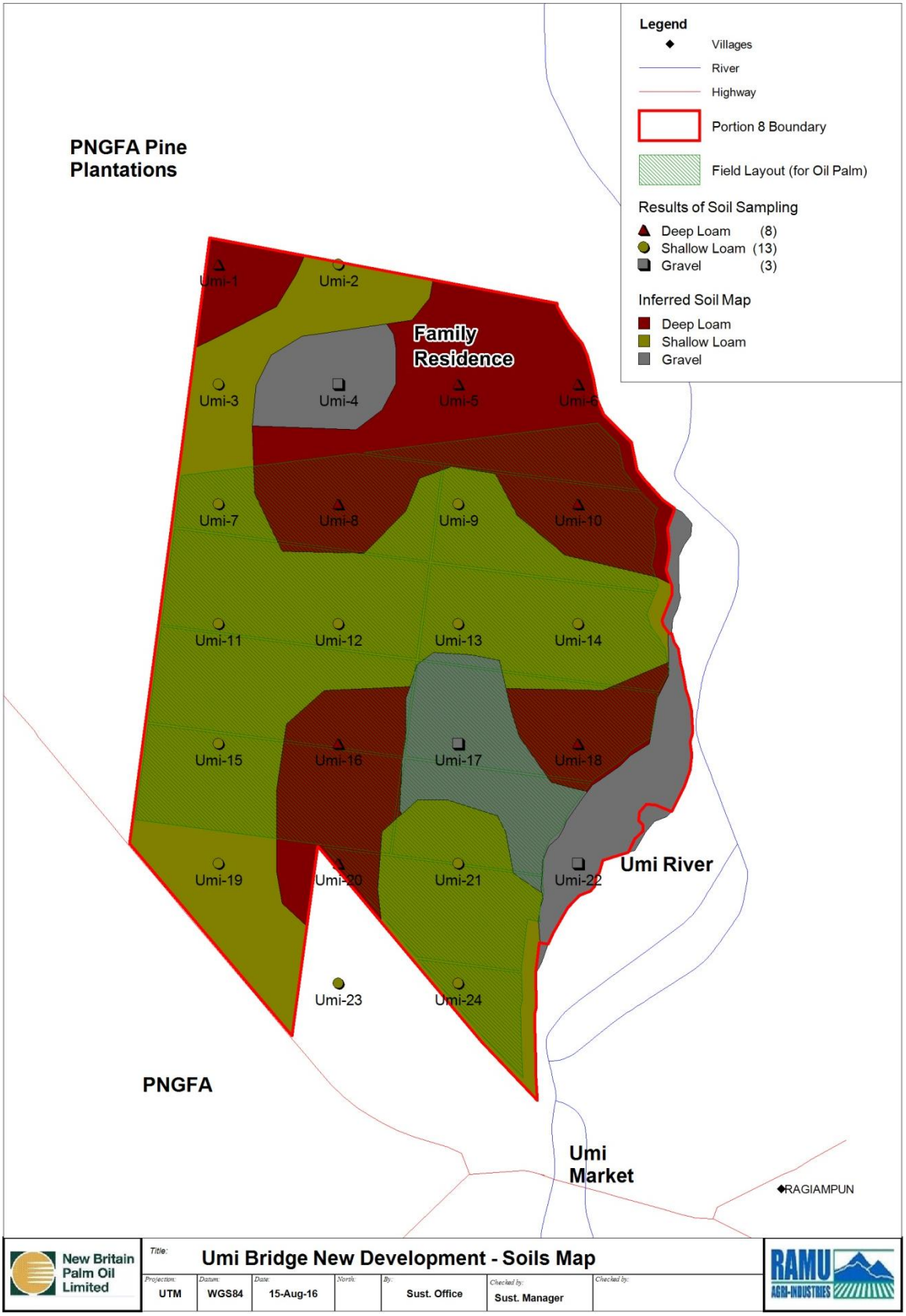


Figure 9; Soil map of Umi Bridge

3.4 Summary of Carbon Stock Assessment and GHG Emissions

Land cover stratification

The High Carbon Stock Assessment and Land Use Change Assessment conducted for the Umi Bridge area concludes that the entire area is considered a grassland. The area holds a standing Carbon stock of 18.2 tC/ha.

This is not seen to be an impediment to development of the site for oil palm which will result in a significant increase in standing carbon over the lifespan of the first oil palm planting. There are no peat soils within this area. A land cover analysis analyzing tree cover at the year 2000 and tree cover loss and gain since then. It shows that the entire area has been static grassland since then with minimal change in tree cover.

Map and description of all areas of significant carbon stocks including areas of peat soils

There were no areas of significant carbon stocks or peat soils identified in the proposed new planting area.

Identification of all likely significant sources of GHG emissions and sequestration related to the proposed development

A GHG Analysis was conducted for the proposed development at Umi Bridge by NBPOL. The study summarizes recommendations of the High Conservation Value and High Carbon Stock Assessments conducted there and provides guidance to company executive management to mitigate the GHG impact of this particular development.

2 Scenarios were tested

1) Full planting of the site with protection of 30.5ha of HCV
2) Same site conditions with methane capture and electricity generation on mill (long term budget plan)

Table 27; Description of development scenarios

		Sc1	**Sc2**
Areas avoided from development	HCV		
	HCS		
	Other set-aside	30.5	30.5
Development area	Primary Forest	0	0
	Disturbed Forest	0	0
	Shrub land	0	0
	Grassland	245	245
POME treatment	Conventional	Yes	
	Methane capture		Yes

While the results clearly highlighted the potential benefits of methane capture systems for POME treatment, the costs do not currently justify the construction of a methane capture system at Gusap Palm Oil Mill.

The optimal development scenario is Scenario 1; full development of the site with full protection of the HCV and continued use of a conventional POME treatment system.

Emissions estimations were made using the "New Development GHG Calculator" (RSPO-PRO-T04-003 V2.0 ENG). The calculator was populated with previous years data for the mill to which the proposed crop will be delivered to. It was assumed that the entire development will take place within one year. It also assumed all existing plantations will be replanted in the first year.

Synthesis Reports:
The following table summarizes the net tCO2e/t of palm products of the proposed development (Scenario 1) as part of the existing operations of RAIL.

Table 28; GHG Calculator Synthesis Summary Report

Field emissions & sinks (Assumes vigorous growth for oil palm - for use by large scale operations)			
	t CO_2e	t CO_2e/ha	t CO_2e/t FFB
Land clearing	**179.63**	**0.77**	**0.03**
Crop sequestration	**-2,174.05**	**-9.36**	**-0.39**
Fertilisers	**129.17**	**0.56**	**0.02**
N2O	**197.29**	**0.85**	**0.04**
Field fuel	**8.69**	**0.04**	**0.00**
Peat	**0.00**	**0.00**	**0.00**
Conservation credit	**-76.25**	**-0.33**	**-0.01**
Total	**-1,735.51**	**-7.47**	**-0.31**

Mill emissions & credit	tCO_2e	t CO_2e/ha	tCO_2e/tFFB
POME	**1,092.49**	**4.70**	**0.20**
Mill fuel	**191.28**	**0.82**	**0.03**
Purchased electricity	**61.08**	**0.26**	**0.01**
Credit (excess electricity exported)	**0.00**	**0.00**	**0.00**
Credit (sale of biomass for power)	**0.00**	**0.00**	**0.00**
Total	**1,344.85**	**5.79**	**0.24**

Total emissions, tCO_2e (field and mill)	**-391**
Allocation:	
t CO_2e/t CPO	**-0.25**
t CO_2e/t PK	**-0.25**

Note that all calculations are made available through the RSPO calculator utilized.

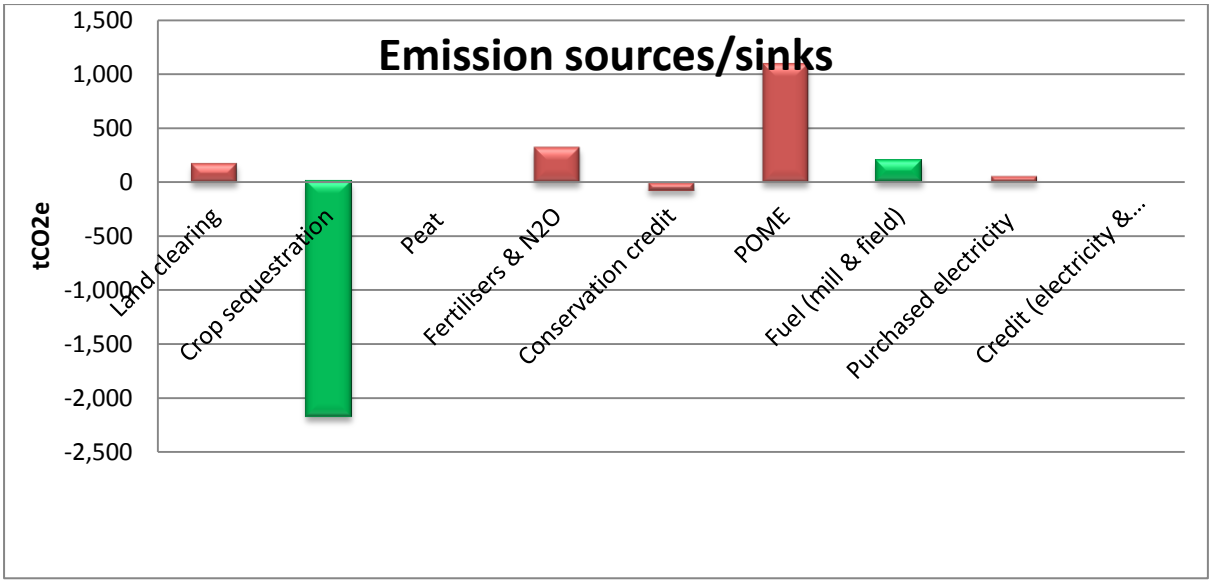


Figure 10; Graph indicating the relative sources and sinks of Carbon

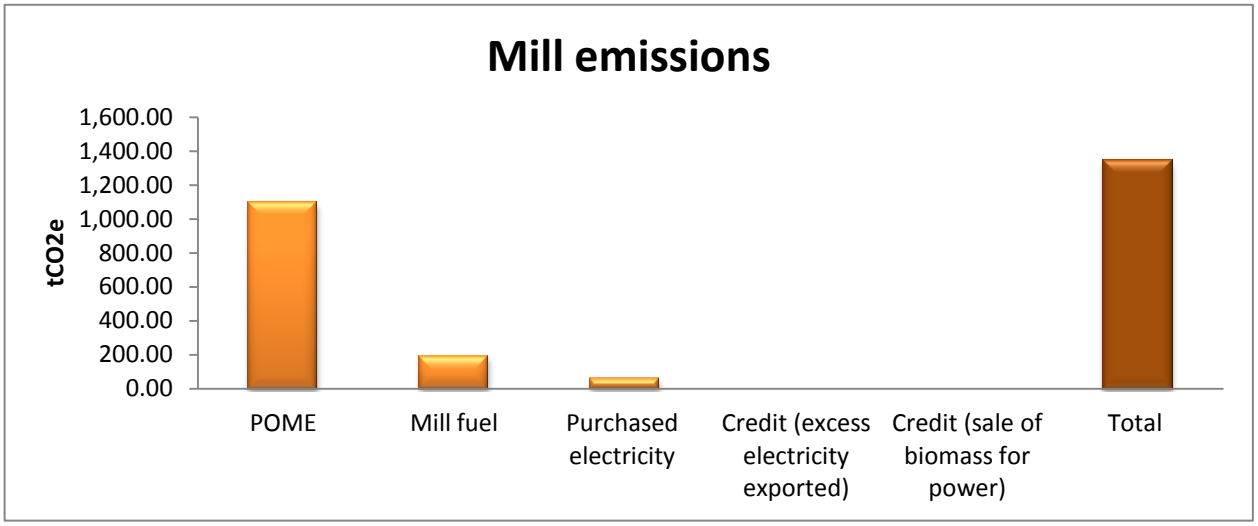


Figure 11; Graph indicating the relative Mill Emissions of Carbon

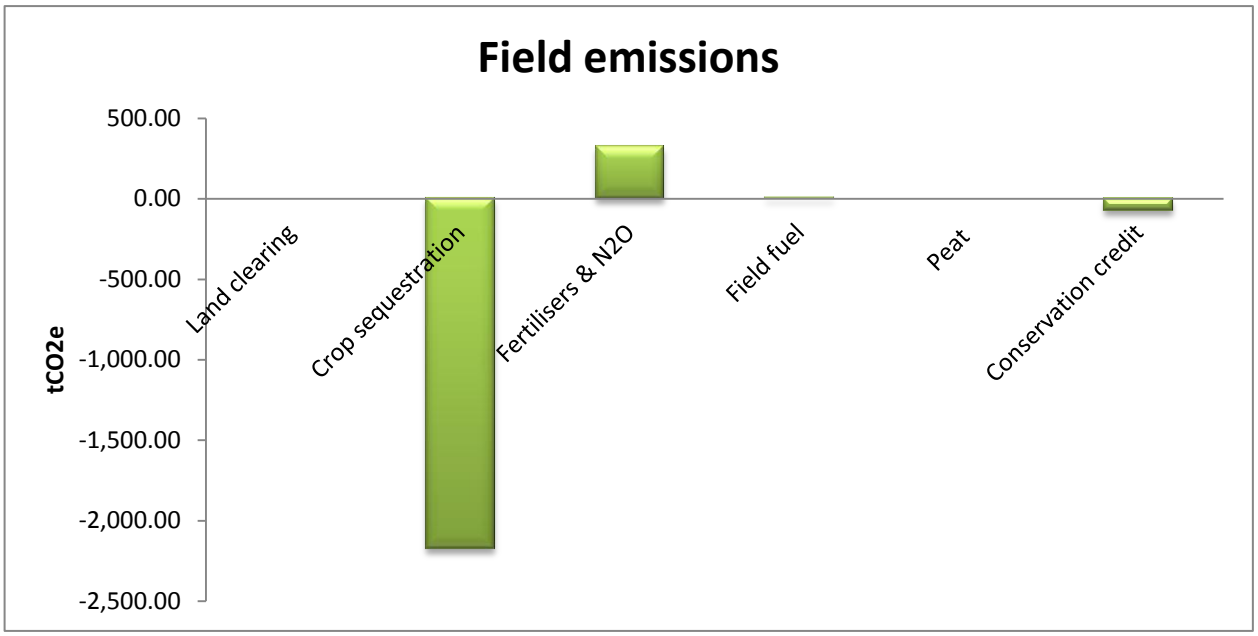


Figure 12; Graph indicating the relative Field Emissions of Carbon

Results and Discussion

In general, the current landuse of the site presents an extremely low carbon option for oil palm development and contributes to lowering the average GHG impact across NBPOL's operations. As per the above, the dominance of grassland on the site indicates a net sequestration of carbon over the first planting cycle of this development.

It is recognized however that the existing operations, especially the mill POME still produces most of the GHG emissions. NBPOL has committed to fitting all of its viable mills with biogas plants pending availability of funding to do so. Due to the financial nature of this investment it is not possible to put a date upon this plan. Reduction in fertilizer use through application of mill residues will also be explored where viable.

However it is recognized that the preferential identification of grasslands over forested lands as an important component of NBPOL's overall commitment to reducing emissions is by itself a robust emissions reduction strategy.

3.5 LUC Analysis

The analysis confirms the findings by Douglas Environmental Services, namely that the proposed development is a grassland, and has been so for as long as recorded history.

As mentioned the land use change analysis concludes that there were no primary forests within the proposed development area before November 2005. The study demonstrates that there has been negligible tree cover loss or gain within the period of 2000 to 2015. This confirms the findings of the HCV assessment and local knowledge of the area.

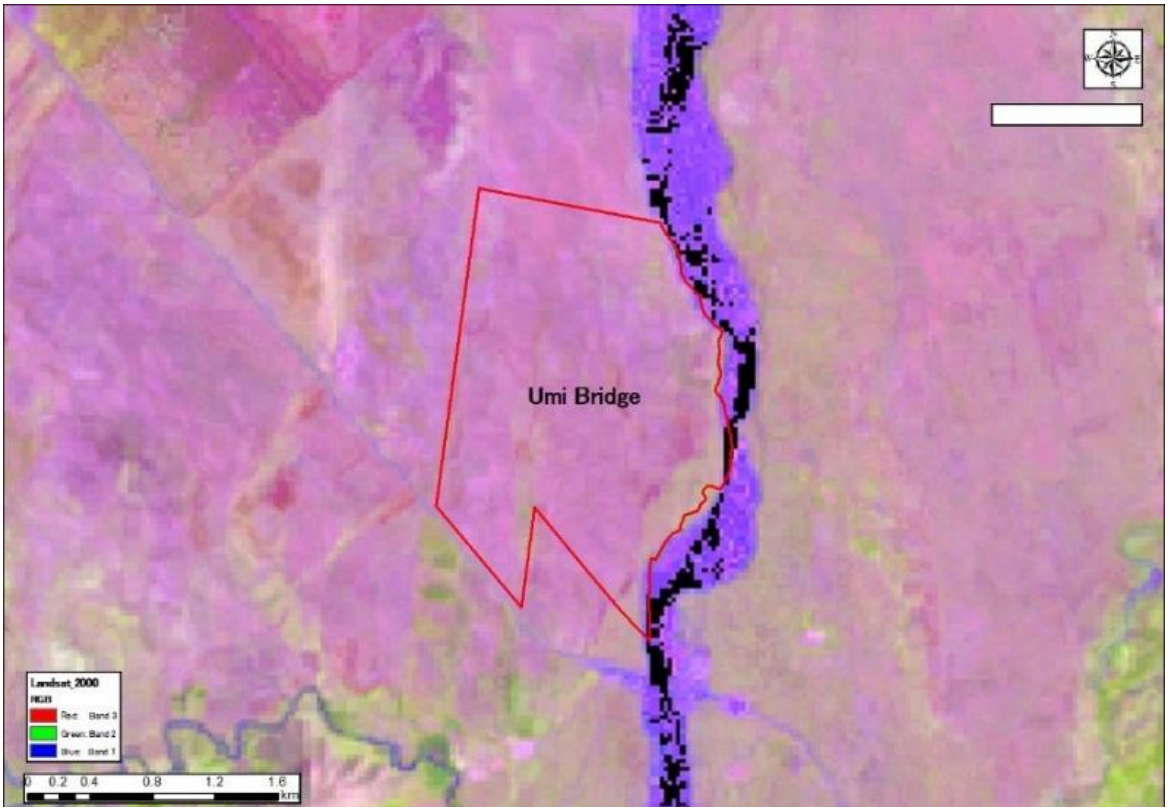


Figure 13; Umi Bridge in the year 2000

As can be seen in Figure 13, the entire area was under grassland at 2000. This is evidence by the pink colour which is indicative of high infrared radiation due to bare ground. A picture of the same area taken from the greenest pixels available from land Sat in 2015 (Figure 14) reveals a very similar land use within the proposed development area. The table below highlights only a minor change in treecover (0% tree cover representing grassland) between 2000 and 2015 relating to ongoing activities on the land by the occupants. The growth of the adjacent pine and teak plantation is the most obvious change in landuse.

SITE NAME	AREA (ha)	Tree canopy cover										
		0%	0-10%	10-20%	20-30%	30-40%	40-50%	50-60%	60-70%	70-80%	80-90%	90-100%
2000	361.8	355.39	2.64	3.32	0	0	0.30	0.15	0	0	0	0
2015	361.8	355.48	2.64	3.32	0	0	0.21	0.15	0	0	0	0

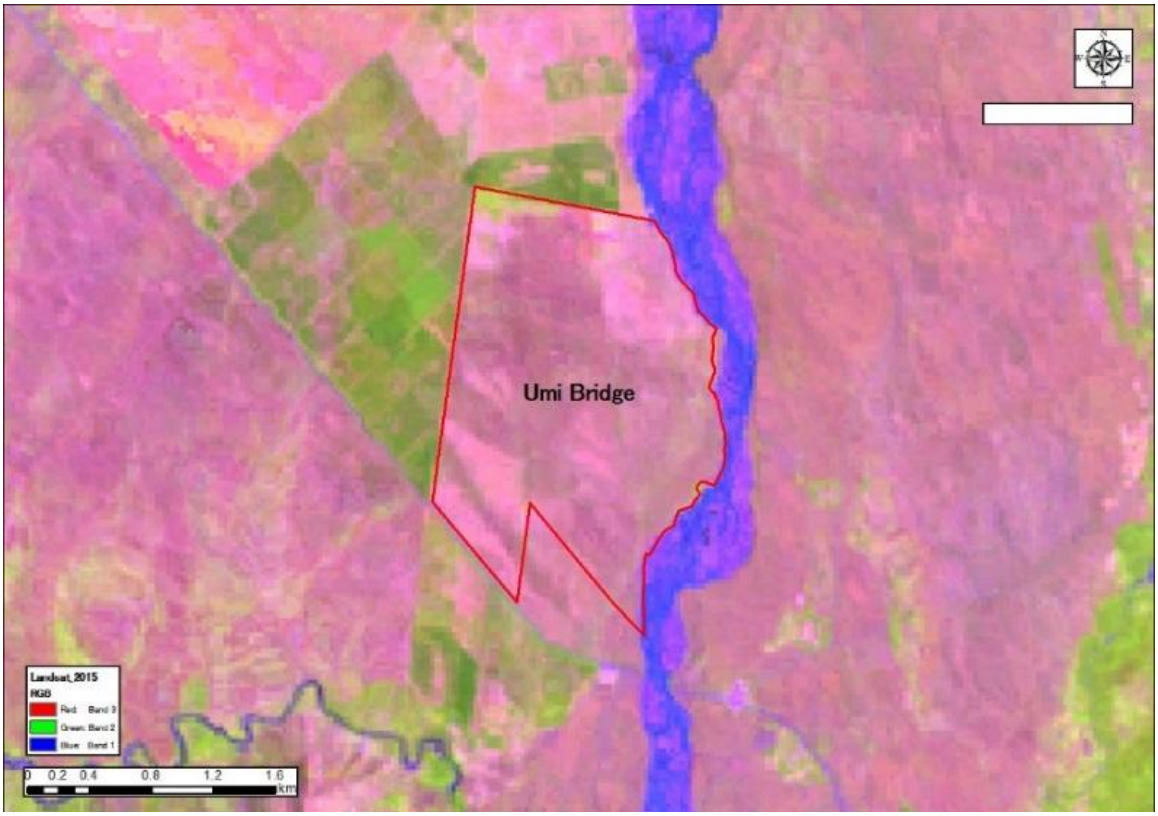


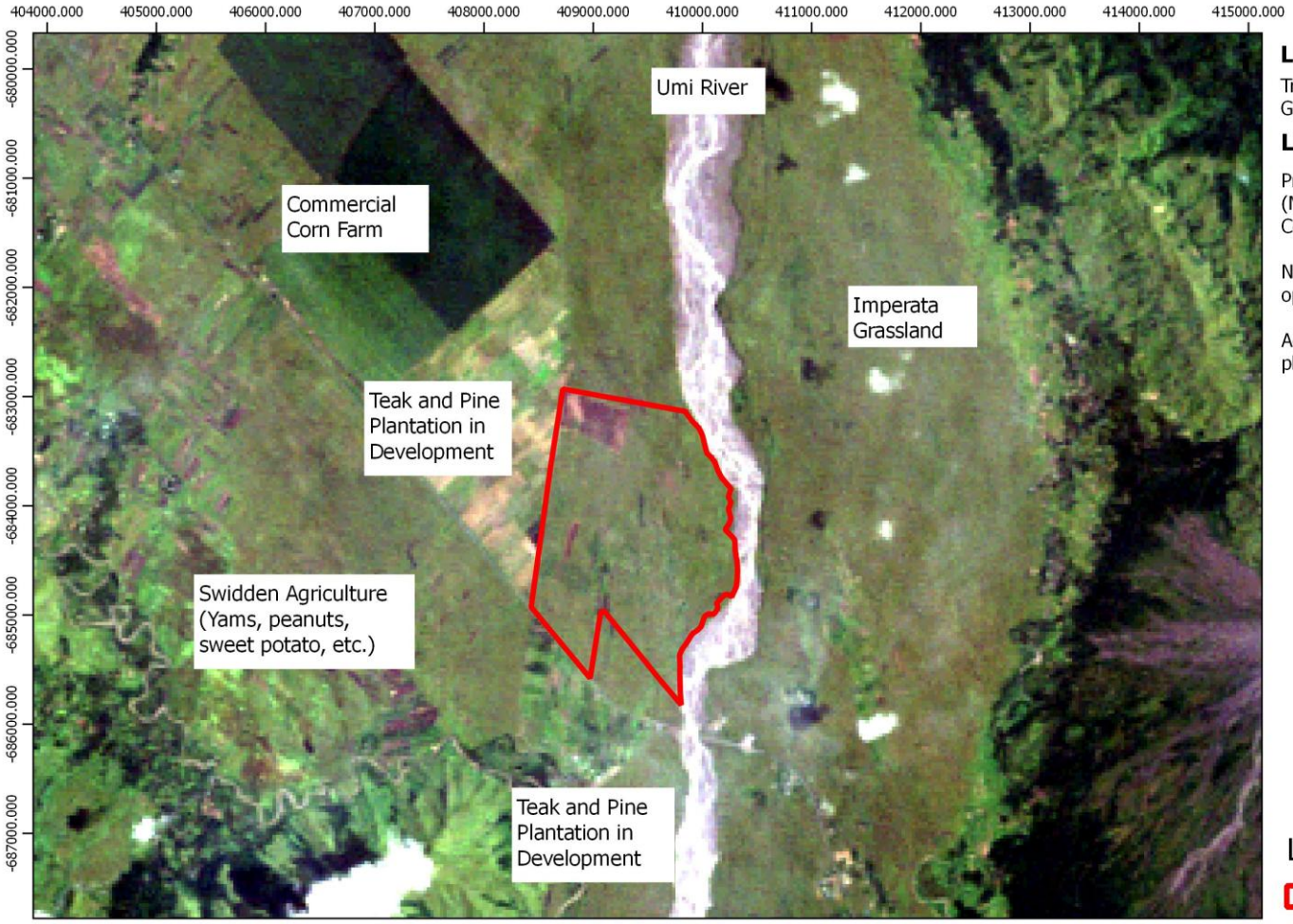
Figure 14; Umi Bridge in the year 2015

The Additional Maps referred to in Section 2.5 are shown on the following pages. The 4 maps relate to the 4 time periods, and a fifth map indicates the Hansen Tree Loss data set (V1.4) that provide a further verification of the landuse change in the site and surrounding landscape.

Conclusion

As per the analysis presented it is evident the proposed new plantings will not replace primary forest, or any area required to maintain or enhance one or more High Conservation Values (HCVs), since November 2005.

Given the above findings, it is clear that there is no Compensation Liability for the site



Landuse on site

Treecover = 0%
Grassland = 100%

Landuse Commentary

Preparation of a small site (NW Corner) for planting of Cocoa and shade crop

Nearby Corn Farm is fully operational

Adjacent Teak and Pine plantation in development

Legend

Umi Bridge Site

N

Umi Bridge Land Use Change Analysis - 2004

1 0 1 2 3 4 km

Satellite Image date: 23rd February, 2004
Data: LandSat 5 RGB Image
Pixel Size: 30m
Coordinate Reference System: WGS84 / UTM 55S
Scale: 1:50,000
Data Downloaded from USGS 19th January 2018
Map prepared by Will Unsworth, NBPOL on 19th January 2018

Landuse on site

Treecover = 0%
Grassland = 100%

Landuse Commentary

Cocoa and shade crop planted in NW Corner now abandoned. Signs of fire damage on East side of Site

Nearby Corn Farm is fully operational

Teak and Pine plantation is expanding to the North of the Site

Garar Land (opposite side of Umi River) has been utilised for swidden agriculture

Legend

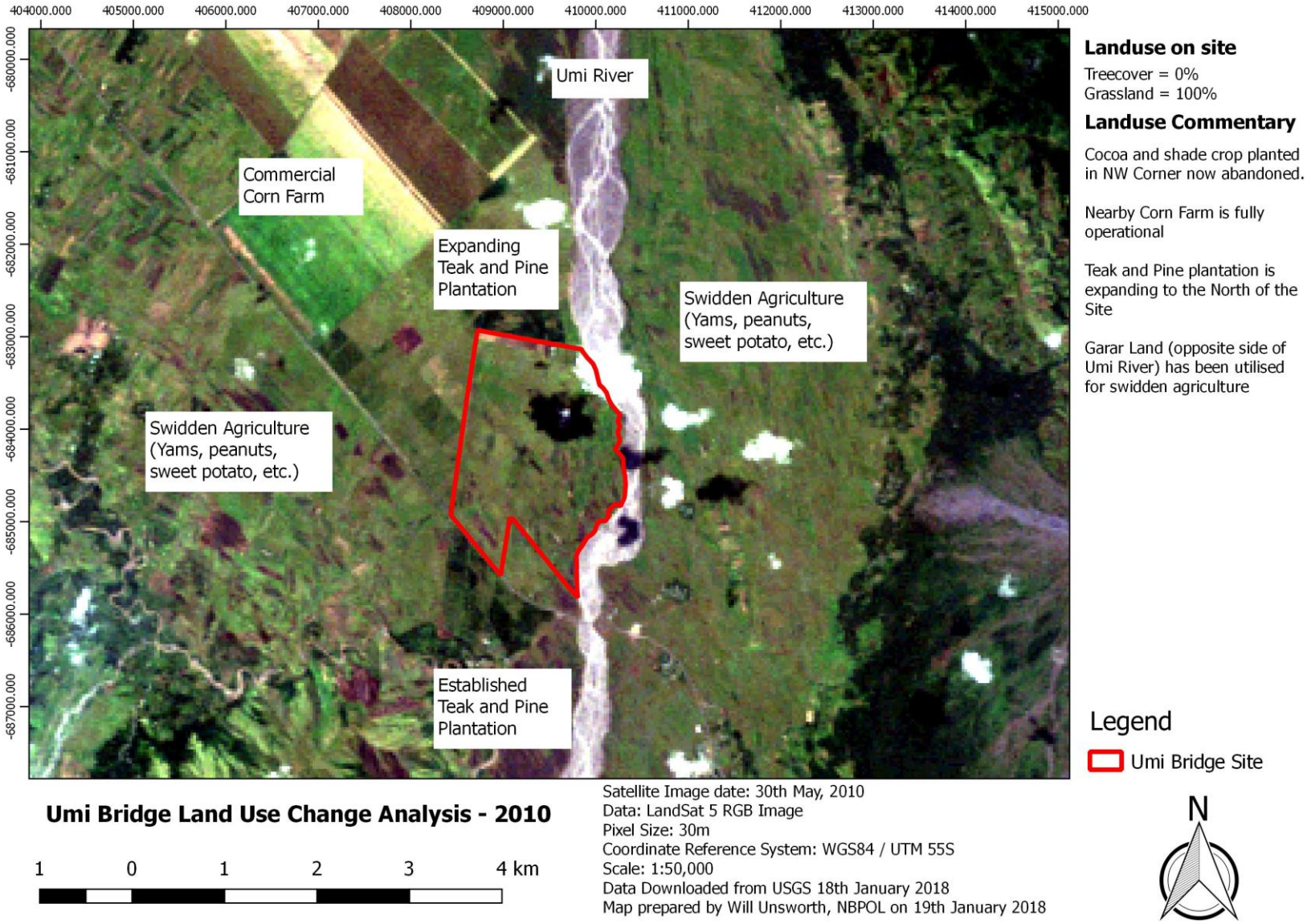
Umi Bridge Site

N

Umi Bridge Land Use Change Analysis - 2009

1 0 1 2 3 4 km

Satellite Image date: 28th June, 2009
Data: LandSat 5 RGB Image
Pixel Size: 30m
Coordinate Reference System: WGS84 / UTM 55S
Scale: 1:50,000
Data Downloaded from USGS 18th January 2018
Map prepared by Will Unsworth, NBPOL on 19th January 2018



Landuse on site

Treecover = 0%
Grassland = 100%

Landuse Commentary

Cocoa and shade crop planted in NW Corner now abandoned.

Nearby Corn Farm is fully operational

Teak and Pine plantation is expanding to the North of the Site

Garar Land (opposite side of Umi River) has been utilised for swidden agriculture

Legend

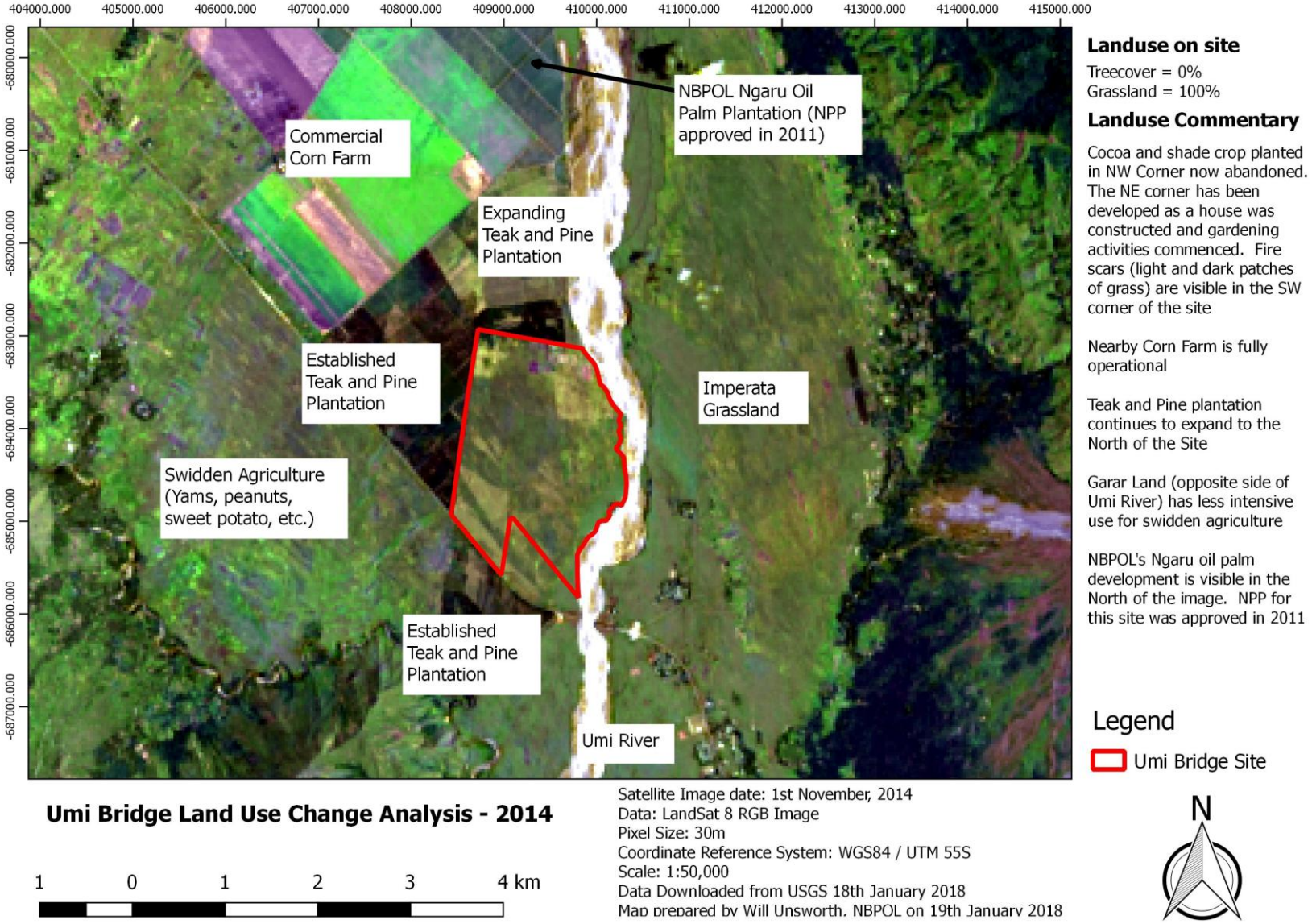
Umi Bridge Site

N

Umi Bridge Land Use Change Analysis - 2010

1 0 1 2 3 4 km

Satellite Image date: 30th May, 2010
Data: LandSat 5 RGB Image
Pixel Size: 30m
Coordinate Reference System: WGS84 / UTM 55S
Scale: 1:50,000
Data Downloaded from USGS 18th January 2018
Map prepared by Will Unsworth, NBPOL on 19th January 2018



Landuse on site

Treecover = 0%
Grassland = 100%

Landuse Commentary

Cocoa and shade crop planted in NW Corner now abandoned. The NE corner has been developed as a house was constructed and gardening activities commenced. Fire scars (light and dark patches of grass) are visible in the SW corner of the site

Nearby Corn Farm is fully operational

Teak and Pine plantation continues to expand to the North of the Site

Garar Land (opposite side of Umi River) has less intensive use for swidden agriculture

NBPOL's Ngaru oil palm development is visible in the North of the image. NPP for this site was approved in 2011

Legend

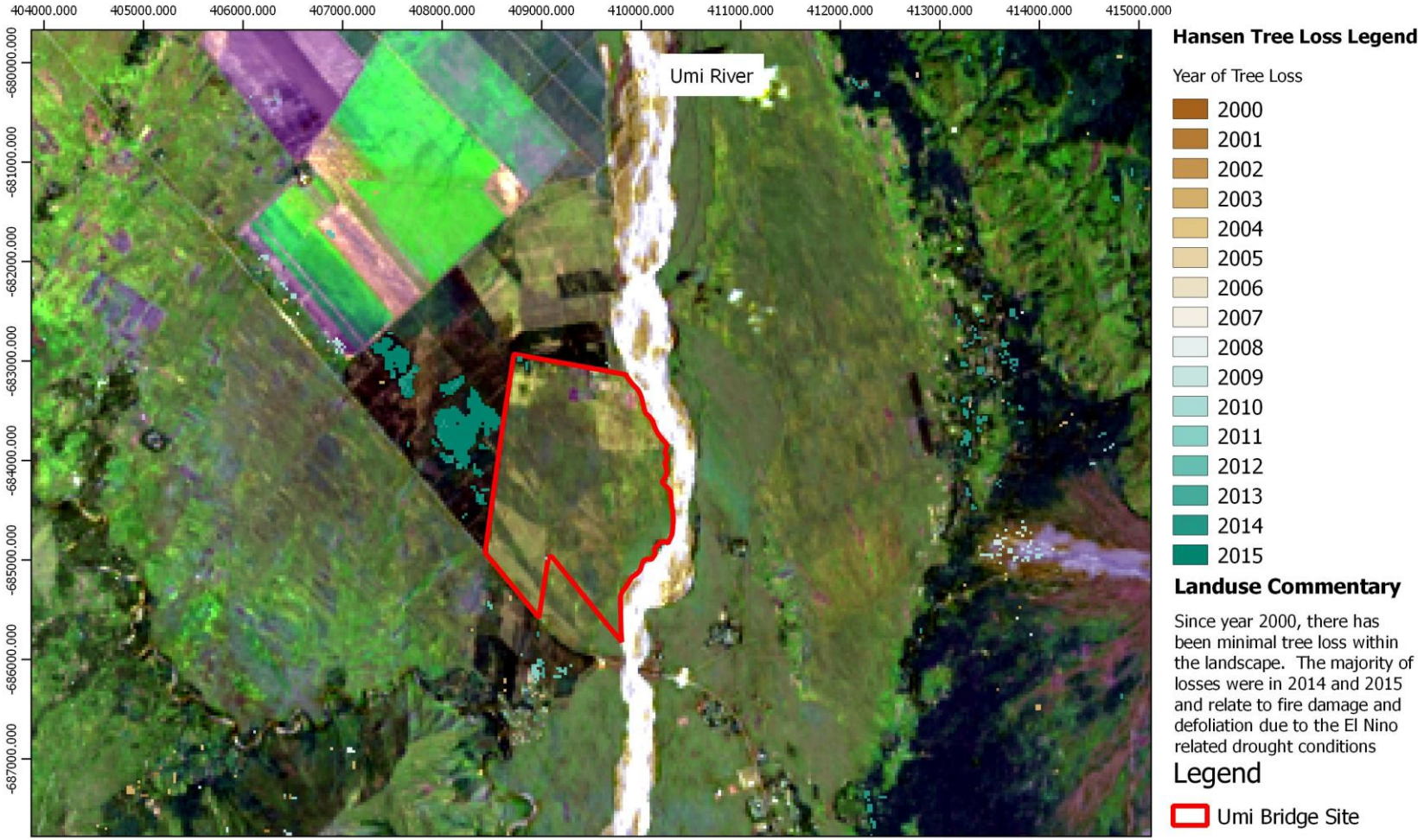
Umi Bridge Site

N

Umi Bridge Land Use Change Analysis - 2014

1 0 1 2 3 4 km

Satellite Image date: 1st November, 2014
Data: LandSat 8 RGB Image
Pixel Size: 30m
Coordinate Reference System: WGS84 / UTM 55S
Scale: 1:50,000
Data Downloaded from USGS 18th January 2018
Map prepared by Will Unsworth, NBPOL on 19th January 2018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-680000.000
-681000.000
-682000.000
-683000.000
-684000.000
-685000.000
-686000.000
-687000.000
Umi River
Hansen Tree Loss Legend
Year of Tree Loss
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
Landuse Commentary
Since year 2000, there has been minimal tree loss within the landscape. The majority of losses were in 2014 and 2015 and relate to fire damage and defoliation due to the El Nino related drought conditions
Legend
Umi Bridge Site
N
Umi Bridge LUCA - Hansen Tree Loss Data
1 0 1 2 3 4 km
Satellite Image date: 1st November, 2014
Data: LandSat 8 RGB Image and GFC 2000-2016 data (v1.4)
Pixel Size: 30m
Coordinate Reference System: WGS84 / UTM 55S
Scale: 1:50,000
Data Downloaded from GCF 9th January 2018
Map prepared by Will Unsworth, NBPOL on 19th January 2018

3.6 FPIC process

The SEIA concludes that Ramu Agri Industries has complied with FPIC since its initial response to the expressions of interest lodged by the landowners. The SEIA recommends that this engagement is maintained and verify that the landowners fully understand the terms and conditions of the sub-lease agreement before endorsing it. It is concluded that the landowning family is allocating the Umi Bridge grassland to RAIL for estate development for mostly positive impacts including revenue generation.

The SEIA provides documentary evidence that Ramu Agri Industries shows it has an adequate process of Free and Prior Informed Consent in place and local people are fully part of the process. Ramu Agri Industries as part of the New Britain Palm Oil Group adheres to the principles and process set forth in the Lands and Mini Estate Guidelines: Land Acquisition (MG21). These guidelines set forth the principles of NBPOL's land acquisition modus operandi, it establishes the professional relationship with a landowner group who wish to mobilise their under-utilised arable land for the planting of estate oil palm and to facilitate this by the signing of a formal Sub-lease Agreement between the landowning family and NBPOL.

4. Summary of Management Plans

4.1 Team responsible for developing management plans

The NBPOL Group and Ramu Agri Industries Sustainability and Plantation Department are responsible to implement the mitigation and management recommendations summarized in this report.

In addition, the management plans were discussed with the PNG Conservation and Environmental Protection Authority, as well as Save PNG; a local NGO. Local Government officials were also consulted with regards to the assessments and management plans. Correspondence with these stakeholders is contained within the HCV Assessment.

Table 29; Internal responsibility for management plans

Position	Responsibility
Sustainability Manager	Ensure communication of management recommendation to all relevant Managers.
	Facilitate compliance to management recommendation through provision of training and technical support.
	Monitor and report implementation of management recommendations through regular inspections.
Estate Manager and Oil Palm Field Manager	Ensure all management recommendations as communicated by Sustainability Manager and this report are implemented.
Head of Oil Palm Department	Ensure all resources as necessary are provided to Plantation staff to implement the management recommendations.
Group Sustainability Manager	Ensure annual monitoring reports are reviewed and compliant to the management plans within this report.

	Implement remote sensing monitoring utilizing a platform as recommended, i.e./Open Foris, Collect Earth.

4.2 Elements to be included in management plans

HCV Management Plan

The recommendations for maintaining and enhancing the HCV encountered are based on the co-management model. The following table summarizes the management and monitoring recommendations as per the HCV report.

Table 30; HCV & HCS Management and mitigation Plans

HCV	Threat	Management Recommendations	Monitoring Recommendations
1	This HCV is absent in the assessment area		
2	This HCV is absent in the assessment area		
3	This HCV is absent in the assessment area		
4	• Settlers • Fire	• Planting trees in the river buffer. If the land is seen to be occupied (i.e. by trees) people will not settle there. Similarly, grass is a much higher fire risk than trees.	• Continuously monitor the area and if people move in, move them away before a community gets established.
4	• River bank erosion • Agricultural chemicals entering the river and water table caused by run-off from the plantation.	• Compliance with RSPO guidelines. Setting agricultural development back 100m from the river bank. • Discouraging community agricultural development in the riparian buffer. • Planting trees in the river buffer to stabilise the buffer as best possible.*	• At time of planting, monitor the distance between the river and the OP. • Monitoring any encroachment into the river buffer through monthly patrols. • The Umi River is a large fast flowing river and the border with the planted area is only 1500 – 2000m – so any effects of chemicals entering the water are unlikely to be detected. Also there are no drainage canals likely to be coming off the assessment area.
5	This HCV is absent in the assessment area		
6	This HCV is absent in the assessment area		

'* On the western and northern side of the assessment area there is a plantation of pines and teak trees. Both stands appear to be growing well. The land on the lower terrace (in the HCV area) is very stony, and not suitable for oil palm. It is likely this area would be more suitable for a tree plantation. This would serve to stop chemical runoff and stabilise the river banks.

SEIA Management Plans

The monitoring and management actions laid out in the table above are aimed at mitigating negative environmental and socio-economic impacts and maximising positive outcomes. The successful implementation of these actions requires the support and close oversight of RAIL management.

All of these management recommendations are summarized in the below table:

Table 31; SEIA Management and Mitigation Plan

No	Aspect/Activity	Potential Impact/s	Relevant RSPO Principles and Criteria	Mitigation measure/s	Performance indicator/s	Monitoring period/ frequency	Persons responsible for mitigation and monitoring
A	**SITE PREPARATION AND OIL PALM PLANTING PHASE**						
1	Detailed survey of entire lease area and demarcation of buffer zones, oil palm plots, access roads and drainage	Buffer zones not appropriately demarcated.	2.1, 4.2, 4.3, 4.4, 5.2, 7.3 & 7.4	Ensure buffer zones are appropriately demarcated.	Buffer zones are appropriately demarcated.	Before site preparation, then monthly through to start of operation phase and six monthly thereafter.	Sustainability Manager (SM) and Plantation Manager (PM)
		Oil palm plots, access roads and drainage not sited to minimize environmental degradation.	2.1, 4.2, 4.3, 4.4, 5.1, 5.2, 5.3, 7.2, 7.3 & 7.4	Ensure plantation works are positioned so that environmental impacts are minimal.	Plantation works are positioned so that the environmental impact is minimal.	Before site preparation, then monthly through to start of operation phase and six monthly thereafter.	SM and PM
2	Direct employment and contractual engagement for site preparation, construction of roads and drainage as well as oil palm planting.	Priority for employment and contractual work not given to nearby villagers.	2.1, 4.7, 4.8, 6.1, 6.5, 6.11 & 7.1	Give priority for employment and contractual work to nearby villagers. .	Priority for employment and contractual work given to nearby villagers.	Prior to start of site preparation.	PM and SM
		Employees not advised of their terms and conditions of employment, not adequately trained and not provided with appropriate PPE.	2.1, 4.7, 4.8, 6.1, 6.5, 6.11 & 7.1	Advise all employees of their terms and conditions of employment, train them and provide appropriate PPE	All employees advised of their terms and conditions of employment, trained and provided with appropriate PPE.	Prior to start of site preparation.	PM and SM
3	Reforestation where necessary of buffer zones.	Some buffer zones not reforested where necessary.	2.1, 4.2, 4.3, 4.4, 5.2, 7.3 & 7.4	Ensure buffer areas are reforested where necessary.	Buffer zones not reforested as required.	Before site preparation, then monthly through to start of routine operation phase	SM and PM

No	Aspect/Activity	Potential Impact/s	Relevant RSPO Principles and Criteria	Mitigation measure/s	Performance indicator/s	Monitoring period/ frequency	Persons responsible for mitigation and monitoring
						and six monthly thereafter	
		Clear and legible signage in English and Tok Pisin not erected alongside buffer zones.	2.1, 4.2, 4.3, 4.4, 5.2 & 7.3	Install sufficient, clear and legible signage in English and Tok Pisin on restrictions within the buffer zones.	Sufficient, clear and legible signage in English and Tok Pisin on restrictions within the buffer zones and conservation reserves installed.	Before site preparation, then monthly through to start of routine operation phase and six monthly thereafter	SM and PM
		Enhancement of local flora in the buffer zones.	2.1, 4.2, 4.3, 4.4, 5.2 & 7.3	Enhance variety of local plant species in each buffer zone.	Inventory of local plant species in each buffer zone is enhanced.	Before site preparation and then six monthly thereafter	SM and PM
		Reduced soil erosion and siltation of nearby surface water bodies.	2.1, 4.2, 4,3, 4.4, 5.3, 7.2 & 7.3	Monitor soil erosion and siltation reduction capacity of buffer zones.	Soil erosion and siltation management capacity of buffer zones are monitored for continuous improvement.	Before site preparation and then six monthly thereafter.	SM and PM
4	Removal of vegetation as demarcated, preparation of oil palm plots as well as construction of access roads and drainage.	Significant variation in local hydrology.	2.1, 4.3, 4.4, 5.1, 5.2, 5.3, 6.1, 7.2, & 7.4	Contour landscape to local natural drainage.	Minimum net deviation from local natural drainage.	During site preparation.	PM and SM
		Increased soil erosion and siltation of surface and marine water	2.1, 4.3, 4.4, 5.1, 5.2, 5.3, 6.1, 7.2, & 7.4	Restrict vegetation clearance to pre-designated areas.	Minimum unwarranted vegetation removed.	During site preparation.	PM and SM
				Where appropriate, use the removed vegetation as flow impediment structures and silt traps.	Removed vegetation effectively used to impede flow and retain silt.		
				Incorporate other silt regulation mechanisms and devices such as silt	Other cost-effective silt management methods successfully applied.		

No	Aspect/Activity	Potential Impact/s	Relevant RSPO Principles and Criteria	Mitigation measure/s	Performance indicator/s	Monitoring period/ frequency	Persons responsible for mitigation and monitoring
				sumps and artificial silt barriers.			
				Where required stockpile topsoil on a zero to very low gradient site for subsequent re-use.	Topsoil strategically stored for later re-use.		
		Elevated noise level in nearby communities.	2.1, 5.1, 5.6 & 6.1	Ensure noise generating machinery and equipment are in good working condition prior to being brought on site;	Noise generating machinery and equipment are in good working condition prior to being brought on site.	During site preparation.	PM and SM
				Ensure regular maintenance of all noise generating machinery and equipment.	Regular maintenance of all noise generating machinery and equipment.		
				Carry out pre-start machinery and equipment check before every shift work.	Pre-start machinery and equipment check carried out before every shift work.		
		Contamination of soil and water by accidental hydrocarbon spillages.	2.1, 4.2, 4.3, 4.4, 5.1, 5.6 & 6.1	Ensure that machinery and equipment are in good working condition prior to arrival on site.	Machinery and equipment are in good working condition prior to being brought on site.	During site preparation.	PM and SM
				Ensure regular maintenance of machinery and equipment.	Regular maintenance of all noise generating machinery and equipment.		
				Carry out pre-start machinery and equipment before every shift work.	Pre-start machinery and equipment check carried out before every shift work.		

No	Aspect/Activity	Potential Impact/s	Relevant RSPO Principles and Criteria	Mitigation measure/s	Performance indicator/s	Monitoring period/ frequency	Persons responsible for mitigation and monitoring
		Generation of excess dust from exposed soil surfaces and vehicular movement especially during dry periods	2.1, 4.7, 5.1, 5.6, 6.1, 7.1 & 7.2	Confine vegetation clearance to pre-designated areas.	Minimum unwarranted vegetation removed.	During site preparation.	PM and SM
				Apply water spraying to suppress excessive dust formation	Dust suppression via water spraying applied at an effective frequency.	As required	PM and SM
5	Management of the various waste-streams generated.	Aesthetic nuisance and habitat destruction. Emission of offensive smoke and odour. Breeding of disease transmission vectors such as rats and flies. Contamination of nearby water bodies.	2.1, 4.1, 4.4, 4.7, 4.8, 5.1, 5.3, 5.5, 6.1, 6.5, 7.1 & 7.7	Segregate waste types and dispose in designated landfill site.	Ensure appropriate management and disposal of wastes.	During site preparation.	PM and SM
				Reduce amount of waste produced and reuse or recycle items where possible			
				Avoid burning of vegetative waste and use it as mulch or for erosion control.			
				Provide adequate water supply and sanitation facilities for all workers.			
6	Planting of ground cover on oil palm plots.	Reduced soil erosion and siltation of surface and marine water.	2.1, 4.3, 4.4, 5.1, 5.2, 6.1, & 7.4	Ensure groundcover planted to improve soil fertility and control erosion.	Groundcover planted to improve soil fertility and control erosion.	Quarterly	PM and SM
7	Planting of oil palm seedlings.	Planting on non-designated sites.	2.1, 4.3, 4.4, 4,5, 4.6, 5.1, 5.2, 6.1, 7.1 ,7.2, 7.3 & 7.4	Ensure seedlings are planted where they should be.	Seedlings planted as demarcated.	During planting of seedlings	PM and SM
B	**OPERATION PHASE**						

No	Aspect/Activity	Potential Impact/s	Relevant RSPO Principles and Criteria	Mitigation measure/s	Performance indicator/s	Monitoring period/ frequency	Persons responsible for mitigation and monitoring
8	Application of soil remediation substances and fertilizers.	Improper handling of soil remediation substances and fertilizers resulting in personal injury to workers and contamination of local surface and ground water	4.1, 4.2, 4.4, 4.6, 4.7, 4.8, 5.1, 6.1 6.5, 7.1 & 7.2	Ensure proper application of soil remediation substances and fertilizers.	Application of soil remediation substances and fertilizers by trained persons using the correct procedure.	Monthly	PM and SM
				Carry out periodic water quality monitoring.	Surface and ground water quality monitoring carried out as scheduled.	Quarterly	
9	Control of weeds	Improper application of herbicides resulting in bodily harm to sprayers and contamination of local surface and groundwater.	2.1, 4.1, 4.4, 4.5, 4.6, 4.7, 4.8, 5.1, 6.1, 6.5 & 7.1	Ensure proper application of herbicides.	Application of herbicides by trained persons using the correct PPE and procedure.	Monthly	PM and SM
				Carry out periodic surface and ground water quality monitoring	Surface and ground water quality monitoring carried out as scheduled.	Quarterly	
10	Control of pests	Improper application of pesticides resulting in bodily harm to sprayers and contamination of surface and ground water.	2.1, 4.1, 4.4, 4.5, 4.6, 4.7, 4.8, 5.1, 6.1, 6.5 & 7.1	Ensure proper application of pesticides.	Application of pesticides by trained persons using the correct PPE and procedure.	Monthly	PM and SM
				Carry out periodic surface and ground water quality monitoring.	Surface and ground water quality monitoring carried out as scheduled.	Quarterly	
11	Harvesting of FFB	Delayed collection of FFB resulting in build-up of free fatty acids (FFA) and loss in value of	4.1, 4.4, 4.8, 5.1, 5.3, 5.5, 6.1 & 7.1	Ensure timely collection of FFB.	Timely collection of FFB.	Monthly	PM and SM

No	Aspect/Activity	Potential Impact/s	Relevant RSPO Principles and Criteria	Mitigation measure/s	Performance indicator/s	Monitoring period/ frequency	Persons responsible for mitigation and monitoring
		the crop. If delay is prolonged the crop will not be millable and will have to be disposed properly.					
				If necessary, correctly dispose the ruined fruit.	Correct disposal of ruined fruit.		
12	Maintenance of buffer zones and conservation reserves.	Neglected buffer zones not effectively performing their intended functions	2.1, 4.3, 4.4, 4.8, 5.1, 5.2, 6.1 & 7.	Maintain local species variety in the buffer zones and conservation reserves.	Diverse local species in the buffer zones and conservation reserves.	Monthly	PM and SM
				Ensure buffer zone signage intact and legible and restrictions are not breached.	Buffer zone signage intact and legible and restrictions enforced.		
13	Maintenance of roads and drainage	Increased erosion and siltation of local water bodies.	2.1, 4.3, 4.4, 5.1, 5.2, 5.3, 6.1, 7.2 & 7.4	Ensure timely maintenance of access roads and site drainage.	Access roads and drainage in a good condition.	Monthly	PM and SM
		Dust generation adversely affecting health and wellbeing of workers and local residents.	2.1, 4.7, 5.1, 5.6, 6.1 & 7.1	Carry out dust suppression during the dry season using water spray trucks.	Dust suppression with water spray carried out during the dry season.		
14	Management of various waste streams generated	Aesthetic nuisance and habitat destruction. Emission of offensive smoke and odour. Breeding of disease transmission vectors such as rats and flies. Contamination of nearby water bodies.	2.1, 4.1, 4.4, 4.7, 4.8, 5.1, 5.3, 5.5, 6.1, 6.5 & 7.1	Maintain waste management equipment and facilities.	Waste management equipment and facilities maintained.	Monthly	PM and SM
				Segregate waste types and dispose in designated sites.	Waste types, segregated and disposed in designated sites.		
				Reduce amount of waste produced and reuse or recycle items where possible.	Amount of waste reduced and where feasible items reused or recycled.		

No	Aspect/Activity	Potential Impact/s	Relevant RSPO Principles and Criteria	Mitigation measure/s	Performance indicator/s	Monitoring period/ frequency	Persons responsible for mitigation and monitoring
				Use organic waste as mulch or for composting.	Organic waste used as mulch or for composting.		
				Provide adequate water supply and sanitation facilities for all workers	Adequate water supply and sanitation facilities provided for all workers		
15	Employment during operation phase	Priority for employment and business contracts not given to nearby villagers.	2.1, 4.7, 4.8, 6.1, 6.5, 6.1 & 7.1	Give priority for employment and business contracts to nearby villagers.	Priority for employment and business contracts given to nearby villagers.	Six monthly	PM and SM
		Employees are not advised of their terms and conditions of employment, not properly trained and not supplied with appropriate PPE.		Educate employees about the terms and conditions of employment, train them and provide them appropriate PPE.	Employees advised of their terms and conditions of employment, trained and provided appropriate PPE.		
16	Contribution where possible to local infrastructural, socio-economic and integrated sustainable development.	Obvious lack of support to local infrastructural, socio-economic and integrated sustainable development.	6.11	Maintain close liaison with local government officials and communities and where possible assist in sustainable development projects.	Close liaison maintained with local government officials and communities and assistance in sustainable development projects provided where possible.	Continuous	PM and SM

Carbon and GHG Management Plans

Based on the carbon emission sources identified in the GHG Calculator (Figure 13), the following management recommendations are made.

Table 32; Management and Monitoring for GHG

Source (Emissions)	Details	Mitigation Measures	Monitoring Actions
Land Clearing	Potential additional emissions through over clearing of boundaries	Site marked out in advance of vegetation clearance activities to ensure no clearance of vegetation outside of lease area	Site Inspections by Sustainability Team to review site mark-out prior to land clearing activities
Fertilisers and N_2O	Risk of sublimation of nitrogen based fertilisers into atmosphere as N_2O	Fertilisers to be applied while soils are wet to ensure that nitrogen moves down into soil and does not dry out on the surface	Amount of fertiliser, and timing of application must be as per the fertiliser schedule (records kept in OMP agronomy database)
Fuel usage	Use of diesel in plantation and milling activities releases greenhouses gases from fossil fuel	As a direct cost input, use of vehicles and diesel is strictly controlled	Regular reporting in monthly reports, as well as RSPO GHG Calculator
POME	Traditional treatment methods for POME release greenhouse gases	At this time, there are no short term plans to implement a biogas system for RAIL, though this remains under consideration in the medium to long term	Review annually as part of CAPEX considerations
Carbon Sequestration	Planting trees and maintaining forest cover will increase carbon sequestration from the atmosphere into long term stores	RAIL will work with the landowner to select appropriate trees for planting in the riparian buffer.	Reports and publications from the ACIAR project, as well as ongoing field mapping and monitoring of tree growth NBPOL will be implementing Collect Earth monitoring for buffers and HCV areas

5. References

5.1 List of references used in the assessments

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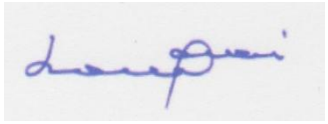
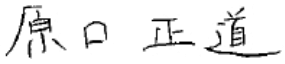
6. Internal responsibility

6.1 Formal signing off (with date) by assessors and grower.

The following assessors formally accept our interpretation of their findings and management recommendation as summarised in this report:

Assessment	Name of Lead Assessor	Signature
High Conservation Value Assessment	John Douglas	
Social Environmental Impact Assessment	Narua Lovai	
Soil Suitability Assessment	William Unsworth	
Land Use Change Analysis	Masamichi Haraguchi	
Carbon Stock Assessment	William Unsworth	
Green House Gas Analysis	William Unsworth	

6.2 Statement of acceptance of responsibility for assessments and Formal signing off (with date) of management plan.

This document is the public summary of the integrated SEIA, HCV & HCS management for new developments of Umi Bridge at Ramu Agri-Industries Ltd. and has been approved by the management.

Ruari Macwilliam: General Manager

Signature:  Date: 6th December, 2017

William Unsworth: Sustainability Manager

Signature:  Date: 6th December, 2017

6.4 Organisational information and contact persons.

Contact persons:

For RSPO Matters:
Sander van den Ende: Group Sustainability Manager, New Britain Palm Oil Group.
Email: svdende@nbpol.com.sg

William Unsworth: Sustainability Manager, Ramu Agri Industries Ltd, New Britain Palm Oil Group.

For Legal and Financial Matters:
Ruari Macwilliam, General Manager, Ramu Agri Industries Ltd, New Britain Palm Oil Group.
Email: rmacwilliam@rai.com.pg

6.5 Personnel involved in planning and implementation.

William Unsworth

Ruari Macwilliam