CHAPTER 8 ASSESSMENT OF POTENTIAL IMPACTS

8.1 INTRODUCTION

The anticipated effects of the interactions between components of project activities and the existing environment in the previous chapter have been identified. From this information, environmental resource components likely to experience potentially significant impacts (positive or negative) due to the Project are identified for analysis, discussion and assessment.

Assessment of environmental impacts involves hand computation, computer modelling and observation as well. Accuracy of primary and secondary data determines the reliability and credibility of evaluation of impacts. To present a fair balanced evaluation, both positive and negative impacts have to be incorporated in the study. The predicted environmental impacts are depicted and analyzed as below.

8.2 SOIL EROSION RISK AND SEDIMENTATION

Forest provides a buffer to filter water and to hold soil in place. Logging project inevitably will incur disturbance of soil structure stability which eventually enhance possibility of soil erosion and sedimentation. Sources of logging project's activities which will cause soil erosion and sedimentation are as below:

i. Site clearance

During site clearance, cutting of vegetation will expose bared soil subject to weathering effect which will cause soil loss and consequently cause soil sedimentation in the tributaries of Sg. Ghuan. Moreover, soil erosion and sedimentation risk increase significantly when losing the holding power towards soil by forest. Appropriate mitigation measure shall be performed.

ii. Construction of logging road and skid trail

Construction of logging road and skid trail will involve site clearance activity in small extend. However, logging road and skid trail is subjected to weathering effect all the time especially during raining monsoon. Soil tends to be carried together by

runoff towards the nearest water receiving body. Thus, proper mitigation measure shall be provided.

iii. Forestry Inventory Survey

Small extent of site clearing is needed to facilitate the surveying process. Insignificant soil erosion and sedimentation is expected.

iv. Felling

Felling of timber will disturb the existing soil stability. Inevitably, strong felling force of timber causes surrounding soil to be dug out. It will accelerate soil erosion, weathering and humus decomposition. In addition, felling operation is the longest activity among the rest of activities. In directly, it means that soil erosion and sedimentation risk is enhanced. Significant impact shall be foreseen unless suitable mitigation measure is provided.

8.2.1 Soil Loss Calculation

Universal soil loss equation (USLE) is the most widely used mathematical method developed in United State. The equation is represented by:

A = RKLSCP, where

- A = Computed soil loss per unit area (tonnes/acres/year)
- R = Rainfall erodibility factor
- K = Soil erodobility factor, Standard condition (bare exposed ground) for factor K is equal to 1.0
- L = Length of slope factor related to overland flow. Standard conditions assumed at 9% slope and length of 22.13 metres.

$$S = \frac{\sqrt{L}}{22.13} x (0.065 + 0.045S + 0.0065S^2)$$

C = Cropping management factor

*crop plantation 0.2 to 0.3

*bare land 1.0

*paved and turfed areas 0.10

P = Erosion control practice factor, P = 1.0 when no conservation measures are instituted.

Soil erosion was calculated using RUSLE in tons per hectare per year. The total soil loss in the study area under different site conditions was calculated by summing up each cell in the watersheds. The detail calculation of soil loss is attached in Appendix F.

Three scenarios are modelled and analyzed that are:

i. Natural Stage (Pre-Operation Stage)

The analysis is to understand the initial soil loss occurred every year and act as a benchmark for comparison between pre-operation and operation stage. It helps to recover the disturbed land back to quo status.

ii. Logging Stage Without Mitigation (Worst Case Scenarios) The analysis is assumed to be worst case scenario without any

The analysis is assumed to be worst case scenario without any mitigation measure. Significant soil loss is foreseen.

iii. Logging Stage With Mitigation

The applied mitigation measures are conservatively assumed to have effectiveness of 50%. Amount of soil shall reduce to half.

The modelling parameter and its result of soil loss is tabulated **Table 8.1**.

	MAGNITUDE			
PARAMETER	NATURAL STAGE	LOGGING STAGE WITHOUT MITIGATION	LOGGING STAGE WITH MITIGATION	
R	14,500	14,500	14,500	
K	0.043	0.043	0.043	
LS	4.421	4.421	4.421	
С	0.030	0.390	0.360	
Р	1	1	0.390	
A (t/ha/year)	82.70	1,075.03	387.01	

Table 8.1: Modeling Parameter and Soil Loss in Project Area

Soil erosion was calculated using RUSLE in tons per hectare per year. The total soil loss in the study area under different site condition was calculated by summing up each cell in the watersheds. The average soil loss under present land use (existing condition) in the study area was 82.70 tons/ha/yr.

The impacts of no-conservation practices (worst case) showed significant soil loss up to 1,075.03 tons/ha/yr for the whole study area and was dramatically reduced under 387.01 tons/ha/yr.

Table 8.2 is shown the estimated average soil erosion per hectare per year under different site condition.

Table 0.2. Estimated Average bon crosion per freetare per rear				
SITE	AVERAGE SOIL LOSS	TOTAL SOIL LOSS		
CONDITION	(TONS/HA/YR)	(TONS/YR)		
Existing	82.70	4,962.00		
Worst case	1,075.03	64,501.80		
Logging period	387.01	23,220.60		

 Table 8.2: Estimated Average Soil erosion per Hectare per Year

In general, higher soil erosion is expected at the northern part of the project site due to the greater slope steepness. Although the overall erosion rate is relatively high as compared with the existing erosion rate, the annual soil loss is expected to be significantly reduced as the logging activities will be carried out by phase. In addition, the impacts could be minimized to acceptable level with implementation of proper mitigating measures on site as recommended in Chapter 9.

The soil conditions during existing environmental and logging phase are fall under category of very low risk as in accordance to Table 8.3. However, proper mitigation is necessary to minimize the impact of soil loss.

Table 0.3. ETUSIUII NISK Calegui y		
EROSION RISK (TONNES/HA/YR)	ІМРАСТ	
<500	Very Low	
501 - 1500	Low	
1501 - 2500	Low Medium	
2501 - 3500	Medium	
3501 - 5000	High	
>5000	Very High	

 Table 8.3: Erosion Risk Category

8.3 WATER QUALITY DEGRADATION

Water quality degradation could not be avoided and is bound to occur from activities conducted under this stage. Pollutants of water quality could be physical, chemical, nutrient or of organic parameters. Pollutants are transferred in a river system via two processes of advection and dispersion. Water quality degradation may result increase in turbidity, BOD and COD level, decrease in DO level and oil and grease pollution.

i. Increased Turbidity

Soil erosion and sedimentation occurred during operation stage is the most prominent factor to cause degradation in water quality. Removal of undergrowth and litter layers rather than the canopy itself by logging activities will accelerate erosion and cause damage to the water quality.

Turbidity is very much related to logging activities from the excess sediment loading into receiving water body. Increase in turbidity of receiving water is largely due to impact of soil erosion and sedimentation. Erosion control measure as described in Chapter 9 must be applied.

ii. Discharged of Untreated/Partially Treated Sewage

Discharge of untreated sewage can be expected from worker base camp if the facility is not properly provided with hygienic sewage disposal system. Sewage and sullage discharge from worker base camp could lead to increment of BOD₅ content and decrement in DO content. Besides, ammonia and nitrogen element in the discharge tends to flourish process of eutrophication. It even worsens the existing scenario. Raw sewage entering the receiving water body results in increase organic loading. High organic loading will induce the quantity of oxygen demand for biological or chemical reaction. Increase in BOD and COD and the subsequent will decrease the DO level. However, the DO level is also correspond to the size of workforce involve in the works.

iii. Indiscriminate Disposal of Municipal Solid Waste

Solid waste generated during logging stage comprises of vegetation debris and domestic waste generated from workers base camp. Illegal disposal of solid waste into river is prohibited. Organic content of solid waste will be decomposed by bacteria and microorganism in water and mixed together with water. BOD_5 and COD will alter significantly at the particular point source. Some of this material can pose a risk to the water quality in which it may involve in reaction whether chemically or biochemically. These will lead to the degradation of river water quality. Indiscriminate solid waste disposal will worsen the condition. Impact can become severe; however, it can be easily mitigated by provision of proper garbage bin at designated area.

An important aspect to consider is logging activity cease after a specific period of time; therefore impacts are deemed temporary in nature. The cumulative impact of the above are not expected to render the river system toxic or harmful to aquatic fauna or downstream river uses. The same goes for the oil and grease impact. Notwithstanding the above statement, standard measures with respect to protecting the environment must be adopted in logging activities. These measures are further dealt with in Chapter 9.

iv. Indiscriminate Disposal of Scheduled Waste

Maintenance and servicing of the machineries are compulsory to ensure the logging work runs well. These will generate used grease, oil, cleaning fluids and used oil filter. Examples of used oils are used lubricating oil and used hydraulic from machineries operations.

Waste oil is toxic to both terrestrial and aquatic flora and fauna. Moreover it can be very flammable thus causing injuries and property losses. The waste should be isolated and suitably constrained in an area so as to initially limit the risks of spill.

v. Decrease of Drinking Water Quality

Logging activities in the project area will be carried out in good logging practices by following "Selective Management System" which produces less impact compared to traditional logging. However there may still be possible impacts on water quality such as siltation to the receiving river body, untreated sewage from workers camp site, domestic waste generated and oil spill during logging activities which will reduce the river water quality of Sg. Ghuan.

Based on the information from Jabatan Kemajuan Orang Asli Kota Bharu, most of orang asli used groundwater as their source of domestic. There are few numbers of residents that use river water when there is a technical problem with the water treatment plant in the village. According to the site terrain in Figure 7.2 (Chapter 7), the directions of water flow is from the rural areas to the project site. Therefore, the logging activity does not contribute contamination to the water along the river near the settlement area.

8.4 AIR QUALITY DEGRADATION

Air pollution is defined as the presence in the outdoor atmosphere of one or more contaminants (pollutants) in such quantities and of such duration and may tend to be injurious to human, plant or animal life (Canter, 1996). Air pollution can be caused by the presence of one or more contaminants such as smoke, haze, carbon monoxide, particulate matter from logging related activities.

The impacts of air pollution on human health include eye irritation, headaches, and aggravation of respiratory difficulties. The aesthetic effects include reductions in visibility, discoloration of air and general disruptions of traffic. Air pollutants, particularly in dust form will be the only source of pollutants during the logging stage due to heavy vehicles movement and felling operation. However, vehicles shall generate potential air pollution in form gaseous emissions as well as CO, SO₂, NO₂ and CO₂. Besides, timber dust will be generated as well during tree cutting.

Air pollution that may arise during the logging stage of the development is caused by the followings:

i. Exhaust Emission

Exhaust emission from machineries can be expected throughout the development. The significance of impact is due to several factors such as the number of logging machineries used, work program, maintenance program and the condition of the existing air quality. Use of heavy vehicles is quite intense during logging period. However, exhaust emissions from logging machinery is negligible and will have insignificant impact on the air quality provided that the machinery is maintained and operated in a proper manner. This impact is considered short term, therefore would not adversely impaired air quality.

ii. Open Burning

The major impacts from logging works will initially involve the problems posed by the disposal of the vegetative waste. A significant amount of vegetative waste is expected from the logging works. Although open burning seems to be the simplest and most economical option of vegetative waste disposal, the practice is strictly prohibited.

iii. Dust Generation

During the access roads clearance phase, heavy vehicles and machinery to be employed will be in low volume. It is estimated eleven heavy vehicles will be used for the project site of 60 hectares. The site clearance for access road, logging road and skid trails will be completed shortest possible time. Furthermore, there already existing road prepared by Felda Aring 5 plantation area. As such, impact on air pollution during the site clearance will be insignificant. Besides, gases of CO and CO_2 can be filtered and up taken by canopy of forest.

The timber dust created during the felling operations is small, thus it is insignificant and localized. Besides, impact on dust generation during the timber felling period is also insignificant due to:

- Timber felling period is estimated to be 4 months;
- Low speed (20 km/h) for the heavy vehicles will be imposed on the unpaved road within and surrounding the project site.

 Movement of bulldozers and crawler tractors are confined only in the logging area.

The environmental impact on air quality is concluded to be in form of particulates matter. Since the project site is located in an area characterized by high humidity and rainfall, it shall encounter lesser amount of particles emissions as compared to drier areas.

Conclusively, dust form will be the only source of pollutants during the logging stage. The impact of dust generation due to heavy vehicles movement shall be concerned. However, the magnitude, duration and frequency of dust generation are expected to be minimal, temporal and localized. Effort must be made by the Contractor to control any arising impact to the existing air quality. This can be done through appropriate mitigation measures as outlined in Chapter 9.

8.5 NOISE POLLUTION

The primary noise sources during operation activities will be the equipment utilize and vehicle including chain saw, excavators, bulldozer and lorries. Normally, these activities are limited to daytime period. During the operation, a minimum number of machinery is used and the machinery only operating when required. Typical noise levels are measured at 30 meter under normal working condition is shown in Table 8.4.

MACHINERY	NOISE LEVELS (dBA) AT 30 METER
Diesel Generator (250 kVA)	74-81
Excavator	75-80
Loader	77-80
Bulldozer	76-80
Chain Saw	76

Table 8.4: Typical Noise Levels of Machinery

Operators or workers could be exposed to a noise level, which, over a period of time, may damage their hearing system, disturbance of sleep, stress and annoyance. Based on the project operation, noise on site is mainly due to mobilization of machinery and vehicles. This level will fluctuate with hours of the day and dependent on numbers and type of vehicles and equipment employ for the proposed project. However, it is envisaged that impact is insignificant, localized and minimal to the community as the project is away from nearest settlements. Table 8.5 show the OSHA noise exposure limits for the work environment.

NOISE (dBA)	PERMISSABLE EXPOSURE (HOURS AND MINUTES)	
85	16 hrs	
87	12 hrs 6 min	
90	8 hrs	
93	5 hrs 18 min	
96	3 hrs 30 min	
99	2 hrs 18 min	
102	1 hr 30 min	
105	1 hr	
108	40 min	
111	26 min	
114	17 min	
115	15 min	
118	10 min	
121	6.6 min	
124	4 min	
127	3 min	
130	1 min	

 Table 8.5: OHSA Noise Exposure Limits for the Work Environment

 NOISE (JPA)
 DEDMISSARI E EXPOSURE (HOURS AND MINUTE)

(Source: Marsh 1991, (cited in Canter 1997))

8.6 ECOLOGICAL IMPACT ON AQUATIC AND TERRESTRIAL HABITAT AND SPECIES

8.6.1 Impact on Flora and Fauna

Logging often destroys natural habitats, resulting in the loss of biodiversity and sometimes leading to the local and possibly global extinction of species. According to joint report by the Worldwide Fund for Nature and the Sarawak Forest Department, logging causes immediate forest disturbances, long term habitat changes (e.g damage to food trees and salt-licks), increased hunting by timber company workers and availability of logging roads as hunting routes. The destruction of wildlife from habitat loss must be recognized to be an enormous scale. Sources of impact are as below:

- Site clearing
- Construction of logging road and skid trail
- Operation of machineries (noise and vibration)

- Water and air quality degradation
- Felling of timber (noise and vibration)

Definitely, there will be localized impacts of fauna and flora inhabiting the area earmarked for logging. Although in a limited scale, it will displace and localized birds inhabiting the area earmarked for logging and its immediate vicinity where some residual impacts are expected.

It must be stressed that the impacts are not only dependent on the type of development being undertaken but also the manner in which they are developed. As an example to the logging operations, a rush and hurried job employing the use of unlimited number of heavy machineries and high density of roads will result in much higher and longer term negative impacts than if it were to be undertaken with proper planning and implemented with strict adherence to environmental protection procedures. Proper guidelines are available with amongst others include Guidelines for Reduced Impact Logging, Forest Road Specifications 1999 and Code of Practices for Inland Forests.

The impacts are summarized as below:

- i. There will be permanent loss of vegetation from the feeder roads.
- ii. There will also be temporary damage to the residual stand due to felling and skidding operations. However, if these activities are implemented properly, the residual stand will be able to re-grow and recover naturally.
- iii. Logging may indirectly make adjacent forests more vulnerable to wind-throw, fire illegal felling and encroachments. Adjacent or residual stands can suffer mechanical damage during logging and clearing of developed sites.
- iv. Loss of carbon sequestration potential from the loss of forest area and the release of greenhouse gases if the burning of woody debris is carried out.
- v. Fuel, metals and other hazardous chemicals, which are brought into the forest during the logging, may pose danger if they are released into the study to negligence or from mishaps.
- vi. Logging operation can injure and kill some animals outright, but more likely it damages or destroys key habitats such as nesting site, including old hollow trees, feeding and breeding grounds. It can also interrupt or eliminate the aerial

pathways of arboreal species that seldom move at ground level. The severity of impact is seriously increases with extent of area logged and cleared.

Proper logging practices that follows various guidelines and specifications as required under the M C & I 2002 will surely minimize the impacts of the logging to a level that will enable the logged out residual vegetation to recover. The impact on ecology shall be significant unless appropriate mitigation measures are proposed and implemented effectively.

8.6.2 Impact on Wildlife

According to Gua Musang Wildlife Department complaints data, elephant is the main wildlife that can be found in Gua Musang area. Elephant interference was detected within 6 km radius on the west side of the project site. In year 2010, the elephant spotted in Plantiful Gold Aring 5 Farm. Whereas in 2012, the disruption have occurred in the First Nationwide Farm also detected 6 km radius from the project site (northwest side).

Illegal killing (poaching), loss of habitat, and other forms of conflict with humans are all major threats to the elephants and these threats are increasing as the continent's human population continues to grow. Human-elephant conflict is one of the impacts as their habitats are transformed into logging activity and agricultural areas. These elephants increasingly feed on crops, which can lead to violent conflicts with humans.

Logging activities as well as illegal hunting may affect the wildlife population. The impact on wildlife shall be significant unless appropriate mitigation measures are proposed and implemented effectively.

8.6.3 Impact on Aquatic Life

The fish species identified is indicative of crystal clear water in the draining basin. They are sensitive species that cannot grow well in a disturbed habitat. Thus, the site clearance, construction of logging tract and removal of logs shall result in the water quality deterioration. This activity will degrade the habitat of mostly small ornamental and recreation fish species such as *Rasbora sp*.

8.7 IMPACT DUE TO TRANSPORTATION OF LOGS

Transportation of logs is a key issue despite felling operation as the proposed area is deeply isolated in the forest. Its access road shall pass Felda Aring 5 Oil Palm Estate and will not passing Orang Asli settlement area. The main road access for log transportation through Felda Aring 5 is well-maintained by the plantation management. The construction road is not publicly accessed by the local people except for plantation vehicles

8.8 SOCIO-ECONOMIC IMPACT

Local people, particularly small holders who are beneficiary of the project as the logged out land will distributed amongst few small holders for agriculture (based on the current landuse pattern). The skills of the locals can be developed when they are given necessary training and guidance. Economically, the project's employment opportunities will reduce the households' dependency in add-jobs and self employment. In addition, their employment will prevent social resentment and conflicts, increase their positive feelings towards the project, and create a sense of pride in oneself.

It is anticipated that during access road construction, the local business will benefit from an increase demand for food supply. It is anticipated that local community will not be able to take up businesses such as consumables, spare parts and other materials except for food supply because of lack of capital, experience and know how.

8.9 SAFETY AND HELATH IMPACT

Safety management is an important aspect of the proposed project dealing with workers engaged in the logging operation. It ensures the safety and healthiness of workers. Occupational Health and Safety practices are vital to the logging activity. The general health of the project workforce will be safeguarded by provision of safety equipment/systems, personal protective equipments and/ or effective safety management

procedures. These provisions will be made in accordance with Occupational Safety and Health Act, 1994.

The company and its workers will have safety cover in terms of insurance and liability. The workforce numbering 15 could be exposed to possible various kinds of illness and accidents or due to accident. Since the workers are chosen from local people, thus the impact on possible infectious kinds of illness is significant.

The safety impact is hardly to be estimated and evaluated. It is depending on commitment and effort of project proponent. Project proponent shall implement occupational safety procedures and appoint health and safety supervisor to supervise the overall working and staying condition in the base camp.

8.10 SOLID AND HAZARDOUS WASTE IMPACT

8.10.1 Base Camp

Minor impacts from the workers base camp are expected. Unlike the full scale housing projects, the size of the base camp will be smaller as there will be only few workers will be staying in the base camp. The need for facilities such as kitchen and bathing facility, and solid waste are in minor scale as the size of the project is only 60 hectares. Project proponent will rent a house in Felda Aring 5 for the workers. Thus, the impact is minimal, insignificant and localized.

8.10.2 Accidental Oil Spillage Due to Vehicle Operation

There will be skid tank with levy around where oil and diesel will be stored for use until the logging operation is complete. Skid tank will be placed on high area away from the water courses. This will help prevent oil spillage into receiving water courses.

8.10.3 Biomass Management at Post Logging Phase

Since pre-development of the project site was forest reserve environment, the amount of vegetation wastes produce can be considered large with variety type of

vegetation. Allocating centralize dumping areas within the proposed project site may involve major transportation and may stretch the project schedule for a long period.

Leaving the wastes for decomposition may also take long period of time. Furthermore, cut vegetation has potential to be fire risk unless properly managed. During heavy rainfall, runoff may bring these materials into earth drain which can cause clogging and overflow.

8.11 AESTHETIC AND LAND USE

There is minimal, localized and insignificant impact on aesthetic and land use form of surrounding environment due to this project. As far as we concerned, the proposed project site is located moderately deep into forest environment. Even though the surrounding project area is fully harvested, however, less likely it will be seen by public communities. Only those that work in oil palm estate and locals shall have opportunity to see it. Thus, the aesthetic value is not concern.

it is believed to have no major impact on land use profile as the surrounding environment is either forest or estate.