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

Impu the proposed new development area

Contents

1. Overview and background

1.1 Description of location

The area proposed for oil palm conversion, hereafter referred as Impu, is located on flat lands within the upper reaches of the Markham valley in Morobe Province.

1.2 Topography and landform

The overall topography of Impu and its surroundings are flat, with a predominant land cover of grasslands. Impu 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 180km southeast to the Huon Gulf of the Solomon Sea near Lea. Beboi Creek, which borders Impu 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 Impu area which the landowners have secured a land title is 1173ha, but only 972ha is available for lease to RAIL / NBPOL. This entire area was assessed for the NPP criteria: ie/High Conservation Value, High Carbon Stock etc. There were no HCV or HCS identified within the original 1173 ha of land originally proposed. The HCV assessors did find 46 ha of adjacent HCV, riparian zone, which it recommend RAIL manage due to concerns of project impact on this HCV. Due to management considerations only 972 hectares of this original 1173 hectares originally assessed are to be leased and converted to oil palm. The 46ha of adjacent HCV is to be protected as illustrated below:

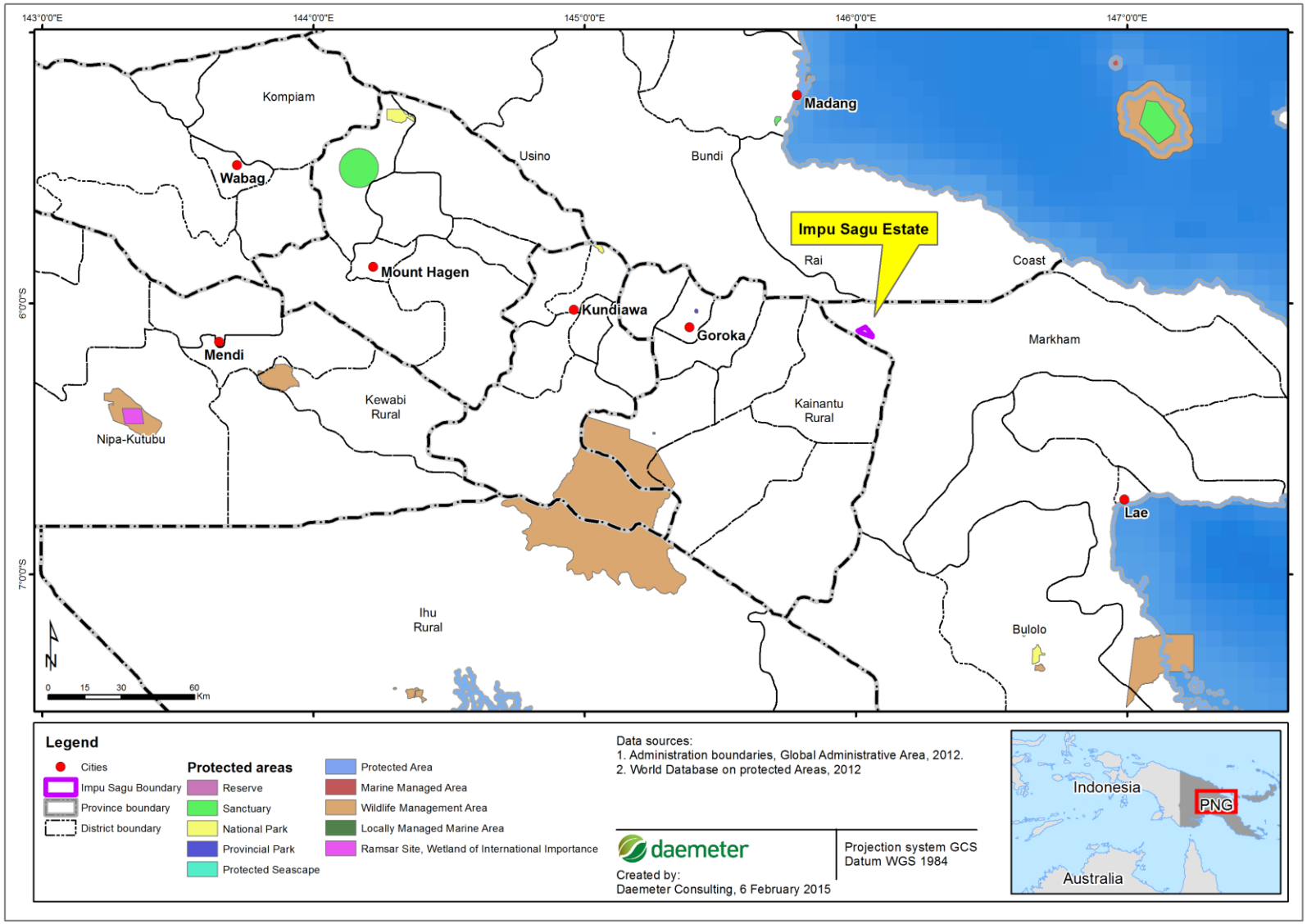

Figure 1; Location of the Impu-Sagu Area of Interest in the broader landscape. Protected Areas are also mapped.

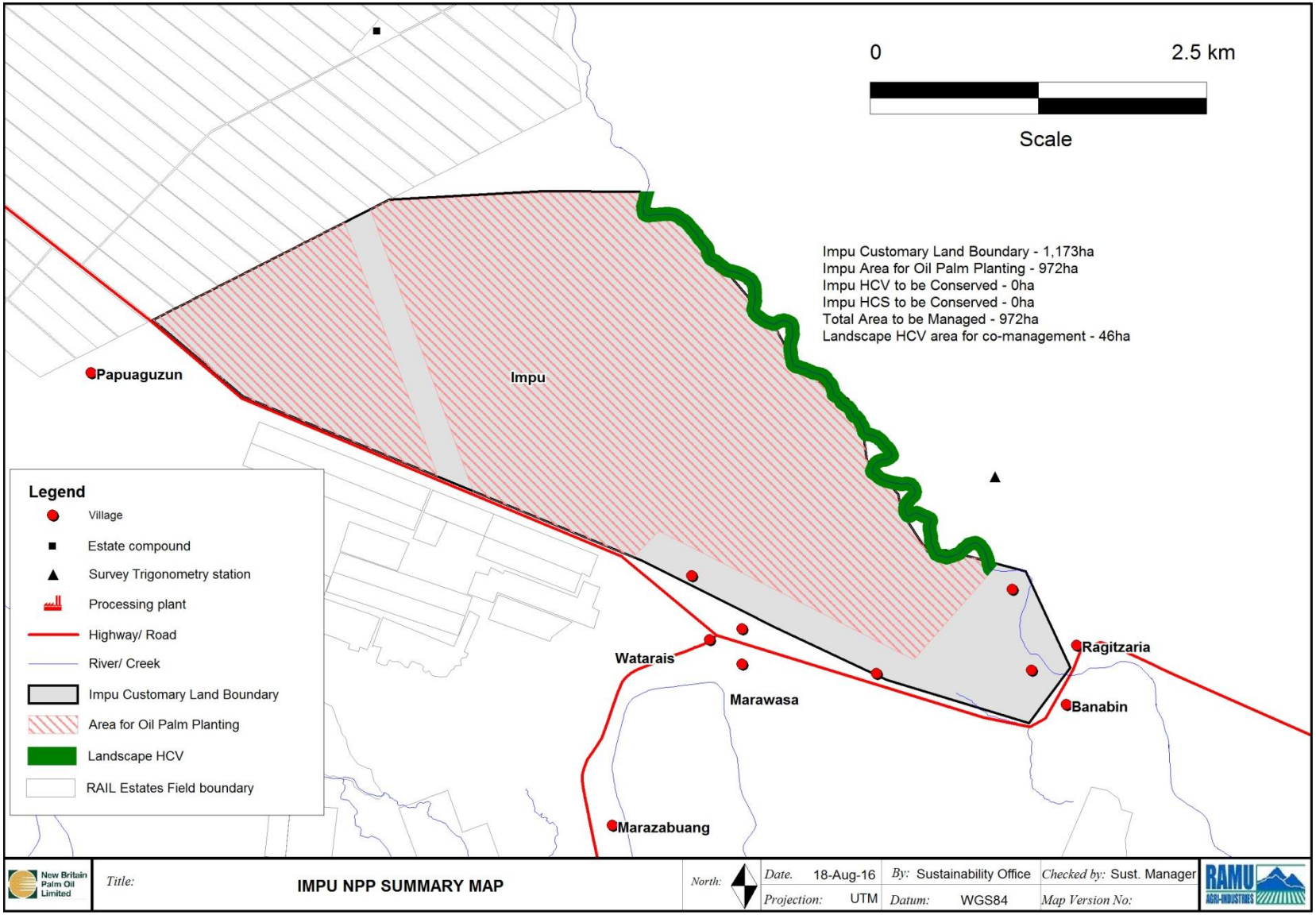

Figure 2; the boundaries of the Impu Area, of which 972ha will be developed and 46 ha of HCV will be co-managed with the local community.

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: 972 ha

Area to be conserved HCV: 0 ha

Area to be conserved HCS: 0 ha

Total Development Area: 972 ha

Adjoining HCV Area for Community Co-Management: 46 ha

2. Assessment process and methods

2.1 HCV Assessment process and methods

Dates HCV assessments were conducted

Daemeter was contracted in February 2015 to carry out the HCV assessment. The HCV assessment team was on site from 23-27 February 2015. Stakeholder consultation of the HCV assessment results was conducted on 6 April 2015. The peer review completed on 9 July 2015 and Public Summary posted on the HCV Network on 2 September 2015.

HCV Assessors and their credentials

Table 1; Daemeter HCV Team Composition

Name	ALS License	Organisation	Role	Expertise
Aisyah Sileuw	Provisionally Licensed Lead Assessor	Daemeter Consulting	Team Leader	Socio-economic and cultural
Julian Crawshaw	Provisional Provisionally Licensed Lead ALS14006JC	Daemeter Consulting	Lead Reporter	Biodiversity Conservation; Ecology Landscape
Muhammad Iqbal		Daemeter Consulting	Fauna Expert	Avifauna
Tom Vigus		Daemeter Consulting	Vegetation Expert	Botany
Sahat Aritonang		Daemeter Consulting	Forestry Expert	Biodiversity Conservation; Ecology Landscape
Indrawan Suryadi		Daemeter Consulting	GIS Expert	Remote Sensing, GIS and mapping.

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:

Land Cover

For the assessment of HCVs 1-4, historical and present forest cover was assessed from satellite imagery. Landsat 2015 ETM satellite images were analysed and confirmed using images from previous years. This land cover mapping gave clear indications of the areas that needed to be surveyed during full assessment.

Topographical data

The Digital Elevation Model (DEM) produced by the Shuttle Radar Topography Mission (SRTM) was used for defining general topography and slopes throughout the estate. HCV 4.2 utilizes this secondary data set to define major components or erosion potential.

Ecosystem Mapping

For the identification of HCV 3 (*Rare or Endangered Ecosystems*), Daemeter used the land system mapping undertaken by the CSIRO, Australia (Robbins, 1976). Unfortunately the maps finished right at the western border of the IMPU. However Daemeter considered it reasonable to extrapolate the mapping over the IMPU for the purposes of HCV 3.

Species Data

For assessment of HCVs 1 and 2, secondary data on species potentially present in the assessment area were extracted from field guides (e.g. Coates 1985, Diamond, 1972). These tables were cross-referenced and augmented by experts that joined the field survey and by consulting community groups with knowledge of the area and species likely present.

Social Cultural Data

Secondary data for assessment of HCV 5 and 6 were available from EIAs and Interim HCV Assessment reports provided by the company; these described a range of social and economic classes, livelihoods, and village infrastructure.

Primary Data Collection

Field verification of topographical conditions

To assess the accuracy of topographical conditions described in secondary DEM data, general field observations were made throughout NBPOL's plantations. The DEM reflected conditions experienced in the field very well.

Plant surveys

There was no remaining natural forest (as defined by satellite imagery and land cover analysis), just scattered remaining trees. These trees were all well known to the surveyors and are common in the area.

Mammals

The survey of mammals and other vertebrates of concern under HCV 1 was conducted using rapid assessment techniques, combining

(i) structured interviews with hunters,
(ii) assessment of habitat quality (in combination with the botany team), and
(iii) direct (visual) and indirect (prints, calls, scat) sightings whilst undertaking habitat assessments.

Community interviews and habitat assessments were conducted at the village level (6 villages). Due to the generally disturbed condition of vegetation in the area, habitat description for mammal and bird surveys was kept simple; differentiating between heavily degraded regrowth forest, riparian forests (along rivers), and non-forest. Interview, habitat, and sighting data produced a provisional list of species confirmed or potentially present in the survey areas. This was then compared with data on known geographic range and habitat requirements for individual species using secondary data sources. The extent of remaining available habitat was identified using land cover maps provided by the GIS team. Primary and secondary data sources were combined to (1) assess the likelihood of presence for each species, (2) assess likely population viability for a number of species, and (3) provide recommendations for management of HCV 1.2 and 1.3 mammals.

Birds

Bird surveys aimed to identify features of the bird community relevant to HCVs 1.3 and 2.3 (HCV 1.2 was deemed very unlikely present for birds given geographic location and land cover). Survey methods included walking transects, opportunistic observations during the survey, and interviews with local hunters. The combination of these methods ensured a holistic bird inventory and increased the likelihood of detecting key species that deserve conservation interventions. A full explanation of methods, areas surveyed, and results is given in Annex 1.

Social and Cultural Surveys to assess HCV 5 and 6

Using the HCV Toolkit as a reference, questions were prepared for meetings at the village level to evaluate the dependency of community members on natural ecosystems to fulfill basic needs (HCV 5) and identify presence of any important cultural sites (HCV 6).

All villages inside or close to the NBPOL were surveyed. A combination of Focus Group Discussions (FGD) and individual-based interviews was used to collect data on social and cultural aspects. The FGD approach is an effective way to collect information on social and cultural dimensions of village life in an informal setting that permits discussion and exchange of ideas between group members. The results of all meetings were openly noted on flipchart paper and questions often repeated, or

cross-checked to confirm understanding of questions and answers given. It was common for groups to talk amongst themselves to clarify, amend, or confirm answers previously given. If the communities were dependent on forest/natural resources in the landscape, participative sketch mapping was used to illustrate location of HCV areas.

Figure 3 Focus Group Discussion underway.

2.2 Social Environmental Impact Assessment

Dates SEIA assessments were conducted

The SEIA stakeholder engagement was conducted 26-30 October 2014. An exchange of information and draft reports preceded the final report which was submitted December 2014.

SEIA Assessors and FPIC experts and their credentials

NaruaLovai is a Freelance Environment Management and Technical Writing Consultant. MrLovai 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 NaruaLovai 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 RamuAgri 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, Imputs 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

An extensive soil suitability assessment was carried out on the land in 2014, and fully documented in 2016. The field sampling was carried out by RAIL's Research and Development team which include soil scientists who agree with the findings of this report. The final report was submitted July 2016.

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)

Soil Suitability Assessment Methods

Secondary Data

The in-field data collection was carried out by the Research and Development team of RAIL, while the mapping, analysis and report writing was carried out by 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 and cross sections provided by streams within the area were utilized to confirm the soil classifications attributed to the area.

Figure 4 Cross-sectional profile of shallow loam soil – eroded inner bank of Beboi Creek

2.4 High Carbon Stock Assessment

Dates High Carbon Stock Assessment was conducted

The High Carbon Stock assessment was carried out 14-20 October 2014.

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 Adex Taul

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 Adex Taul are junior assistants working for the Sustainability Section at Ramu Agri Industries.

High Carbon Stock Assessment Methods

The HCS Approach methodology was utilized in order to conduct the carbon stock assessment.

Secondary Data

Satellite imagery was used, Google Earth to classify the land cover of the proposed area. Due to their only being one strata, it was not necessary to purchase any other imagery. The sampling procedure was based on taking a random representative sample from within the strata.

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 along the recognised variation in 'wetness' and vegetation from West to East. The previously identified trees along the riparian buffer were not sampled in this methodology, but as they will not be removed, they have no impact on the carbon stock of the land to be cleared. The 88 sample sites provide a total sample area of 4.4ha (0.05 x 88 sites) on a site of 1,022 ha representing 0.43% of the total area.

2.5 Land Use Change Assessment

Dates Land Use Change assessments were conducted

The land use change assessments were carried out by two independent assessors. The first assessment was carried out by Daemeter Consulting as part of the HCV assessment. This was conducted as part of the HCV contract period between February-September 2015. The second Land Use Change assessment was conducted during July 8-10, 2016.

Land Use Change Assessors and their credentials

The HCV and its included land use change assessment was conducted by Daemeter Consulting and lead by Jules Crawshaw. See details above for credentials.

The second 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.

Land Use Change Assessment Methods

The HCV assessment included a land use change analysis which utilized satellite imagery and field verification to ascertain the land use history of the proposed area Because this assessment did not produce maps a subsequent assessment was undertaken to complement the HCV assessment. This assessment consists of a systematic land use change analysis utilizing satellite imagery which shows the land use of the proposed area before during and after November 2005. The analysis confirms the findings by Daemeter, namely that the proposed development is a grassland dominant grassland and has been so for as long as recorded history. The analysis utilized a hybrid analysis with local ground data from NBPOL and Global Dataset, e.g. Hansen data. The analysis utilized a historical time series analysis utilizing Landsat Cloud Free Mosaic (Annual Greenest Pixel) and baseline data which compared annual tree cover and loss from 2000 to 2015. The analysis utilized the current land-cover/land use analysis (quantitative) to overlay with high Resolution Satellite to verify/validate the analysis.

2.6 Greenhouse Gas Analysis

Dates Greenhouse Gas Analysis was conducted

The Greenhouse Gas Analysis was conducted in July 2016.

Greenhouse Gas Analyst credentials

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

Greenhouse Gas Analysis Methods

The two above scenarios were run using the RSPO GHG calculator provided for this purpose http://www.rspo.org/certification/carbon-assessment-tool. 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.

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 Imputs 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; Potential Impacts Associated with Aspects and Activities as raised by Stakeholders

Aspect/Activity	Potential Impact/s	Medium E- Environmental S- Social
Detailed survey of entire lease area and demarcation of buffer zones, oil palm plots, access roads and drainage	Buffer zones not appropriately demarcated.	E
Detailed survey of entire lease area and demarcation of buffer zones, oil palm plots, access roads and drainage	Oil palm plots, access roads and drainage not sited to minimize environmental degradation.	E
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 local villagers.	S
Direct employment and contractual engagement for site preparation, construction of roads and drainage as well as oil palm planting.	Employees not advised of their terms and conditions of employment, not adequately trained and not provided with appropriate PPE.	S
Reforestation where necessary of buffer zones.	Some buffer zones not reforested where necessary.	E
Reforestation where necessary of buffer zones.	Clear and legible signage in English and TokPisin not erected alongside buffer zones .	E
Reforestation where necessary of buffer zones.	Enhancement of local flora in the buffer zones.	E
Reforestation where necessary of buffer zones.	Reduced soil erosion and siltation of nearby surface water bodies.	E
Removal of vegetation as demarcated, preparation of oil palm plots as well as construction of access roads and drainage.	Significant variation in local hydrology.	E
Removal of vegetation as demarcated, preparation of oil palm plots as well as construction of access roads and drainage.	Increased soil erosion and siltation of surface and marine water	E
Removal of vegetation as demarcated, preparation of oil palm plots as well as construction of access roads and drainage.	Elevated noise level in nearby communities.	S
Removal of vegetation as demarcated, preparation of oil palm plots as well as construction of access roads and drainage.	Contamination of soil and water by accidental hydrocarbon spillages.	E

Aspect/Activity	Potential Impact/s	Medium E- Environmental S- Social
Removal of vegetation as demarcated, preparation of oil palm plots as well as construction of access roads and drainage.	Generation of excess dust from exposed soil surfaces and vehicular movement especially during dry periods	S
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.	E
Planting of ground cover on oil palm plots.	Reduced soil erosion and siltation of surface and marine water.	E
Planting of oil palm seedlings.	Planting on non-designated sites.	E
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	E
Control of weeds	Improper application of herbicides resulting in bodily harm to sprayers and contamination of local surface and groundwater.	E
Control of pests	Improper application of pesticides resulting in bodily harm to sprayers and contamination of surface and ground water.	E
Harvesting of FFB	Delayed collection of FFB resulting in build-up of free fatty acids (FFA) and loss in value of the crop. If delay is prolonged the crop will not be millable and will have to be disposed properly.	E
Maintenance of buffer zones and conservation reserves.	Neglected buffer zones not effectively performing their intended functions	E
Maintenance of roads and drainage	Increased erosion and siltation of local water bodies.	E
Maintenance of roads and drainage	Dust generation adversely affecting health and wellbeing of workers and local residents.	E
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.	E
Employment during operation phase	Priority for employment and business contracts not given to local villagers.	S
Employment during operation phase	Employees are not advised of their terms and conditions of employment, not properly trained and not supplied with appropriate PPE.	S
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.	S

Positive and negative environmental effects

The implementation of this project will result in at least 972ha of area to be converted plus 46 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 protectedriparian zone. The protection and assisted restoration of the riparian zone will increase wildlife habitat. While the

establishment of the mini estate is welcomed by the landowning clans and not opposed by other downstream villagers, the overriding concern everyone has is the potential for erosion and contamination/pollution of local water sources. RAIL pointed out this possibility to the villagers during initial discussions on the development of the estate. Instead of continuing to draw from the current sources of water for drinking and other domestic uses, the people would prefer using alternative safer and reliable water supply systems. Although the need for safe water and sanitation is obvious, the recurring hindrances relating to responsibility for these services and provision of resources to deliver them need to be resolved. The District Administration has prioritized water supply in its five year (2013 to 2017) development plan for Markham District and Wankun Village has been selected as one the four water supply project locations in 2015.

Socio-economic impacts to country, region and local communities

The socio economic impact of this particular project on a regional scale is significant. The Markham Valley has long been known for extensive land uses such as cattle farming and to a lesser extent sugar cange. It is only since 2003 that the successful introduction of oil palm into the region has resulted in a more intensive crop. Oil palm represents continual job creation and income throughout the year. Importantly, oil palm has a high employment to hectare ratio as well as social inclusion through smallholder participation and the option to rent out unused land as was the case.

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 are summarized in the table above and 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, and the lack of direct support of the project into infrastructural development.

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 demonstrated concern with pollution to water sources and lack of benefitting to the full economical potential of the project. All of these are summarized in the table above.

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 LLG's have been informed and included in discussions.
- MOU with landowners setting out terms and conditions
- HCV Assessment Report by Daemeter Consulting July 2015
- SEIA Assessment Report by Narua Lovai December 2014
- HCS Assessment Report by RAIL October, 2014
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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 Group Incorporation (Amendment) Act	Lands Department	2009
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

PNG has large expanses of pristine habitat, high levels of biodiversity, and low human population density. PNG encompasses some of the world's last great tracts of mature tropical rainforest and largest coral reefs, including a unique array of species that have evolved here in isolation. This has made PNG one of the world's most important biodiversity hotspots.

PNG's assemblage of flora and fauna represents almost 7 percent of the world's biodiversity. It is home to more than 200 species of mammals and 700 species of birds, as well as 21,000 species of plants. It has extensive, high quality natural habitats and ecosystems, ranging from alpine grasslands to lowland rainforest and coral reefs.

Nevertheless PNG has strong aspirations for development and is balancing development against conservation of natural areas. The base of the Markham Valley has been developed for agriculture and is an environment that has been heavily modified.

Scope

The boundaries of the Impu area are displayed in Figures 1 and 2. These boundaries are the land registered to the ILGs. NBPOL only leases the internal block from the ILG (labelled "Area for Oil Palm Planting" in Figure 2). The leased area is set 50 m back from Beboi Creek and excludes some village gardens in the south eastern corner.

The scope of the assessment is the lease area referred to as the area of interest (Impu) in this document.

Demographic and Socioeconomic Context

Incomes

The Imput proposed area has approximately 6 villages located near the borders, although there is no permanent habitation within the boundaries. The lease area is set back from the ILG boundary to exclude some areas of village gardens in the south-eastern corner.

In the project area, 77% of the people make their income from gardening whilst others made money from cattle and informal business. Overall, income for over a half (50.5%) of the households was between K0.00 and K100.00 fortnightly. Slightly more than 20 percent earned between K101.00 and K200.00 fortnightly. A good number of people earned more than K200.00 per fortnight. More than 12 percent made more than K500.00. (K100 is approximately USD40).This shows this area is well below the average GDP/capita USD2088/year (USD 80 / fortnight)

Figure 5 Informal roadside markets, typically selling produce from local gardens.

The majority of people aregardeners, the most common crop planted is bananas, the staple food of the area. Other food crops like kaukau, taro, yam and *tapioca* (cassava) are also cultivated in large numbers. (ACIAR)

Given the suitability of this area for agriculture it is somewhat surprising that the population density is approximately 16 people / km^2, compared with Highland areas which are quite densely populated. This maybe dates back to times where the plains were seen as battlefields without places to hide, therefore considered dangerous.

People sell the produce from their gardens at local markets. The only industrial scale agriculture is owned by corporates such as NBPOL. Thereare several hundred hectares of smallholder oil palm in the area (approximately 2 ha / smallholder) of which some of the landowning communities of Impu are successful participants. There is anaverage quality road to Lae which is something of an exception in PNG where infrastructure is a major hindrance to market development. From Lae CPO is shipped to markets in Europe.

Education

There are major shortages of resources for education, particularly a shortage of teachers. 75 per cent of primary school-aged children attend school, but only 12 per cent of secondary school-aged children were enrolled.

Many children, especially in poor, rural areas, never enrol, because their families cannot afford the school fees, which can equal more than 50 per cent of some families' earnings.

In the Imput area the overwhelming majority of the participants are unskilled (78%). However, 22 percent of the respondents indicated receiving technical trainings, work experience, and/or life skills. The participants identified skills as, for example, tending cattle. Unskilled participants were those who had absolutely no knowledge of basic book-keeping skills, carpentry or other formal activities, and were thus confined to gardening. (Sullivan 2011)

Health

The delivery of basic essential social and health services by government has deteriorated in recent years, in part due to the lack of up-keep of roads and other transportation infrastructure. This situation has been compounded by smaller government budgets and centralized funding programmes, which have led to the closure of aid posts and health centres. Those that remain open are often understocked (e.g. with antibiotics and anti-malarial drugs). Infant and child mortality rates are high and increasing. In recent surveys infant mortality was twice that of urban areas. Malnutrition is another problem and it appears to be increasing. AIDS is of grave concern and could climb to 30% of the total population in the next 10 years.

The situation with services is not good. Services are difficult to access in most places covered in the study area. Kesowai has a small aid-post that caters to all the people in the area. Dumpu has no health facility (the nearest is the Ramu Health Centre, about 40km away). The people at Impu go to Bibuai clinic which is also some distance away. Common sicknesses are headaches, fever, diahorrea and malaria.

Most people sought treatment at the health clinics. (Sullivan 2011)

Religion

The 2000 census found that 96% of citizens identified themselves as members of a Christian church; however, many citizens combine their Christian faith with some pre-Christian traditional indigenous religious practices. The census percentages were as follows:

- Roman Catholic, (27.0%)
- Protestant (69.4 %) divided into various sects
- Baha'i (0.3%)
- Islam, Buddhism, etc (3.3%)

Western missionaries proselytized the country in the nineteenth century.(Wikipedia. 2014.)

Land Ownership

Customary land is held by land groups according to local tradition and custom. Customary land may have several overlapping claims, identifying the correct landowners is important, and often difficult.

Cultural Implications

Customary landowners have never considered their land as property but only as a means of generational survival of land group members in the past, present and future.Customary land tenure has been criticized as it isolates the land from mainstream development. Traditionally landowners do not view land as a commodity that can be traded and disposed of.

Incorporated Land Group

Becoming an Incorporated Land Group (ILG) enables clans or customary landowning groups in PNG to become a corporation and be recognized as a modern legal corporate entity through the Department of Lands under the Land Groups Incorporation (Amendment) Act 2009 in order to

participate in the real estate sector and development of their land. The ILG comprises of all its clan members as automatic citizens who are by virtue of communal rights of proprietary or possessory kind that belongs to the landowning clan and arises from and is regulated by their own custom and tradition respectively. The ILG has its duly appointed executive committees authorized to represent and act on its behalf and is responsible to govern the affairs of the ILG.

Voluntary Customary Land Registration (VCLR)

Land titles over customary land can only be registered and issued to a registered ILG under the current Land Registration (Amendment) Act 2009. The previous Lease-Lease Back concept through Special Agriculture & Business Leases (SABLs) is no longer applicable. The new Customary Land registration process enables the ILG to gain legal registered ownership and tenure over their customary land and can also be able to further lease the land, as is the case in the current proposed area. The lease by the ILG to RAIL will also be done through a controlled dealing process by which the State (Department of Lands) will approve, create, register and issue a Lease for a period authorized to by the ILG. The Customary land will not entirely lose its customary character as the ultimate ownership in principal over the registered customary land will still remain with the ILG.

Protected Areas

The difficulties of acquiring land have precluded the development of a protected area system as it would be recognized in other countries. Papua New Guinea does not have dedicated protected areas legislation and its protected areas take different forms that often do not fit the IUCN classification. To date, there are 52 *nationally designated protected areas* in Papua New Guinea, covering approximately 2.5 % of the country's territory (Menazza, S. 2010).

Landscape Context

Landforms, Rivers and Land Cover

Landforms

The below figure shows that that Impu is basically flat and lies in the centre of a deep valley.

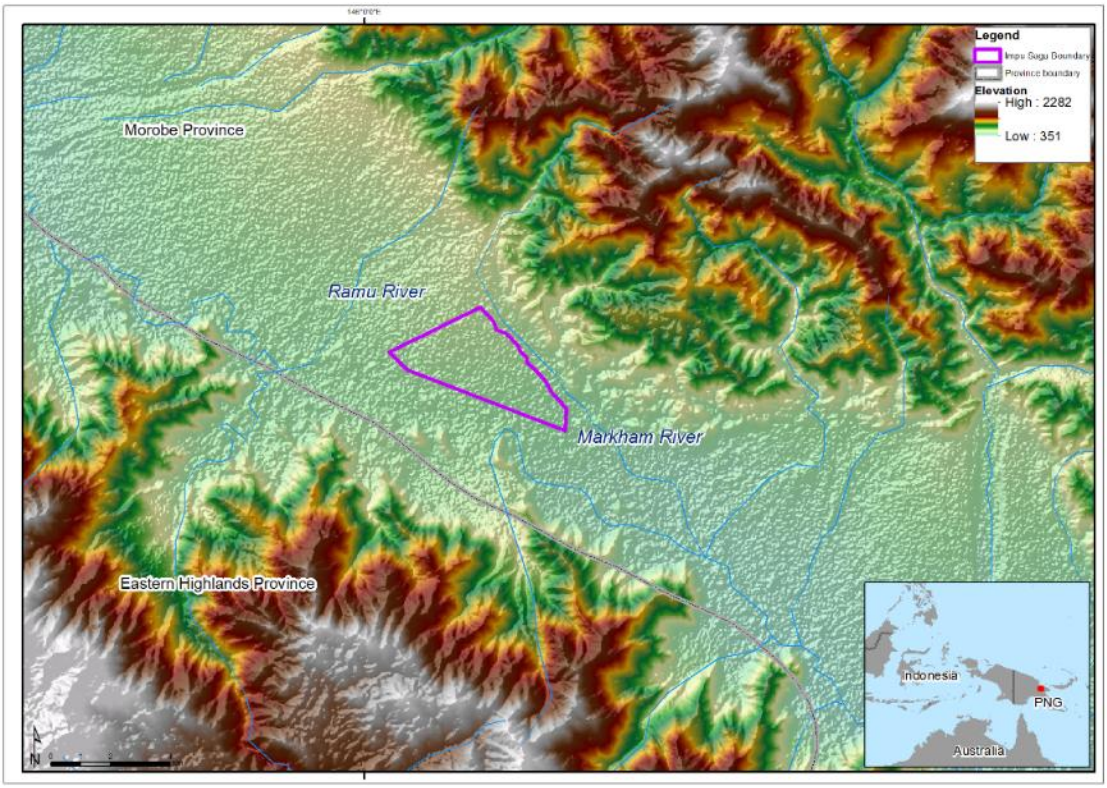

Figure 6 Topography of the IMPU and surrounding landscape. The flat valley floor separates the Finistere Range of Madang and Morobe provinces along the eastern coast from the central Bismarck Range of the Eastern Highlands province.

Rivers

The proposed area is located at the head of the Ramu/Markham valleys; these valleys are each drained by rivers of the same name. These flow in opposite directions, with the watershed divide between them roughly located at the proposed Impu VOP. From there, the Markham River and its tributaries flow about 180km southeast to the Huon Gulf of the Solomon Sea near Lea.Beboi Creek, which borders the IMPUis 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.

Land Cover

The vegetation in the Impu-Sagu area consists predominantly of open grassland. The grassland climax, now established is maintained by annual burning. The other vegetation consists of a few scattered trees, small clusters of native trees at the boundary with Watarais Village, typical local subsistence crops in a number of gardens on the north-eastern side towards Beboi Creek, riverine forest trees and grasses alongside a section of the inner bank of the creek as well as coconuts and other food crop trees just beyond the south-eastern boundary of the proposed estate.

HCV Outcomes and Justification

Table 4; HCV Identification Summary

HCV	Description	Present	Potentially Present	Not Present
1.1	Protected areas			
1.2	Concentrations of rare, threatened and endangered species			
1.3	Concentrations of endemic species			
1.4	Critical temporal concentrations of species			
2	Natural ecosystems or ecosystem mosaics which are large in extent, un-fragmented, form a significant components of the landscape or are of significant importance at a local, regional of national level, and which contain most of the naturally occurring species.			
3	Ecosystems that are naturally rare, have become rare due to historical processes, or threatened by present or future processes.			
4.1	Areas critical to water catchments			
4.2	Areas critical for soil erosion			
4.3	Areas critical for fire prevention			
5	Sites and resources fundamental for the basic necessities of local communities or indigenous peoples.			
6	Cultural values critical to the traditional cultural identity of local communities, including areas of cultural, ecological, economic, religious or archaeological significance.			

HCV 1 – Concentrations of Biodiversity Values

1.1 Protected areas

Interpretation

Key Question	Outcome
Does the proposed area contain or does the surrounding landscape contain any of the following categories of Protected Areas (PA)? • Gazetted Protected Areas, • Conservation Deeds and • Proposed Protected Areas with forest cover	**Not Present**

Justification

All gazetted PAs, Conservation Deeds and proposed areas with forest cover should be considered HCVs. However 97% of land in PNG is privately owned under traditional land tenure systems.This makes PAs scarce.

There are no protected areas in or near the Ramu valley.

Findings in the IMPU
There are no Protected Areas in the IMPU**, therefore HCV 1.1 is deemed to be Not Present**

1.2 Concentrations of rare, threatened and endangered species

Interpretation

Key Question	Outcome
Is the proposed area or the adjoining landscape known or likely to contain areas with significant concentrations of rare, threatened, or endangered plant or animal species?	**Not Present**

Findings in the IMPU
There were no forested areas in the development area, nor were there any HCV 1.2 species plants, mammals or birds present. For this reason **HCV1.2 is deemed Not Present.**

1.3 Concentrations of endemic species

Interpretation

Key Question	Outcome
Is the proposed area in or adjoining landscape known or likely to contain concentrations of endemic species?	**Not Present**

Justification

Birds

The ornithological survey documented 32 bird species. Of these, two species identified as Least Concern but none are of global conservation concern, Critically Endangered, Endangered, or Vulnerable on the IUCN Red List. These two least concern species, one species identified as protected by Government of PNG (Eastern Great Egret – *Ardea modesta*) and listed as Appendix 1 of CITES (Palm cockatoo - *Proboscis aterrimus*).

Plants

None of the species identified on site (listed in the full report) are considered vulnerable and on the IUCN Red List Data source. Internal RAIL studies have found an unidentified ground orchid which is yet to be classified but is considered common in all grassland areas by villagers.

Fish and Mammals

For mammals and freshwater fish species, the team performed the survey in conjunction with bird observation, through observation tracks and faeces. In addition, the team was assisted by local people who used to hunt around the IMPU. Based on the results of previous reports that have been done in this area, there were no significant mammals living in this area due to the activity of hunting and repeated land clearing using burning.

Findings in the proposed area
There were no forested areas in the development area, nor were there any HCV 1.3 species plants, mammals or birds present. **For this reason HCV1.3 is deemed Not Present.**

1.4 Critical temporal concentrations of species

Interpretation

Key Question	Outcome
Is the proposed area within or the adjoining landscape known or likely to contain critical temporal concentrations of species?	**Not Present**

Findings in the proposed area
No areas where animals or birds concentrate seasonally were either noted during the field survey or recorded based on interviews with local people.**For this reason HCV 1.4 is deemed Not Present.**

HCV 2 – Landscape Level Ecosystems and Mosaics

Interpretation

Key Question	Outcome
Does the proposed are or surrounding landscape contain natural ecosystems or ecosystem mosaics which are large in extent, largely un-fragmented, form a significant components of the landscape or are of significant importance at a local, regional of national level, and which contain most of the naturally occurring species?	**Not Present**

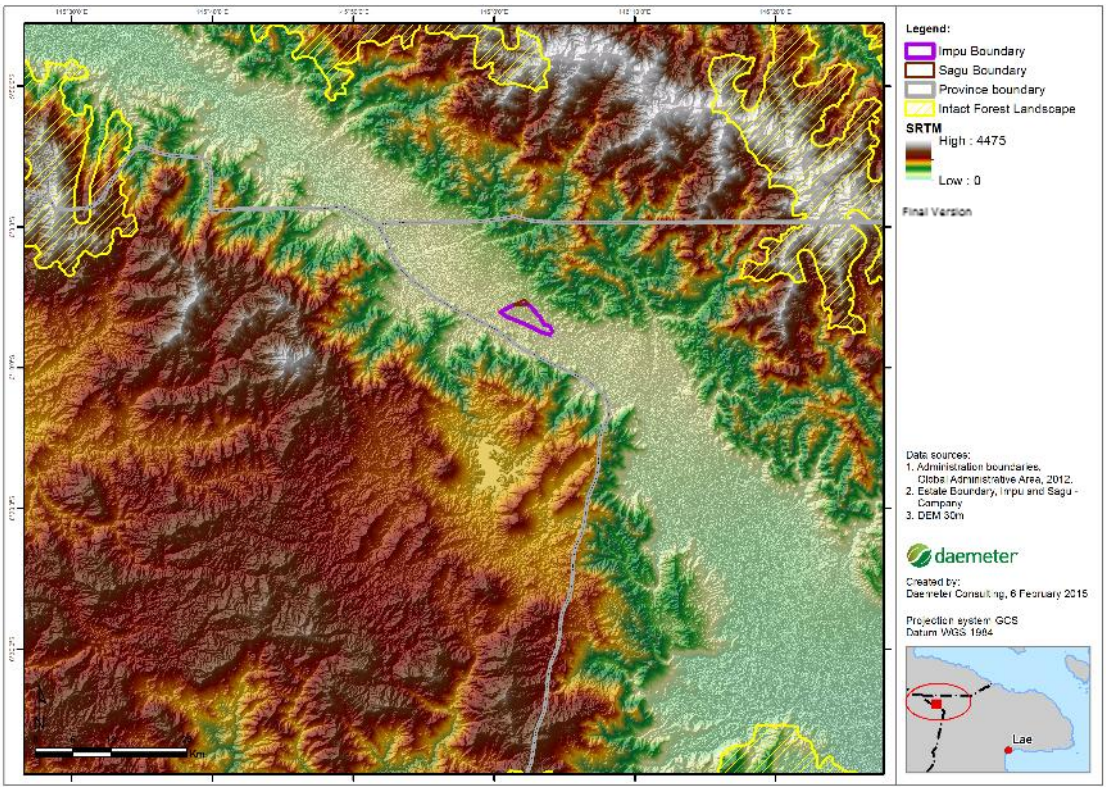

Figure 7As a first step the NI suggests mapping the IMPU and it's connection to Intact Forest Landscapes (IFL). In this map the IFL are confined to the mountain tops and there is no connectivity with the IMPU.

Findings in the IMPU

There is no intersection between the proposed area with intact forested landscapes. **For this reason HCV 2 is deemed Not Present.**

HCV 3 – Ecosystems and Habitats

Interpretation

Key Question	Outcome
Does the proposed area or surrounding landscape contain ecosystems that are naturally rare, have become rare due to past processes, or threatened by current and future processes?	**Not Present**

Findings in the Impu

The flat valley bottoms have a long history of use for agriculture (with a regime of burning associated) and have been deforested a long time ago. There are very few, if any, areas of contiguous natural forest on the flat valley bottoms. Forest on these land systems would be considered rare and therefore be HCV 3. However the proposed area only has scattered trees therefore cannot be considered HCV3. **For this reason HCV3 is deemed Not Present.**

HCV 4 – Critical Ecosystem Services

HCV 4.1 Areas critical to water catchments

Interpretation

Key Question	Outcome
Does the proposed area or surrounding landscape contain areas that are critical to the protection of water catchments?	**Present**

The critical nature of water catchments will be considered if their loss or destruction could result in catastrophic changes in people's livelihood or the ecology of those ecosystems. For guidance on buffer widths the PNG Logging Code of Practice was used (PNG, 1995).

Table 5; Rivers and Mandatory Buffer Widths (PNG, 1995)

Category	Minimum Buffer Width
Class 1 permanent stream (as defined in Key Standard No 1)	50 m
Class 2 permanent stream (as defined in Key Standard No 1)	10m
A stream,(permanent or non-permanent) of any width used by the community	50 m
Non-permanent water courses and streams less than 1 metre not used by the community	10 m
Lakes, lagoons, coastal shoreline, swamps	100 m
Cultural sites, reserves, conservation and garden areas	100 m

Table 6; Watercourse Definitions (PNG, 1995)

Watercourse Definitions
1a Permanent watercourses have water flowing for part or all of the year for most years. The beds have no vegetation growing on them. The beds may consist of waterwashed sand, silt, stone, gravel or exposed bed rock materials.
Class 1 Stream Bed width = more than 5 metres
Class 2 Stream Bed width = less than 5 and greater than 1 metres
1b Non-permanent watercourses or drainage channels are usually stable, non-incised depressions which carry surface water during times of high rainfall. The beds are soil and will usually be covered with leaf litter and vegetation
1c Swamps have surface water present for 6 months of the year

1d Stream Buffer Zone start point (adjacent to the stream). Delineation of the buffer will start where the vegetation is 10 metres high or greater

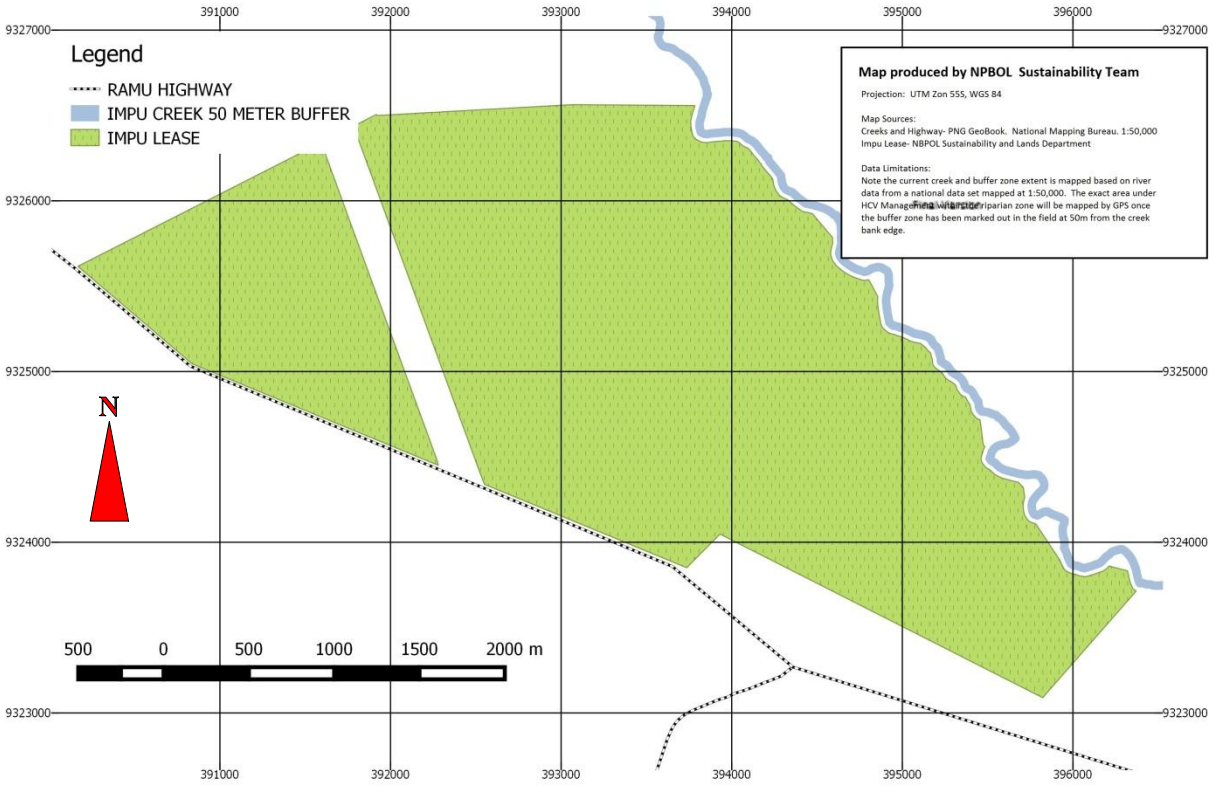

Figure 8. HCV 4.1 map, with buffers required along rivers. The riparian buffer width is 50 m given that that these streams are "a stream, (permanent or non-permanent) of any width used by the community". This is based on the definitions in Table 5 and Table 6

Findings in the IMPU

The HCV 4.1 Area is delineated in Figure 8. The inability to use the water would have a major impact on the people's life as there is no viable alternative. Furthermore there is a genuine concern in the community that oil palm, with its heavy use of fertilizer and pesticides, will reduce the potability of the water and cause serious health problems. **HCV 4.1 is deemed present** because Beboi Creek provides water to communities for drinking, washing and cleaning.

Although this river buffer area is outside NBPOL's direct control and responsibility, it is recommended NBPOL undertake its best endeavours to manage and monitor the HCV in this area.

HCV 4.2 Areas critical for soil erosion

Interpretation

Key Question	Outcome
Does the proposed area or surrounding landscape contain areas that are critical for preventing soil erosion?	**Present**

Justification

The PNG Toolkit emphasizes areas where consequences could potentially be severe in terms of loss of productive land or ecosystems, cause damage or loss of human life. This toolkit is very focused on forested areas for this HCV, whereas the proposed area is predominantly grassland. For this reason Daemeter defers to HCV Common Guidance. It states that forest areas may provide a vital function in stabilising slopes above a settlement, or, in the upper reaches of an important stream catchment. This service may be critical when disturbing operations would lead to drastic soil erosion with impacts on people's property or livelihoods.

Figure 9 River bank erosion on Beboi Creek, the IMPU is on the RHS.

Findings in the IMPU

The proposed area is very flat for this reason there is no risk of hillside erosion. The area that borders the Beboi Creek will clearly be subject to river bank erosion (Figure). However the proposed area is right at the top of the Ramu / Markham watershed and supplies water to downstream villages and continued erosion of the banks will impact on property. **For this reason HCV 4.2 is deemed to be present.**

HCV 4.3 Areas critical for fire prevention

Interpretation

Key Question	Outcome
Does the IMPU or surrounding landscape contain areas that are critical for fire prevention?	**Not Present**

Findings in the proposed area

The proposed area and its surrounding landscape have a history of fire. As with the other grasslands, it is frequently burnt over in the dry season. It grades into the *Ophiuros-Imperata*grassland and includes most of the associate grasses as well as the scattered fire-tolerant trees. No large, continually inundated wetlands exist in areas that would be considered an important, natural fire buffer to forests or villages. Based on these two factors, no areas in the IMPU or surrounding landscape are considered to be critical for the prevention of fire. **Therefore HCV 4.3 is deemed Not Present**.

HCV 5 - Basic Needs of Local Communities

Interpretation

Key Question	Outcome
Does the proposed area or surrounding landscape contain sites and resources fundamental for the basic necessities of local communities or indigenous peoples?	**Not Present**

Justification

The Common Guidance considers the following as indicators of HCV 5:

- Access to health centres or hospitals is difficult,
- Most houses are built from, and household tools made from, locally available traditional/ natural materials,
- There is little or no water and electricity infrastructure
- People have a low capacity to accumulate wealth (living “day to day”)
- Farming and livestock raising are done on a small or subsistence scale
- Indigenous hunter-gatherers are present
- There is presence of permanent or nomadic pastoralists
- Hunting and/or fishing is an important source of protein and income
- A wild food resource constitutes a significant part of the diet, either throughout the year or only during critical seasons

Almost all these indicators are present in the villages around the IMPU.

Findings in the proposed area

The villagers relied on the natural environment for meeting their basic needs. All the important areasfor the villagers to meet their basic needs are located outside the IMPU. For this reason **it is deemed that HCV 5 is not present in the area of interest**.

HCV 6 - Cultural Values

Interpretation

Key Question	Outcome
Does the proposed area or surrounding landscape contain areas that are tied to cultural values critical to the traditional cultural identity of local communities, including areas of cultural, ecological, economic, religious or archaeological significance?	**Not Present**

Findings in the proposed area

There are no such sites within the development area, therefore **HCV 6 is deemed to be Not Present.**

Stakeholder Consultation

Stakeholder Imput focused on opinions and concerns about RAIL's proposed development of the IMPU and specific Imput on biodiversity issues, environmental services, local livelihoods and other issues of concern to local communities and broader stakeholder groups. Due to the small size of the development all relevant stakeholders were invited to a central location.

Table 7; Results of the stakeholder consultations

Organisation	Name	Recommendations / Concerns
Markham District Administrator	John Orebut	Concerned about pollution to Beboi Ck which flows into Markham River and out to sea. This was answered in terms of the need for healthy riparian strips between the plantation and the creek in collaboration with the community. Will Unsworth mentioned a number of species that they were investigating planting e.g. Multi-purpose species (fruit / nuts) trees, eucalypts, native species (collected from remnant forest areas)
Markham District Oil Palm Coordinator	EkiRonuc	Commented about preventing damage to the creek banks. Plantation companies keeping to their management guidelines to ensure no environmental damage.
Ratazaria people		They were worried about where the boundary of the oil palm would be. They were concerned that they would lose their gardens. Daemeter had an A0 map on the board and it was explained the development boundaries would not impinge on their gardens. There would be a buffer between palm oil and the gardens.
School Headmaster Wararia Primary School	Samuel Motaia	Concern over the protection of the water supply (this is a spring that rises just on the border of the school). It appears that the spring flows all year round whereas the Beboi dries up, this would indicate the spring is not linked to Beboi Ck. Samuel wanted to know whether Daemeter tested the water. Daemeter replied they didn't because a one-off test would not be useful, however RAIL has start a ground water testing regime. This would give a baseline water quality and subsequent changes caused by OP development.
Ward Councillor	Yappie Christine	She was promised a water supply at Papua village because of pollution from the existing plantation. This was allegedly made in 2005. She stated she wanted a water supply before any development takes place.

3.3 Soil and Topography

The parent material of the soils in the Ramu-Markham valley intersection area is alluvium. The soils have developed into clayey, silty and sandy sediments from the weathering of rock fragments. Rock types in the nearby mountain ranges include sandstone, siltstone, limestone, basalt and igneous rocks. Most of the broader valley area is covered with slightly gravelly topsoils and gravelly or stony subsoils interspersed with areas bearing deep topsoil layers (Hartemink, 1998). The soil within the mini estate is about 90% deep loam and the remainder is shallow loam.

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 10; Soil map of Impu

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 Impu area a concludes that the entire area is considered a grassland. The area holds a standing stock of 1.65 tC/ha in woody vegetation which when incorporated with the default figure for tropical grasslands gives a value of 7 tonnes of Carbon per hectare in Above Ground Biomass. Incorporating the Below Ground biomass, and with no peat soils on site, the carbon stock of Impu is 18.2 t C/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 analysing tree cover at the year 2000 and tree cover loss and gain since then. It shows that the entire area has been a static grassland since then with minimal change in tree cover.

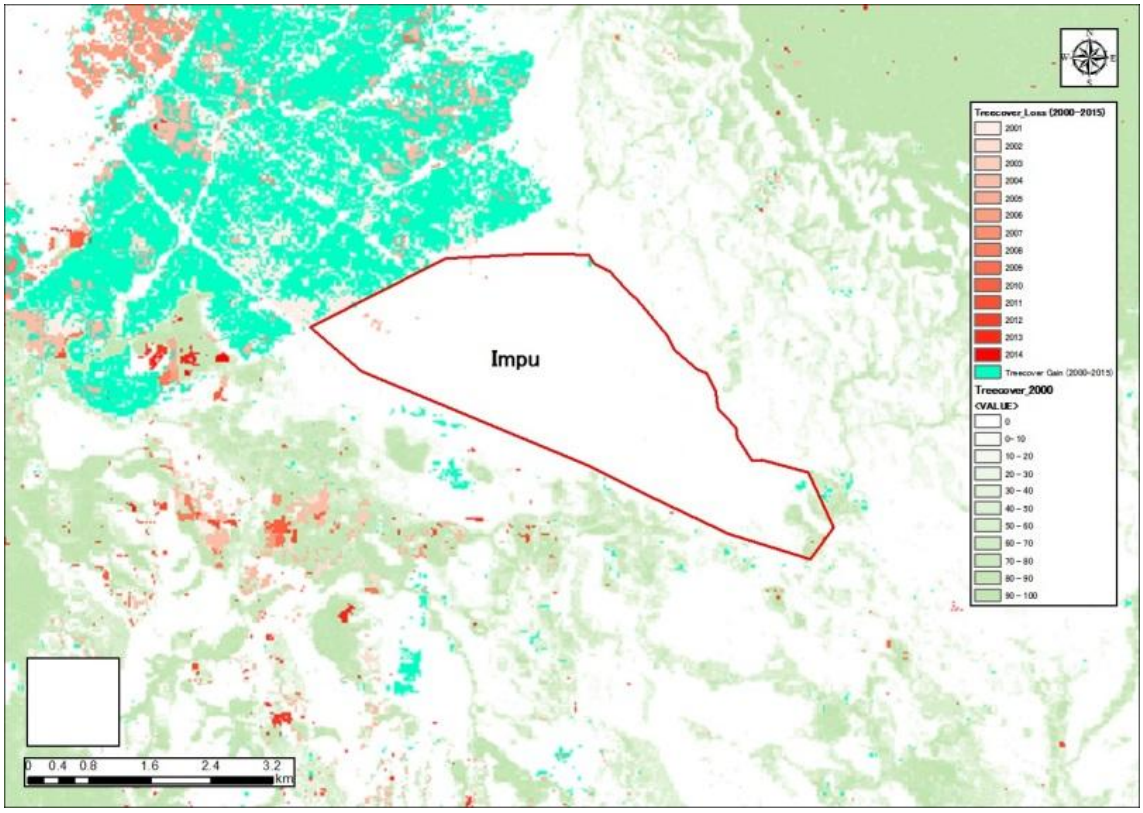

Figure 10 land cover map showing tree cover gain and loss 2000-2015

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 Impu by NBPOL. The study summarizes recommendations of the High Conservation Value and High Carbon Stock Assessments

conducted there and presents 2 different scenarios based on the outcome of community consultations and the rules applied by HCV and HCS approaches. These scenarios are provided to guide final consultation with landowners and company executive management to mitigate the GHG impact of this particular development.
The following are the basic rules utilized to generate the scenarios:

1. All HCV areas are earmarked for conservation (Note that the only HCV identified is outside the proposed lease land)
2. All adjacent HCVs are conserved through co-management with community consultation

Table 8; Indication of the land developed at Impu by landcover

	Conserve (ha)	Develop (ha)
High Density		
Medium Density		
Low Density		
Regrowth vegetation		
Scrub		
Grassland		972
Plantation		
Total	0	972

Emissions estimations

Two scenarios were run using the RSPO GHG calculator provided for this purpose http://www.rspo.org/certification/carbon-assessment-tool. 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 as part of the existing operations of RAIL.

Table 9; GHG Calculator synthesis summary report

	HCV Only
Product	**tCO2e/t product**
CPO	**0.07**
PK	**0.07**
PKO	**0.07**
PKE	**0.07**

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

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 nett 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 all of 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.

This is a Confirmation by the New Britain Palm Oil that the above has been undertaken using the latest available version of the RSPO GHG Assessment Procedure for estimating the carbon stock of above ground and below ground biomass for land earmarked for new oil palm development and that the potential net GHG emission arising from the development has been estimated. In addition, New Britain Palm Oil Ltd confirms that the assessment includes a plan to minimise net GHG emissions which takes into account avoidance of land areas with high carbon stocks and/or sequestration options.

3.5 LUC Analysis

The current assessment was undertaken to complement the HCV assessment. It consists of a systematic land use change analysis was conducted utilizing satellite imagery. The analysis was conducted by an external independent consultant firm: Kokusai Kogyo, Ltd. Japan Asia Group http://www.kkc.co.jp/english/company/history.html . The study consisted of a systematic land use change analysis with the use of comparative satellite imagery which shows the land use of the proposed area before during and after November 2005. The analysis confirms the findings by Daemeter, namely that the proposed development is a grassland dominant grassland and has been so for as long as recorded history. The analysis utilized a hybrid analysis with local ground data from NBPOL and Global Dataset, e.g. Hansen data. The analysis utilized a historical time series analysis utilizing Landsat Cloud Free Mosaic (Annual Greenest Pixel) and baseline data which compared annual tree cover and loss from 2000 to 2015. The analysis utilized the current land-cover/land use analysis (quantitative) to overlay with high Resolution Satellite to verify/validate the analysis. The analyst suggests that the NBPOL utilizes OpenForis Collect Earth for future monitoring of the HCV areas to be maintained. 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.

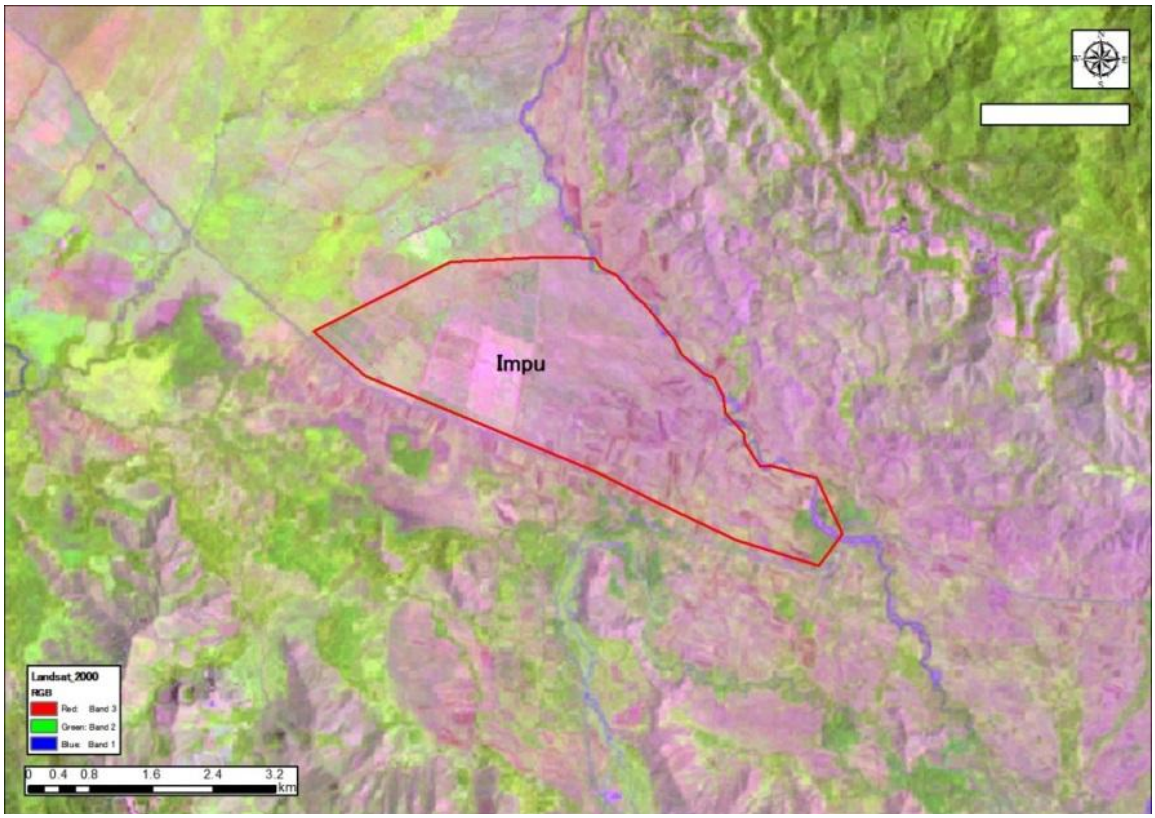

Figure 11; Impu in the year 2000

As can be seen in Figure 1, 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. There is an area of cultivated land, probably which has long since converted back to grassland. A picture of the same area taken from the greenest pixels available from landsat in 2015 reveals a very similar land use within the proposed development area.

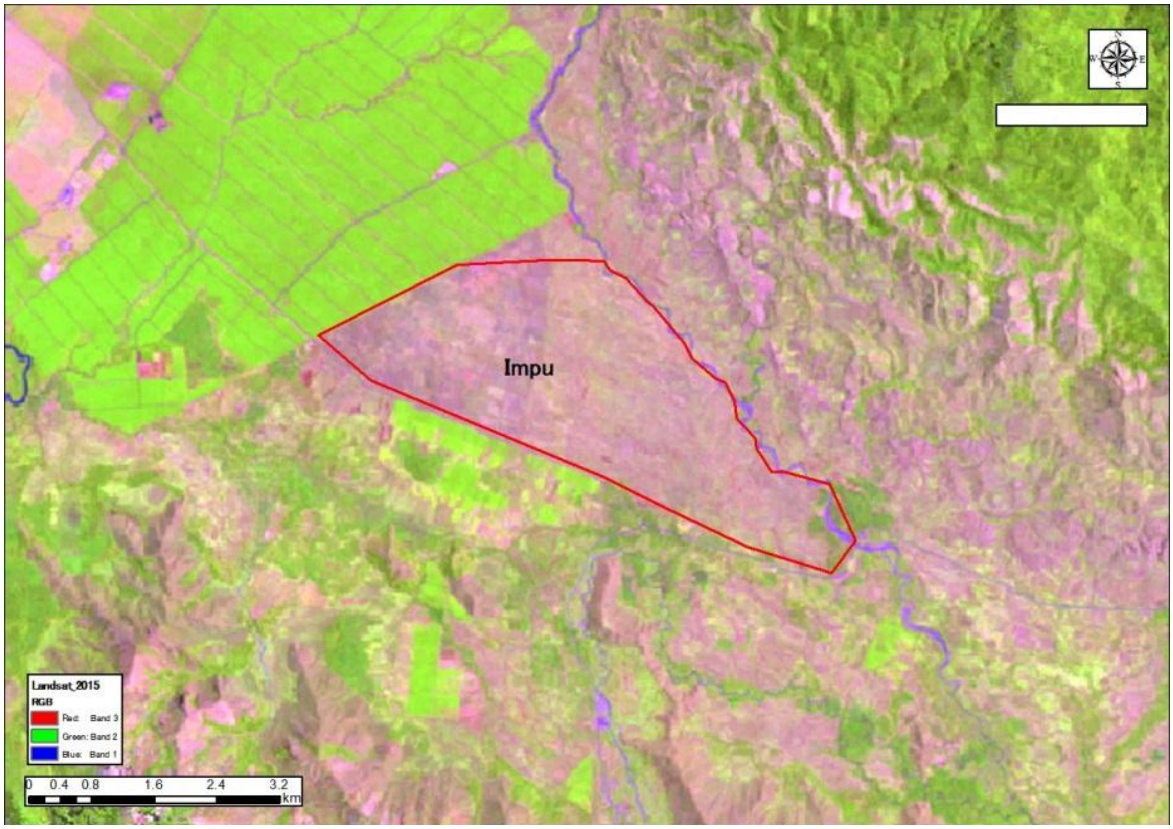

Figure 12; Impu in the year 2015

As in the previous figure it is clear that this area has been managed as a grass land. This is achieved through the traditional means of using fire to clear the vegetation competing with grass.The above figure shows there is negligible tree cover loss or tree cover gain within the whole proposed area. This is also represented in the land cover map shown in figure 11. The following tables summarize the percent tree cover in 2000 as well as the percent tree cover loss at Impu during the period from 2000-2015.

Table 10; Tree Cover at Impu in the year 2000

ID	SITE_NAME	AREA	0%	0-10%	10-20%	20-30%	30-40%	40-50%
	Impu	1,173	1132	5	7	2	2	4
			40-50%	50-60%	60-70%	70-80%	80-90%	90-100%
			4	4	5	3	4	2

Table 11; Tree Cover Loss at Impu 2000-2015

SITE_NAME	AREA	Y2001	Y2002	Y2003	Y2004	Y2005	Y2006	Y2007	Y2008
Impu	1,173	0.10	0.00	0	1.42	0.00	0.00	0.00	0.09
RATE		0.01%	0.00%	0.00%	0.12%	0.00%	0.00%	0.00%	0.01%
		Y2009	Y2010	Y2011	Y2012	Y2013	Y2014	TOTAL	RATE
		0.00	0.00	0.19	0.00	0.00	0.00	1.80	0.15%
		0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.15%	

As can be seen from the above tables the area has had negligible tree cover and tree cover loss during the period analysed. The average rate of loss has been less than 1 percent (0.15%).

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. As per the offsite HCV identified, the management recommendation presented will be adopted and the the new plantings shall be planned and managed to best ensure the HCVs identified are maintained and/or enhanced (see Criterion 5.2). As reported a comprehensive HCV assessment, including stakeholder consultation, was conducted prior to the proposed new planting. This included a land use change analysis which together with the present analysis determined changes to the vegetation since November 2005. This analysis has been used, with vegetation as a proxy, to indicate no changes to HCV status will follow from the proposed new planting.

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 clans have ample land for other uses and are allocating the Impugrassland to RAIL for estate development for mostly positive impacts including revenue generation, improving road access, and individual access to housing, water supply and sanitation.

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 their Incorporated Land Group and NBPOL.

Mini Estates Office Principles

1. The approach to enter into a joint venture to establish a mini estate with NBPOL must originate from the Land owner group(s) This may be a verbal invitation but must be followed up by a letter stating such interest signed by the leaders of the Landowning Clans.
2. Projects are to benefit a community (Clans/ subclans) and not one family or an individual.
3. Each potential project is individually assessed with regard to not only its economic viability but its sustainability and effect on future village life.
4. The Provincial Govt. is to be informed on a regular basis on all Mini Estate inquiries and upon their establishment and/or development to obtain status reports on issues, problems and achievements of such projects.
5. NBPOL will only enter into a joint venture to establish a Mini Estate with an Incorporated Land Group (ILG) or, in special circumstances, a Landowner Company.
6. NBPOL will manage such Mini Estates following all Environmental Policies and Codes of Practice as stipulated in its RSPO certification and as per the

Conditions formalised through the signing of a Sub-lease Agreement with the ILG.

4. Summary of Management Plans

4.1 Team responsible for developing management plans

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

Table 12; 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, ie/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 13; HCV & HCS Management and mitigation Plans

HCV	Threat	Management Recommendation	Monitoring Recommendation
4.1	• Burning to assist agricultural development within the riparian buffer strip. • Lack of awareness by company employees and contractors about HCV 4, particularly small river riparian buffers and mismanagement of high risk activities within buffer areas.	• Demarcate boundaries of HCV areas • Maintain and establish riparian buffers – this involves planting trees of value to the community in the riparian areas • Collaborate with local communities to maintain environmental values – particularly stopping burning, not building huts and raising	• Take predevelopment baseline measurements of water quality • Ongoing, routine monitoring of riparian buffer condition • Routine water quality surveys in rivers • Monitor the success of community engagement initiatives to offset environmental impacts

	• People constructing huts and living (permanently or temporarily) and farming animals.	animals. • Maintain or improve water quality in all rivers in the area of operations	(e.g., encroachment into riparian areas) • Use of adaptive management to evaluate and adjust management and monitoring activities as necessary
4.2	Threats, Management and Monitoring for HCV 4.2 are exactly the same as 4.1 and are not repeated.		

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. The main actions have therefore been reiterated below as critical management measures for consideration and execution by RAIL management.

- Management of potential environmental impacts

  - Conduct RSPO awareness in each intending ILG community.
  - Make sure all buffer zones are clearly marked and left intact for the duration of each ME.
  - Enrich species diversity in the buffer zones and ensure their interconnectivity.
  - Carry out a water quality monitoring before site preparation and six monthly thereafter.
  - Ensure appropriate disposal of all waste generated on each ME.

- Management of potential socio-economic aspects

  - Verify that all the clan members are kept informed of agreement negotiations.
  - Evaluate increases in land rental and FFB royalty rates that would lead to improved socio-economic welfare in each ILG community.
  - Ascertain that all members understand the Sub-lease agreement before signing it.
  - Ensure priority for employment and contracts is given to each ILG community.
  - Investigate ways and means of improving living conditions and social services in each ILG community particularly with water supply and sanitation.
  - Arrange project planning and financial management training for each ILG Committee.
  - Organise training and awareness on budgeting and saving income for ILG community members.

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

Table 14; SEIA Management and Mitigation Plan

No	Aspect/Activity	Potential Impact/s	Relevant RSPO Principles and Criteria	Management and 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 components are positioned so that environmental impacts are minimal.	Components 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 local villagers.	2.1, 4.7, 4.8, 6.1, 6.5, 6.11 & 7.1	Give priority for employment and contractual work to local villagers. .	Priority for employment and contractual work given to local villagers.	Prior to start of site preparation.	PM and SM.
		Employees not advised of their terms and conditions of employment, not adequately trained and	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	All employees advised of their terms and conditions of employment, trained and provided with	Prior to start of site preparation.	PM and SM.

No	Aspect/Activity	Potential Impact/s	Relevant RSPO Principles and Criteria	Management and Mitigation measure/s	Performance indicator/s	Monitoring period/ frequency	Persons responsible for mitigation and monitoring
		not provided with appropriate PPE.		appropriate PPE	appropriate PPE.		
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 operation phase and six monthly thereafter	SM and PM
		Clear and legible signage in English and TokPisin 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 TokPisin on restrictions within the buffer zones.	Sufficient, clear and legible signage in English and TokPisin on restrictions within the buffer zones and conservation reserves installed.	Before site preparation, then monthly through to start of 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 each buffer zone.	Soil erosion and siltation management capacity of each buffer is monitored for continuous	Before site preparation and then six monthly thereafter.	SM and PM

No	Aspect/Activity	Potential Impact/s	Relevant RSPO Principles and Criteria	Management and Mitigation measure/s	Performance indicator/s	Monitoring period/ frequency	Persons responsible for mitigation and monitoring
					improvement.		
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 sumps and artificial silt barriers.	Other cost-effective silt management methods successfully applied.		
				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	Noise generating machinery and equipment are in good	During site preparation.	PM and SM

No	Aspect/Activity	Potential Impact/s	Relevant RSPO Principles and Criteria	Management and Mitigation measure/s	Performance indicator/s	Monitoring period/ frequency	Persons responsible for mitigation and monitoring
				good working condition prior to being brought on site;	working condition prior to being brought on site.		
				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 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	Management and 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

No	Aspect/Activity	Potential Impact/s	Relevant RSPO Principles and Criteria	Management and Mitigation measure/s	Performance indicator/s	Monitoring period/ frequency	Persons responsible for mitigation and monitoring
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
C	**OPERATION PHASE**						
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	2.1, 4.1, 4.4, 4.5, 4.6, 4.7,	Ensure proper application of	Application of pesticides by trained	Monthly	PM and SM

No	Aspect/Activity	Potential Impact/s	Relevant RSPO Principles and Criteria	Management and Mitigation measure/s	Performance indicator/s	Monitoring period/ frequency	Persons responsible for mitigation and monitoring
		bodily harm to sprayers and contamination of surface and ground water.	4.8, 5.1, 6.1, 6.5 & 7.1	pesticides.	persons using the correct PPE and procedure.		
				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 the crop. If delay is prolonged the crop will not be millable and will have to be disposed properly.	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
				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 and conservation reserve signage intact and legible and restrictions are not breached.	Buffer zone and conservation reserve signage intact and legible and restrictions enforced.		

No	Aspect/Activity	Potential Impact/s	Relevant RSPO Principles and Criteria	Management and Mitigation measure/s	Performance indicator/s	Monitoring period/ frequency	Persons responsible for mitigation and monitoring
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 facilitiesmaintained.	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.		
				Use organic waste as mulch or for composting.	Organic waste used as mulch or for composting.		
				Provide adequate water supply and sanitation	Adequate water supply and sanitation facilities		

No	Aspect/Activity	Potential Impact/s	Relevant RSPO Principles and Criteria	Management and Mitigation measure/s	Performance indicator/s	Monitoring period/ frequency	Persons responsible for mitigation and monitoring
				facilities for all workers	provided for all workers		
15	Employment during operation phase	Priority for employment and business contracts not given to local villagers.	2.1, 4.7, 4.8, 6.1, 6.5, 6.1 & 7.1	Give priority for employment and business contracts to local villagers.	Priority for employment and business contracts given to local 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.		Advise 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 tolocal 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 15; 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	Timing of fertiliser application as per the fertiliser schedule (records in OMP)
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	The nearby communities will be encouraged and supported to plant trees on 46ha of riparian buffer adjacent to the site. This will be implemented using external expertise through an Auatralian Centre for Internatioanl Agricultural Research (ACIAR) project into community Forestry, as well as RAIL's internal forestry nursery	Reports and publications from the ACIAR project, as well as ongoing field mapping and monitoring of tree growth

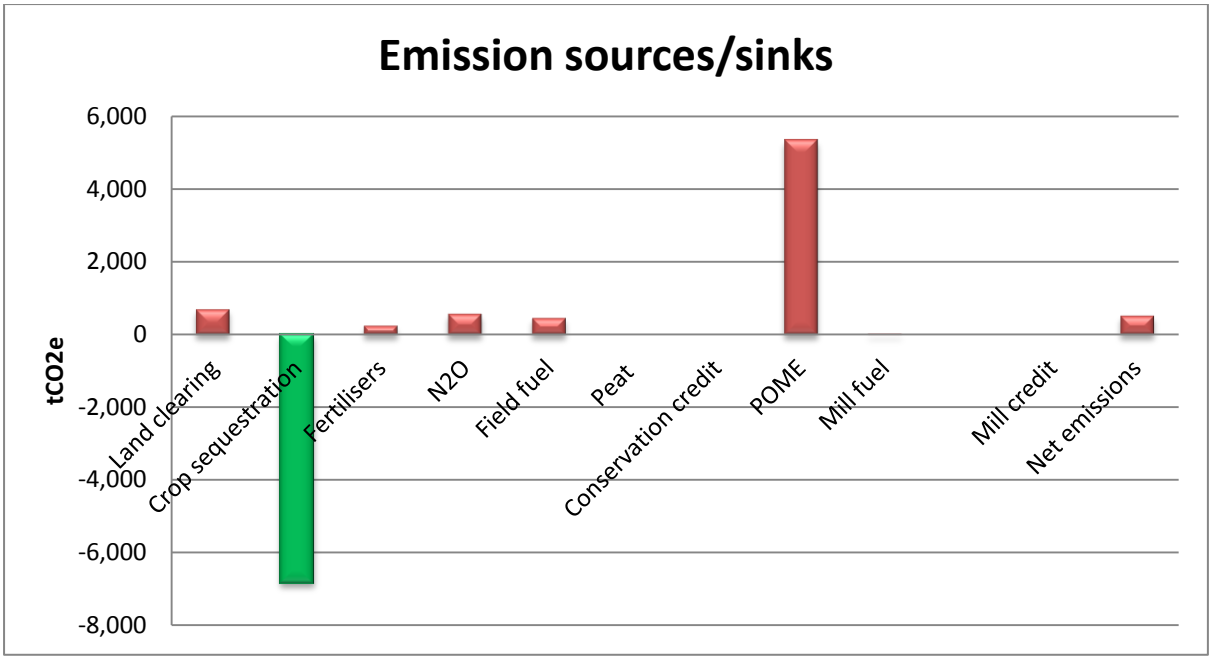

Figure 13; Graph indicating the relative sources and sinks of Carbon

5. References

5.1 List of references used in the assessments

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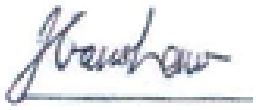
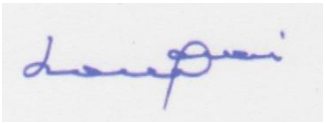
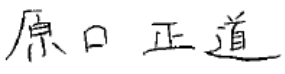
6. Internal responsibility

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	Jules Crawshaw	
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 Impu at Ramu Agri-Industries Ltd. and has been approved by the management.

Ruari Macwilliam: General Manager

Signature:  Date: 1st August, 2016

Abdul Jalil Bin Sulaiman: Head of Oil Palm

Signature:  Date: 1st August, 2016

William Unsworth: Sustainability Manager

Signature:  Date: 1st August, 2016

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

Abdul Jalil Bin Sulaiman.