

CHAPTER 8

MITIGATION MEASURES

8.1 INTRODUCTION

1. This section discussed the mitigation measures to minimize negative impact due to proposed Project.
2. All mitigation measures proposed is based on SMART solution concept. SMART stand for Sustainable, Measurable, Attainable, Receivable and Timeline reflection.
3. The proposal for mitigating measures is applicable for specific stage including pre, during development and operational phase.

8.2 ADHERENCE TO DOE GUIDELINES

1. Project proponent must be assessed adherence to DOE guidelines for applying the appropriate Land Disturbing Pollution Prevention and Mitigation Measures (LDP2M2) approach in implementing the Best Available Technologies (BAT) or any practical practices. This practices should implement during both development and operation phase.
2. The requirements and specifications stipulated in the following documents issued by the DOE shall be adhered to:
 - EIA Guidelines in Malaysia, 2016
 - Guidance Document for the preparation of Land Disturbing Pollution Prevention and Mitigation Measures (LDP2M2).
 - Environmental Impact Assessment, Guidelines for Mines and Quarries.

- Other relevant guidelines and guidance documents issued by the DOE pertaining to environmental-related system and management.
3. Project proponent are required to carry out an environmental monitoring and audit program during development phase as part of the conditions of the implementation of the LDP2M2 in order to ensure the environmental compliance in term of water quality due to the effects of erosion and sedimentation.

8.3 ADHERENCE TO OTHER AGENCIES REQUIREMENT

1. As stipulated in the comment by other related agencies during One Stop Agency meeting dated 17 December 2018, all activities need to follow strictly all requirement stated by agencies. List of the guidelines and references by other are depicted in **Table 8-1** below.

Table 8-1: List of Guidelines by other agencies

No	Agencies	Requirements/ mitigating measures
1.	Ministry of Natural Resources and Environment	1. National Policy on Biology Diversity 2016-2020, 2012
2.	Department of Irrigation and Drainage (JPS)	1. Guideline for Erosion and Sediment Control in Malaysia, 2010 2. Urban Stormwater Management Manual (MASMA) published by JPS in 2000 (Revised version 2012).
3.	Plan Malaysia	1. National Physical Plan 3, 2016 2. Rancangan Tempatan Daerah Marang, 2015

8.4 PROPOSED MITIGATION MESURES

8.4.1 Geology

8.4.1.1 Pre-construction Phase

No physical works involved at this stage. Thus no impact on geology during this phase and no mitigating measure required. .

8.4.1.2 Construction Phase

1. Landslide

It is proposed to create a boundary between granite and metamorphic rocks as a safe zone of 50 m wide, so that the proposed Project area is avoided from the effects of landslides. In addition, it is also necessary to make the slope of granite slope not exceeding than 30°.

2. Weathering

The surface area will always be covered by plants (diameter 5cm and below) to reduce the impact of rainfall infiltration into the rock. Every land clearing work will be followed planting activities immediately.

8.4.1.3 Operational Phase

1. Create a buffer zone, this buffer zone that will help minimize erosion and naturally filter stormwater runoff that may contain sediment.
2. Implementation of LDP2M2 at site especially at the slope area is a must.
3. After mining finished, the mine area must under rehabilitation, waste dumps are contoured to flatten them to further stabilise them, covered with a clay to proven access of rain water and oxygen from the air, planted with vegetative to help consolidate the materials.

8.4.2 Soil Erosion and Sediment Control Measures.

8.4.2.1 Pre-construction Phase

No mitigating measures required during this stage.

8.4.2.2 Construction and Operational Phase

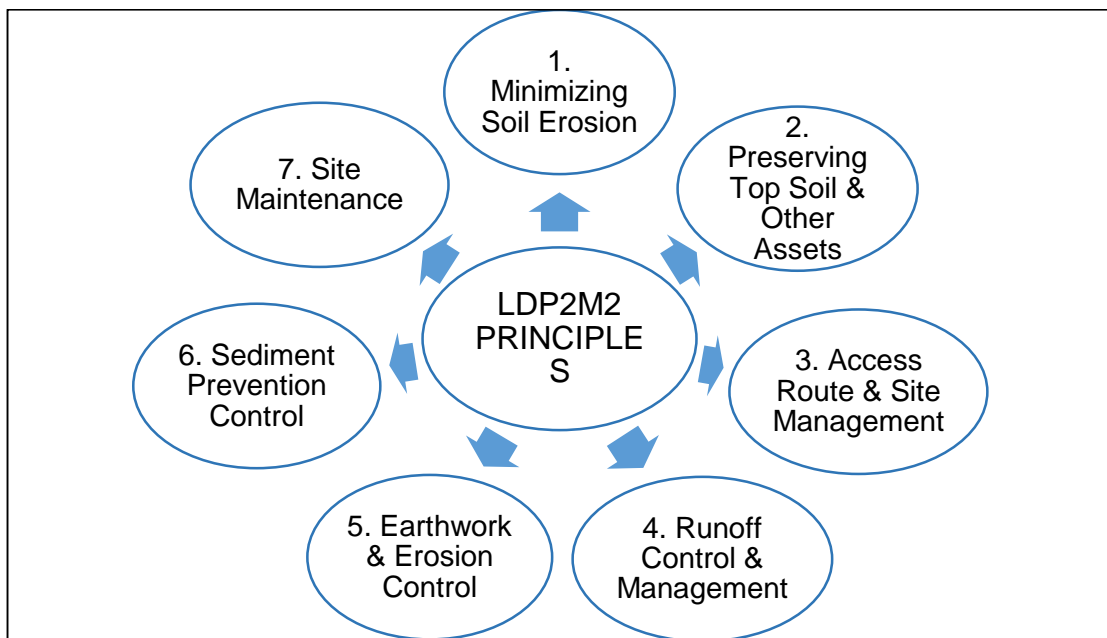
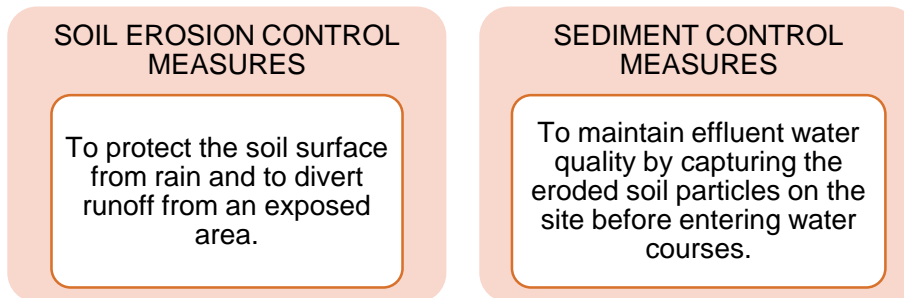
1. The proposed erosion and sediment control measures are designed in accordance with the following documents:
 - "Guideline for Erosion and Sediment Control in Malaysia", published by Department of Irrigation & Drainage (DID) Malaysia, 2010.
 - "Urban Storm Water Management Manual for Malaysia, Second Edition", published by the DID, 2012.
 - "Guidance Document for Addressing Soil Erosion and Sediment Control Aspects in the Environmental Impact Assessment (EIA) Report", published by DOE, 2016.
 - Guidance Document for the Preparation of Land Disturbing Pollution Prevention and Mitigation Measure (LDP2M2).

2. It is highly recommended that erosion and sedimentation control measures shall be constructed at the appropriate areas before any commencement of development activity. The recommended soil erosion and sediment control measures essentially consist of the following:
 - **Scheduling and Staging of Development**

Scheduling as well as staging all the activities will preserve the soil surface with existing vegetation which is not immediately affected by the land development. Land clearing activities must not be carried out during the rainy season.
 - **Implementation of Land Disturbing Pollution Prevention and Mitigation Measures (LDP2M2)**

The main objective of LDP2M2 is to protect, restore and enhance the environmental quality at the project site and its surrounding areas through a proper and systematic planning, implementation, monitoring and auditing of

mitigation measures on soil erosion and sedimentation. The LDP2M2 for the project development must be submitted to and approved by the DOE prior to the start any activities in the development activities. The control measures focus on soil erosion and sedimentation is as shown below: The LDP2M2 consists of seven elements as shown in **Figure 8-1**.



Source: *Guideline for Erosion and Sediment Control in Malaysia, DID 2010*

Figure 8-1: LDP2M2 Principles

8.4.3.1 Land Disturbing Pollution Prevention and Mitigation Measures (LDP2M2)

The LDP2M2 for the project can be classified into the following best categories:

- a) Site Planning;
- b) Soil and vegetation stabilization;
- c) Physical stabilization;
- d) Diversion of runoff;
- e) Sediment trapping;
- f) Housekeeping; and
- g) Inspection and Maintenance

The implementation of the said categories will be guided by the requirement of ESCP and MASMA prepared by JPS to ensure that all the set criteria and standards are met.

The drawing for the LDP2M2 related to soil erosion and sediment control are attached in **APPENDIX IX**. The LDP2M2 will be applied during construction and operation phase.

1. Site Planning

1. Proper sequencing of development phase activities to reduce erosion potential should be incorporated into the schedule of development projects. This includes avoiding alteration to the existing natural terrain, avoid major land clearing during rainy season, phasing out the land clearing into manageable lots, minimizing the period of exposed soil to rainfall and practice erosion and sediment control all year round.
2. The project proponent should pay particular attention to the current state of the proposed site located in a sloped area with surface water flows from the surrounding area. The developer are required to ensure

that the flow of water through natural (or natural) groves from high to low areas is reasonably taken into account by providing a systematic drainage system to handle any future changes of runoff water.

3. Preservation of existing vegetation and topsoil is vital in the early stage of the project. Careful planning on the preservation corridor can minimize the potential of soil erosion that serves as buffer zones to separate disturbed land from an adjacent watercourse. The project proponent is required to ensure there is no river diversion, alignment, reclamation or other activity involving water bodies as well as development activities within 50 meters of river bank.
4. Among the priority of the site planning works related with the implementation of LDP2M2 are listed below:
 - Identify vehicle, equipment, material storage and development access area;
 - Identify and construct the temporary access for sedimentation basin;
 - Construct the temporary earth drains that channeled to the sediment basin;
 - Install the silt fence along the perimeter of the site;
 - Construct wash trough and channeled to the nearest earth drain or sediment basin;
 - Provide maintenance schedule and record for the applied ESC measures

2. Soil Stabilization

1. Soil stabilization is the component that combines with runoff management to be the site management practice that limits or controls erosion. It can be done by keeping the soil in place and limit its mobilization within the project area so the need for sediment control is minimized.
2. All new open area must be compacted in avoiding soil loose during raining day. In addition, preservation of the vegetative below 5cm diameter is good measures for soil stabilisation. In the meantime, no clearing works in the area with 25% slope.

3. Vegetation Stabilization

1. The best way to protect the soil surface and limit erosion is to preserve the existing vegetative ground cover. Corridors of vegetation act as buffer zones to separate disturbed land from an adjacent watercourse, protected forest, or other sensitive areas such as steep slopes and building sites in wooded areas. It can help to reduce rainfall impact, reduces surface-water velocities, enhances infiltration, traps sediment in vegetative shoots, retains soil particles in roots and promotes establishment of permanent vegetation.
2. Planting activity should be implemented shortly in order to avoid exposed soil for long periods of time. Grasses, shrubs and ground covers provide long-term stabilization of soil should be remained.

4. Diversion of Runoff and Flow Velocity Reduction

1. Temporary Diversion Channel and Silt Trap

1.1 Temporary diversion channels (**Figure 8-2**) can be used to divert off-site runoff around the project site into the proposed silt traps. Temporary diversion channels should be constructed when the site is initially graded and remain in place until permanent BMPs are installed and all graded slopes are stabilized.

1.2 The temporary diversion channel alignment proposed follows the existing stream as well as the proposed permanent drains alignment. The sizing of the diversion channels are to be carried out using Manning’s formula as outlined in MSMA. The diversion channels are preferably designed as trapezoidal earth drains if space is not a constraint. The design velocities of diversion channels are ensured to be within the outlined limits to prevent excessive erosion and siltation. Temporary diversion channels to divert site runoff into the sediment basins are aligned the same as the proposed permanent drains alignment.

1.3 Silt trap (**Figure 8-3**) shall be required to prevent siltation to the downstream watercourses. The total number of proposed silt trap in the project area are 19 (**Table 8-2**). They shall be constructed at strategic locations immediately after site clearing works and before commencement of earthworks. Silt traps should be maintained until the site area is permanently protected against erosion. Whenever possible, silt traps should be constructed before clearing works begin.

Table 8-2: Number of Silt Trap in Project Area

No	Location	Quantity
1	Site A	11
2	Site B	4
3	Site C	4

2. Silt Fence

2.1 Silt fences (**Figure 8-4 and 8-5**) are installed to trap sediment in swales, small ephemeral drainages, or along hill slopes where other methods cannot be used. They provide temporary sediment storage. Sediment fences are also installed to monitor sediment movement as part of effectiveness monitoring. A silt fence is a temporary sediment barrier consisting of filter fabric stretched across and attached to supporting posts, entrenched, and depending upon the strength of the fabric used, backed by a wire fence for support. Silt fences trap sediment by:

2.2 Intercepting and detaining small amounts of sediment from disturbed areas during development and operational phase in order to promote sedimentation behind the fence; and decreasing the velocity of low flows (up to 15 l/s) in swales and small diversion channels.

2.3 Silt fences are generally effective in locations where the flow is concentrated and are only applicable for sheet or overland flows.

2.4 Limitation:

- Do not place the fence on a slope, or across any contour line;
- Do not use in streams, channels, or where the flow is concentrated; and
- Do not use in locations where ponded water may cause flooding.

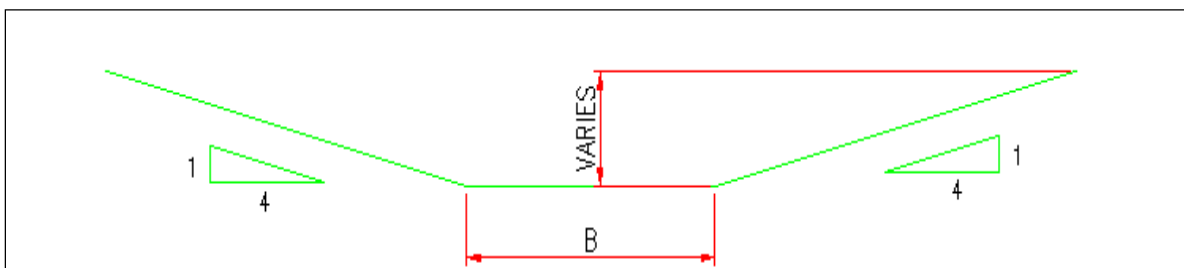


Figure 8-2: Typical Cross-Section for Temporary Channel

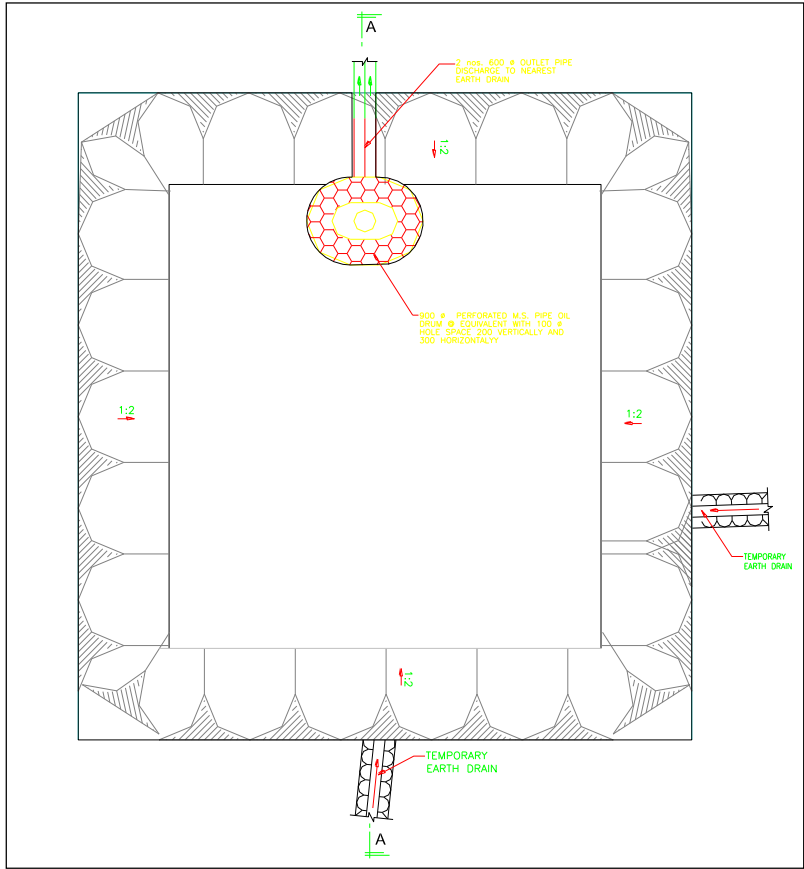


Figure 8-3: Example of Sediment Trap

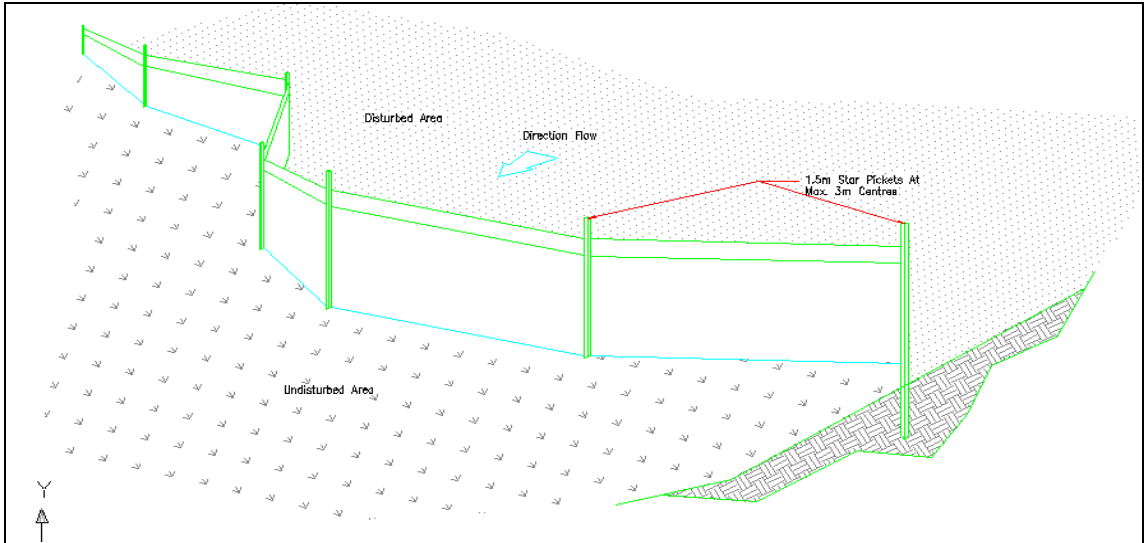


Figure 8-4: Typical Silt Fence

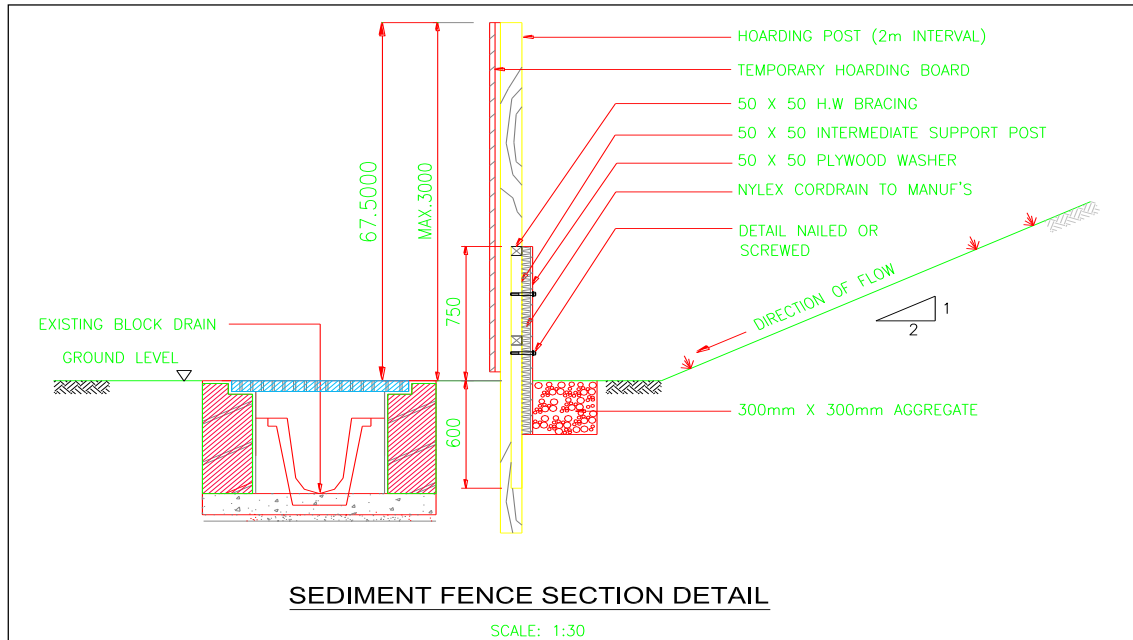


Figure 8-5: Typical Slit Fence Installation

3. Check Dams

3.1 Check dams (**Figure 8-6**) are provided at each channel branch to reduce the velocity of concentrated stormwater flows, thereby reducing erosion of the diversion channel or swale and promoting sedimentation behind the dam.

3.2 The check dams are provided at the temporary diversion branches to reduce the amount of sediment being transferred into the sediment basin.

3.3 Periodic inspection for sediment build-up and signs of erosion around the dam is required after each storm event.

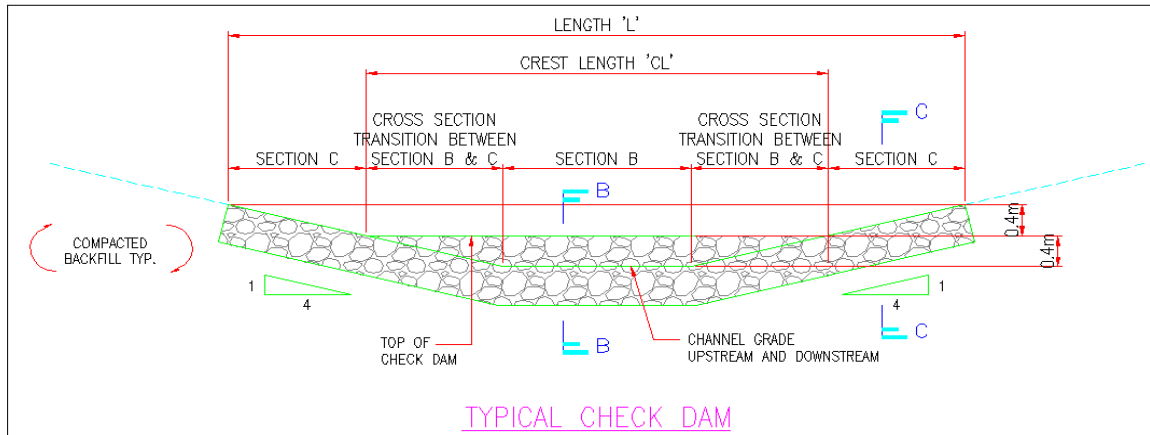


Figure 8-6: Typical Check Dam

4. Sediment Trapping and Filtering

4.1 Sediment fence:

- Inspect weekly and after each rainfall;
- Repair whenever fence is damaged; and
- Remove sediment when it reaches one-third of the fence's height.

4.2 Silt Trap:

- Inspect weekly and after each rainfall;
- Remove sediment when the sediment storage zone becomes full; and
- In the case of wet silt traps, the captured stormwater in the settling zone should be drained or pumped out within the five-day period following rainfall, provided that an acceptable water quality has been achieved.

4.3 The target water quality should be specified by the local authority in terms of the National Water Quality Standards for Malaysia (NWQS). Typically, Class III Standards will be required (e.g. TSS < 150mg/L). If this quality is not achieved by settling, a flocculating agent (e.g. gypsum, enzymes) should be added to the stored water. A peg or other mark should be placed in the basin to indicate the top of the sediment storage zone. A floating inlet should be used on the pump to ensure that

settled sediment is not picked up during the dewatering process. Supplies of flocculants shall be kept on or near the site for this purpose. Such dosing should occur within 24 hours of a rainfall event.

5. Good Housekeeping Practices

5.1 Vegetative Stabilisation

- Shrubs and trees must be adequately watered, fertilized, and pruned if needed; and
- Grasses may need to be watered and mowed.

5.2 Diversion of Runoff and Flow Velocity Reduction

- Inspect periodically and after every significant rainfall;
- Repair as necessary;
- Remove sediment which builds up in the channel and restricts its flow capacity;
- Inspect for sediment build-up and signs of erosion around the check dam after each rainfall; and
- Remove accumulated sediment whenever it reaches one-third of the height of the dam, or one-half of the sump depth if a sump is provided.

5.3 Wash Trough

Wash area (**Figure 8-7**) must be built up at the exit point of the project site area. A wash area without walls and roof is the least desirable option because building roof and walls prevent entry of precipitation while walls also contain wash water. The standards are designed to prevent release of petroleum compounds and metals into the environment and minimize the discharge of precipitation to the sanitary sewer and rivers/drains.

A designated wash area should be paved, preferably with concrete,

and constructed as a spill containment pad to prevent the run-on of stormwater from adjacent pavement areas. The spill containment area should be graded so that all water is collected in a containment pad drain system. The containment pad should be sized to extend out a minimum of four feet on all sides of the vehicles.

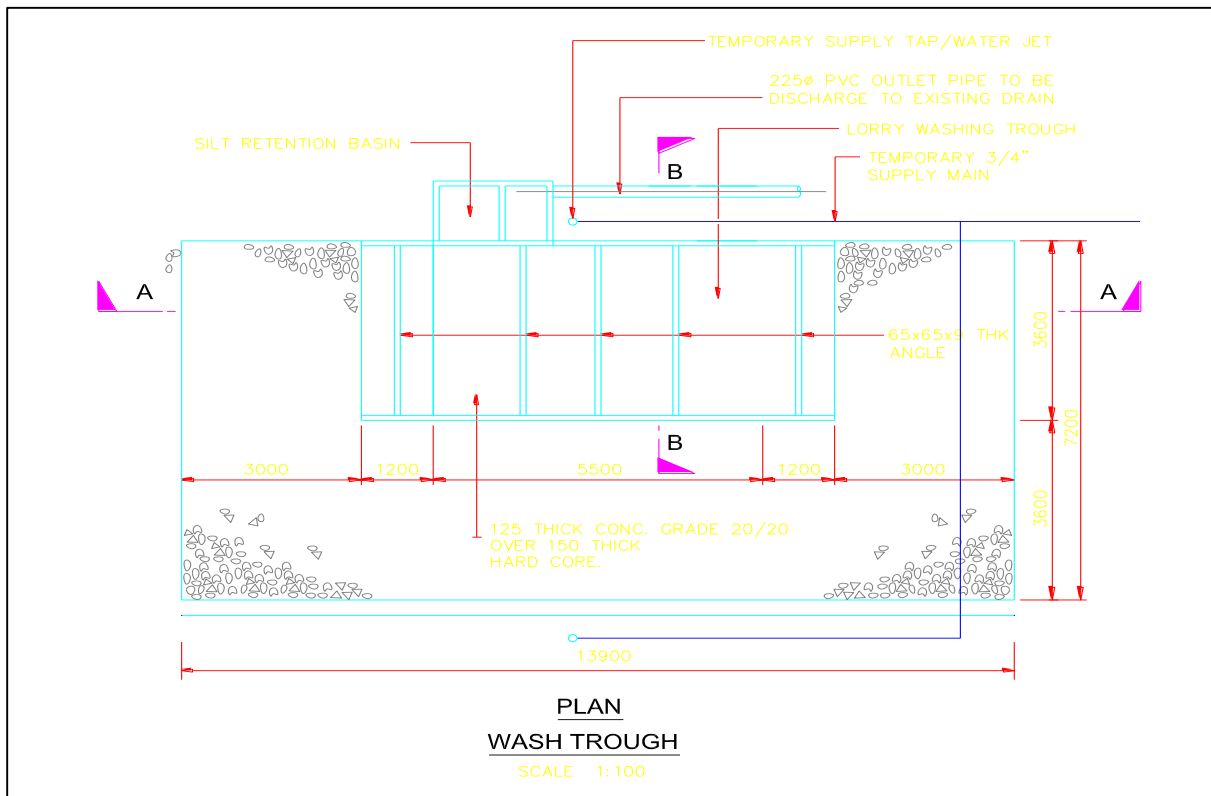


Figure 8-7: Typical Wash Trough

7. Management of Exposed Soil

Temporary soil stabilization shall be applied to exposed areas within fourteen (14) days after final formation level is reached on any portion of the site. Temporary soil stabilization shall be applied within seven (7) days to exposed areas that may not be at final grade but will remain unattended for longer than fourteen (14) days. Erosion Control Bracket (ECB) can be used as a temporary material to cover the exposed slopes and soils.

8. Inspection and Maintenance

If sediment and erosion control measures are to remain effective, they must be installed correctly, inspected in a timely manner and properly maintained. The inspection and maintenance criteria in a project area depend on several factors such as the location, weather, size and type of project. The requirement of inspection should be fully understood by the parties involved. Therefore, both contractors and inspectors must continually educate and work with the designers to ensure effective plans are designed and implemented. The proposed sediment basins should be constructed before clearing and grading work begins. Periodic inspection and maintenance is required to remove trapped sediments and repair any damage, especially after heavy rainfall.

Table 8-3 below lists a schedule of regular inspection and repairs to erosion and sediment control practice that are provided in the ESC Plan. The maintenance of the erosion control measures shall be carried out by the contractor throughout the development phase period and good housekeeping practices should be strictly adhered to as discussed.

Table 8-3: Proposed Inspection and Maintenance during the development phase

ESCP	Development Period	Maintenance Required
Sediment Basins	Initial Stage before grading works.	Weekly inspection and after rainfall event or rainfall reading equal or more than 12.5 mm. Remove trapped sediment when one-third full
Earth Drain Channels	Initial Stage before grading works.	Weekly inspection and after rainfall event or rainfall reading equal or more than 12.5 mm.
Check Dams	Initial Stage before grading works but after development activity of temporary diversion channels.	Weekly inspection and after rainfall event or rainfall reading equal or more than 12.5 mm. Remove trapped sediment when one-third full.
Silt Fence	Initial Stage before grading works.	Weekly inspection and after rainfall event or rainfall reading equal or more than 12.5 mm. Remove silt and repair as necessary.
Preserved	Do not disturb areas where vegetation is to be preserved	

ESCP	Development Period	Maintenance Required
Vegetation		
Stockpile	During earthworks.	The exposed stockpile should be covered.
Inlet Protection	Initial Stage before grading works	Weekly inspection and after rainfall event or rainfall reading equal or more than 12.5 mm Remove and clean silt into the construction waste bin.
Monitoring Programme	TSS and turbidity parameter at the discharged outlet of the sediment basin	Monthly basis

8.4.4 Hydrology

8.4.4.1 Pre-construction Phase

No specific mitigating measures applicable during this stage

8.4.4.2 Construction and Operational Phase

1. Reduce Sediment Transport due to land clearing and excavation works

Implementation of LDP2M2 is a must.

2. Remain Drainage Pattern and River Buffer Zone

Prior to the land clearing work, clear mapping of the streams and tributaries in the basin is compulsory to ensure the existence of the streams was not interrupted. Make sure the 50m river buffer to be in place as required by JPS for gazetted river in the project site. Used of bridge or culvert is a must in river crossing area. No river diversion is prohibited. No cut and filling in the swampy and lowland area.

3. Flood Management

Flood simulation has been conducted by the consultant in this study. 2D model simulation has been develop using XPSWMM software owned by East Coast Environmental Research Institute, UniSZA. Based on the simulation, the impact of

the flood in downstream area due to proposed project could be control if all mitigating measures in place. Please refer **Chapter 6** for detail simulation of the study area.

8.4.4.3 During Operation

1. Excavation work represents another essential factor influencing the quantity and quality of water in the site. The process of mine works can not only cause a significant change in runoff patterns in terms of both peak flow volumes and speed of runoff. Volume discharge needs to be monitored and stabilized from time to time.
2. Make sure the breakup/excavate is not too deep or does not exceed the depth of the groundwater level.

8.4.5 Water Quality

8.4.5.1 Pre-construction Phase

No significant impact on water quality during this phase. Therefore no mitigating measures are required.

8.4.5.2 Construction Phase

1. It is important that the Contractor be guided in his approach and planning of site clearance and earthworks. Contractor need to strictly follow LDP2M2 plan provided in this report as in accordance with the “Guidelines on Land Disturbing Pollution Prevention and Mitigation Measures (LDP2M2)” published by the Department of Environment in 2016 is recommended for the Project. Some of the proposed LDP2M2 are discussed below:

2. The removal of vegetation and bush clearing should only be carried out once the designs have been completed and the site is ready to be worked upon. The area to be cleared should only be within the proposed mining development in accordingly to the procedures given in **Table 8-4** below:

Table 8-4: Procedures of Erosion and Sediment Control Program

Activity	Comments
Supervision	Supervision is needed during all stages of activity that are being implemented if erosion is to be controlled. Proper documentation must be kept on all measures undertaken so that evaluation on their effectiveness can be undertaken later.
Maintenance	Maintenance is upkeep of an area or system to a predetermined standard. This will reduce degradation of the erosion control measures and the area they are protecting. All the erosion control measures should be inspected and maintained regularly to be effective. For example, silt traps have to be de-silted at frequent intervals to prevent overflow. A regular maintenance program should be in place to avoid unexpected and expensive repair work.
Monitor	Monitoring is the observation of the area and recording what is happening. It may take many forms including field observations or use of appropriate instruments. The aim of the monitoring is to ensure that the erosion control measures undertaken are effective. Monitoring of all measures must be properly documented for further analyses, such as, to established trends in the sediment outputs from the project site prior, during and after project development or to establish whether the measures undertaken are sufficient and effective.
Field training	There must be a certain amount of field training for site

Activity	Comments
	workers, sub-contractors, lorry drivers, etc. relating to their responsibilities in minimizing erosion and transporting earth materials from the site. There should also be signs throughout the project site to remind them of the need to reduce erosion.

(Source: Guidelines for prevention and Control of Soil Erosion and Siltation in Malaysia, DOE, 1996)

3. All temporary discharge points required in the earthworks will be located, designed and constructed in a manner that will minimise the potential threat of flooding in Sg. Gali and Sg. Kerak.
4. 50m buffer zone will be created in the both right and left side of river water as the JPS Guideline (if any).
5. Any disturbed earth caused by earthwork activities must be firmly consolidated and compacted by earth moving vehicles and compactors to reduce the rate of possible erosion and release of loose soil particles. This is to prevent soil erosion which could lead to increased water turbidity and sediment load in the receiving water courses.
6. Unprotected stockpiles of excavated material or topsoil are very prone to erosion and therefore must be protected. Small stockpiles can be covered with biodegradable construction plastic sheets and large stockpiles should be stabilised by erosion blankets.
7. Silt traps and settling basins of adequate sizes, to trap silt and sediment from the on-going construction works, will be provided at suitable locations prior to discharge into Sg. Gali and Sg. Kerak. These structures will be regularly maintained and de-silted to provide maximum silt removal efficiencies. A silt marker will be installed at the outlet of all constructed structures to ensure silt

entrapment efficiency (of up to 100%). Weekly inspection of such facilities is required of the Contractor.

8. The amount of soil erosion and sedimentation resulting from land clearing activities will be minimised by planning the exercise in such a way that only a minimum amount of denuded surfaces will be left exposed at any one time before re-vegetation.
9. Temporary earth drain will be provided to facilitate runoff discharge via sediment basin or silt traps. These soil-trapping structures must be adequately sized and designed for initial storms of 5 year return period and; strategically located.
10. The contractor should ensure that any solid materials, debris, litter or wastes are not indiscriminately dumped on site or disposed of in the streams within the site. These construction wastes or domestic wastes will be collected regularly and disposed of at approved dump sites by licensed contractors.
11. The sewage generated from the workers' camp and site office must be treated to meet the prescribed Standard B quality as stipulated in the Environmental Quality (Sewage) Regulations, 2009. Discharge of any untreated sewage from the worker camp or construction site is prohibited. The temporary sanitary facilities should be de-sludged on a regular basis by licensed contractor. Water quality monitoring should also be conducted in monthly basis as per recommended in the Environmental Management Plan (EMP) report.

Meanwhile, other appropriate P2M2s as listed below are also recommended:

12. Spent lubricants such as oil and grease and hydraulic oil from machineries are categorised as scheduled waste under the Environmental Quality (Scheduled Waste) Regulations 2005 and must be handled and stored appropriately on site.

Off-site disposal of scheduled wastes should be carried out by licensed contractors.

13. Spillage of fuel, engine oil, chemicals and scheduled wastes on the ground or anywhere must be scraped away or cleaned up and stored the contaminated soil at the storage area.
14. To control the discharge from the project site, implementation of LDP2M2 should be executed stringently. Preserving the river buffer zone area is very important to make sure, there is an adequate filtration for any runoff from entering the river. All the component that has been highlighted in LDP2M2 must be installed on-site, to ensure any possible runoff can be contained on-site prior to be released to the river. **Table 8-5** shows the river buffer zone required for Sg Gali, Sg Kerak and Sg Marang.

Table 8-5: The distribution of the Marang River tributaries that located in the east and west banks of Marang River

No	Main Basin	Reserve River (m)
1	Marang River	50
2	Sungai Kerak	40
6	Sungai Gali	10

(Source: Hygrology Study, JPS Marang, 2012)

8.4.5.3 Operational Stage

1. During the operational phase, wastewater generated from the site would comprise sewage and sullage from the site office. Thereby, sanitary facilities with septic tanks should be provided on-site.
2. Discharge of any untreated sewage from the Project site is prohibited and all sanitary facilities should be de-sludged on a regular basis by licensed contractor.

3. Water quality monitoring should also be conducted in monthly basis as per recommended in the Environmental Management Plan (EMP) report.

8.4.6 Air Quality

8.4.6.1 Pre-construction Phase

No significant impact on air quality during this phase. Therefore no mitigating measures are required.

8.4.6.2 Construction and Operational Phase

1. Trucks carrying loads should have their loads adequately covered with canvas to reduce spillage.
2. The speed at which trucks ply unpaved roads or dry mud tracks should be restricted as dust generation would be excessive at high speeds on these roads, especially during dry period.
3. Maintain the access road with crusher run or gravel to protect the earth surface from precipitation and dry weather.
4. For dust control, cleared areas especially in the pathway of vehicles should be watered down regularly or dampened to settle the dust by using water sprays.
5. Vehicles should be regularly serviced and maintained to reduce undesirable emissions.

6. Open burning is strictly prohibited under the *Environmental Quality Act, 1974, Section 29A (1)*. Notwithstanding anything to the contrary contained in this act, no person shall allow or cause open burning on any premises.
7. Workers are strictly prohibited to carry out open burning at site. Any incidents must be reported and the offender must be fined.
8. The supervisor for the project site must keep a log book to compile all complaints from the surrounding dwellers and address the issues immediately.

8.4.7 Noise

8.4.7.1 Pre-construction Phase

No significant impact on ambient noise during this phase. Therefore no mitigating measures are required.

8.4.7.2 Construction and Operational Phase

1. Combined noisy operations occur in the same time period. The total noise level produced shall not be significantly greater than the level produced if the operations were performed separately.
2. Vehicles and machineries shall be regularly serviced and maintained to reduce or avoid any unwanted sound.

3. Work should be limited to daytime hours (7.00 am to 7.00 pm) only to avoid nuisance to the nearest settlement area.
4. Safety signboards will be place to identify high noise areas to ensure any access to these areas will require the use of Personal Protective Equipment (PPE).
5. Ensure any equipment not in use for extended periods are switch off.
6. The supervisor for the project site must keep a log book to compile all complaints from the surrounding dwellers and address the issues immediately.

8.4.8 Terrestrial Flora

8.4.7.1 Pre-construction Phase

1. Notices and signages will be display in appropriate locations informing the workers of no-tolerent to encroachment and biomass burning.
2. Only vegetation directly in the path of the proposed access roads to be removed.
3. Useable plant materials will be utilised on-site.

8.4.7.2 Construction Phase

1. Only trees and shrubs immediately on the project area will be removed.

2. Vegetation on higher elevation and steep slope will be left undisturbed to minimise soil erosion and filter the run-off during rainy days.
3. Vegetation strips shall be planted in around ponds and waterways to create buffer and filter the net delivery of silt during runoff from higher ground area to the lower areas.

8.4.7.3 Operation Phase

1. Progressive rehabilitation of affected areas to restore ecosystem function, where possible with fast growing trees and leguminous creeper species.
2. Any major removal of plants will be directed towards the adjacent forested area to facilitate fauna movement.
3. Vegetation should be encouraged to establish on the stockpiles of topsoil and subsoils to curb potential erosion.
4. Removal of vegetation should be restricted to the relevant infrastructure footprints only.
5. Invasive alien species should be prevented from occurring on site, as disturbance in natural habitat and compaction of soil usually leads to the establishment of alien plant species.

8.4.9 Terrestrial Fauna

8.4.8.1 Pre-construction Phase

No physical works applicable during this stage. However, all regulation related to working procedure in the forest need to be adherence. Activities to be involved

during site survey and list of workers need to in the knowledge of Forestry Department Peninsular Malaysia.

8.4.8.2 Construction Phase

A. Mammals

1. Prohibition of Wildlife Poaching and Trapping

- The contractors and workers must be prohibited from wildlife hunting and poaching. The Wildlife Conservation Act 2010 [Act 716] states that any person who commits an offence (illegal poaching and hunting) be liable to a fine and imprisonment for a term **(Figure 8-8)**.



Figure 8-8: Example of Warning for Illegal Hunting or Poaching

- Access roads must be constructed for the purpose of the project site only. Unauthorized individuals shall prevent from using these roads to prevent illegal hunting and trapping.

- Place “No Hunting” and “No Trespassing” signage at appropriate locations that can be seen by the contractors and workers (**Figure 8-9 and Figure 8-10**).



Figure 8-9: Example of Warning Sign for Wildlife Poaching



Figure 8-10: Example of Warning Sign for Wildlife Poaching

- Built a permanent guard house with 24 hours surveillance at the entrance of the access road to the Project site to prevent intrusion by poachers and other intruders (**Figure 8-11**).



Figure 8-11: Example of Permanent Guard House

- Any information related to illegal hunting and poaching should be reported immediately and that information must be channeled to the relevant enforcement authority, e.g. PERHILITAN, Malaysian Police and etc.
- Precautions must be taken to avoid trapping of wildlife during the operational phase of the project. An Environmental Management Plan (EMP) needs to be established to counter potential negative impacts of the Project. The proposed environmental monitoring and auditing programmes will ensure that environmental requirements are observed and followed by the project proponent.

2. Wildlife-Human Conflict: Sun bears, Wild Boars

- The loss of existing habitats and fragmentation of the forests will result in food scarcity for many of the animals. As such, the secondary growth areas would be the main target for wildlife such as sun bears and wild boars. The animals may also wander and encroach onto fruit plantations in nearby settlements and giving rise to human animal conflicts.

- To avoid any unwarranted incidents, the project proponent/mining management is advised to initiate a dialogue with the Department of Wildlife and National Parks and seek their guidance on how to handle wildlife and human conflicts
- **Contingency Plan** - The mining management shall seek consultation with the Jabatan PERHILITAN for developing a contingency plan to resolve potential sun bear and wild boar coming to the mining areas and workers housing areas.
- Any wildlife conflict encountered by nearby residents must be immediately reported to PERHILITAN Terengganu, or the complaint can be made online via http://perhilitan.wildlife.gov.my/e_aduan/index.php (Figure 8-13 and 8-14).

SISTEM e-ADUAN / e-COMPLAINT SYSTEM
 Jabatan Perlindungan Hidupan Liar Dan Taman Negara (PERHILITAN) Semenanjung Malaysia

RUANGAN YANG DITANDA [*] ADALAH WAJIB DIISI (Items marked with [*] are required fields) :: Panduan Pengguna :: Keluar / Logout ::

Maklumat Pengadu (Complainer's Information)

Nama : *

No. KP / Pasport : * Contoh (example): 68031501XXXX
 (NRIC / Passport)

Alamat : *

Poskod (Postcode): Negeri (State): * Sila Pilih (Please Select) *

Nombor Telefon : Sila isi sekurang-kurangnya satu nombor telefon
 (Telephone Number) Rumah (home): (at least one contact number)
 Pejabat (Office): contoh (example): 0312345678 atau (or) 0191234567
 Tel. Bimbit (handphone):

Alamat Email : * Contoh (example): ahmad@abc.com
 (Email Address)

Maklumat Aduan (Complaint's Information)

Jenis Aduan : *
 (Type of complaint) Gangguan Hidupan Liar (Wildlife Disturbance)

Keterangan Aduan : *
 (Complaint's description) 500 perkataan sahaja (500 words only).

Alamat Tempat Kejadian : *
 (Event's location) Negeri (State): * Sila Pilih (Please Select) *

Tarikh Kejadian : - - 2019
 (Date of event) Hari (day) - Bulan (month) - (dd-mm-yyyy)

Masa Kejadian : : :
 (Time of event) Jam (hour) - Minit (minutes) - Sila Pilih (Please Select)

Spesies :
 (Others) Sila Pilih (Please Select)

Pengakuan (Acknowledgement)

* Saya mengaku bahawa saya telah membaca dan memahami prosedur pengurusan aduan oleh pihak Jabatan PERHILITAN. Segala maklumat diri dan maklumat perkara yang dikemukakan oleh saya adalah benar dan saya bertanggungjawab ke atasnya.

Hantar / Send Isi Semula / Reset

* Nota: Keterangan yang diberi adalah sulit dan tidak akan diberikan kepada pihak-pihak yang tidak berkenaan.
 (Information submitted related to complaint treated confidentially by Department of Wildlife and National Park and will not be disclosed to other parties)

Figure 8-12: Online e-Aduan/e-Complaint

JABATAN PERLINDUNGAN HIDUPAN LIAR & TAMAN NEGARA (PERHILITAN)
SEMENANJUNG MALAYSIA
KM.10 JALAN CHERAS
56100 KUALA LUMPUR
TEL : 03-9086 6800
FAKS : 03-9075 2873

JABATAN PERLINDUNGAN HIDUPAN LIAR & TAMAN NEGARA (PERHILITAN)
PERHILITAN Negeri Terengganu
Tingkat 4, Wisma Persekutuan, Jalan Sultan Ismail, 20200, Kuala Terengganu,
Terengganu, 20200
TEL: 09-622 1460

Figure 8-13: Address

Proponents, locals and workers also play bigger roles in reporting any sighting of displaced or presence of wildlife within or near project site. The report of any conflicts or sighting can be made to PERHILITAN in several ways as in **Figure 8-15**.



Figure 8-14: Phone call to PERHILITAN'S Hotline.

B. Avifauna Management

1. Signage on Prohibition of Bird Hunting or Trapping

Bird trapping is an illegal, non-selective and cruel practice used by the poachers which involve large-scale and indiscriminate killing of birds including many endangered and protected ones. To discourage any attempt by the public, especially poachers in hunting, keeping, or trapping birds, a warning post must be placed in order to remind them of the offense and the penalty they have to face if committed in breaking the law. Proper signage on prohibition of bird hunting or trapping must be placed at suitable conspicuous locations for workers and contractors (**Figure 8-16**). Violators will be prosecuted if they break the law.



Figure 8-15: Example of No Hunting Sign

8.4.8.3 Operation Phase

All effective measure described in the construction phase is applicable for operation and rehabilitation phase. Project proponent has to have close collaboration with PERHILITAN in order to improve monitoring works and effective system to make sure wildlife issues arising from the project is manageable.

8.4.10 Socio-Economic

8.4.9.1 Pre-construction Phase

Minimal impact of job creating during this stage. However, project proponent is advised to prioritize local people to be a temporary workers such survey assistant, guides, potters.

8.4.9.2 During Construction

The project does not involve any land alienation. Therefore, the major concern is the impacts on communities who live outside the project site mainly on issues related to road access, wildlife conflict and river pollution during site clearing of the project.

a) Management of Wildlife

Project proponent should follow as proposed by consultant fauna in report for wildlife management. Additionally, proposed project could expose illegal encroachment by workers and locals into the forest. Awareness program should be conducted to make sure they are aware it is against the laws and have potential risks. Another measure is local must have safety preparation on wildlife encroachment to their residential area to avoid any unexpected incidents. Project proponent and locals should seek first consultation from PERHILITAN before conducting any actions.

b) Workers base camp

The Project proponent must provide adequate utilities and facilities to the base camps, which should be built at suitable locations and include decent living quarters with water supply, electricity, toilets and sufficient recreational space. These facilities will reduce or eliminate public health problems and social problems. Workers must be given sufficient instructions, training and advice and information of good work procedures, work ethics, and code of conduct and safety rulings during working and after working hours. The work/base camps must be sited away from nearby local settlement areas. Project site must also have demarcated boundary markers and fences for the determination of working area and also to avoid unnecessary trespassing from local people and wildlife that can cause incidents.

c) Priority for Local Community

Job opportunity should be given for local people. Foreign labor used just in case of labor shortage. In case of foreign labour being recruit, they have to be informed about local culture in order to avoid social conflict.

d) Existing Road

Existing road condition needs to be upgrade by having proper signage and traffic guides. The PP must also bear the maintenance cost of the existing road. Heavy vehicles from the project site should avoid using road during peak hours to avoid traffic congestion and risks. All drivers of heavy vehicles should follow the traffic and safety rules to avoid any accident occurs. Another proposed is, project proponent should continuously maintenance all their heavy vehicles to keep its in good condition

e) River and Soil Erosion

The project proponent must ensure that the land clearing activities follow the recommendations put forward in this report. It covers the provision of vegetative buffer zones along the river banks (as specified by JPS). By installing and maintaining proper erosion controls during construction phase to minimize run-off of top soil and disturbances to natural areas. If ineffective erosion controls may wash valuable topsoil downhill and impact waterways.

During Operation

a) Corporate Social Responsible (CSR)

Corporate Social Responsibility (CSR) can become an important agenda for project proponent in development period of the proposed project. It is also an important tool to maximize the positive impact from the proposed project to the surrounding communities.

Project proponent can focus in various aspects in their CSR mechanism such as:

- developing human resources by hiring the local communities hence give economic benefits
- construct a new infrastructure that can be share with the local communities such as a new paved access road which also can reduce nuisance and increase road safety; and
- build relationships with the local community, schools, social groups, clubs in taking part or sponsor in their community events.

8.4.10 Waste Management

1. Cut Vegetation

- Large stumps, small branches and other organic materials shall be disposed of via mulching/ composting in suitable area within the site.
- Open burning shall be prohibited.

2. Excavated Materials

- Surplus excavated material and inert wastes shall be reused on site as structural fill, landscaping, erosion control and restoration features wherever practicable.

3. General Refuse

The following measures may be undertaken:

- General refuse generated on-site shall be stored in enclosed bins separate from scheduled wastes.
- Minimize the generation of solid waste by proper planning and reusing whenever it is possible.
- Do not litter general solid waste into watercourses to prevent blockage.
- Always segregate solid waste from hazardous waste.

- Scheduled and prompt collection by the council will pose as potential beneficial action against the impact of water quality degradation.
- Solid wastes generated from the project site especially from the site office are expected to be minimal. Thus, the disposal of solid waste from the project site is not expected to be problem.

4. Construction Wastes

The following measures may be undertaken:

- The generation of construction waste shall be minimized through careful control of materials ordering procedures to avoid surplus materials.
- Scrap material (eg. Welding rods, end caps, off-cuts etc.) shall be recovered and sent for recycling as scrap.
- Other inert general wastes shall be collected and disposed of via local dumpsites or as infill material if appropriate.

5. Scheduled Wastes

- The Contractor need to ensure that all mobile machinery is well maintained and in good operating condition.
- The Contractor shall refrain from disposing of used oil and grease from his equipment and machinery into streams, drains, or vegetation in the area.
- No indiscriminate dumping of any waste material direct into the watercourses is allowed. The waste will be dump in the nearest landfill which is Landfill Tertak Batu in Marang District, Terengganu. The proposed contractor for solid waste is RD Paper Sdn. Bhd.
- The Contractor shall provide for the prompt removal of oil and grease spillage from his sub-Contractor's vehicles and equipment resulting from his work or carelessness in the execution of the works.
- The Contractor shall take necessary measures to collect and store used oil and grease from his vehicles and machinery in a manner deemed proper

by the Project Manager. Such measures will prevent pollution to the adjacent watercourses and groundwater.

- Immobile machinery such as generators usually leaks some amount of oil, often proportional to their age. It has been found that approximately 1-2% of overall oil consumption will leak from older generators. Such equipment must be placed on a cement pad, bounded by a small retaining wall to confine any leakage before collection. No leakage should be allowed to spill onto the surrounding soils.
- Oily wastes are categorized as a schedule waste and their handling, storage, transportation and disposal are governed by Environmental Quality (Scheduled Wastes) Regulations, 2005.
- All temporary fuel tanks and storage areas shall be provided with drip collection devices and be sited on sealed areas with a bunded enclosure capable of containing 110% of the capacity of the largest tank in the bund. Provision of shelter over the storage tank is an appropriate measure to prevent the accumulation of rainwater within the bund.
- Refueling activities shall not be conducted within 100 m watercourses or on-site drainage channels.
- The relevant authorities shall be immediately informed of any accidental spills. The resultant recovered material shall be appropriately disposed of as a hazardous waste.
- Waste handling and waste management shall be carried out properly as stipulated under Environmental Quality (Scheduled Waste) Regulations, 2005. It covers from the labeling (Third Schedule), storage and inventory (Fifth Scheduled), notification (Second Schedule) and transportation (using consignment notes under Sixth Schedule).
- The possibilities of oil spill during development and planting stage are mainly generated from the maintenance and service of machineries including heavy vehicles such as lorries, excavator and generator.

8.5 PROJECT ABANDONMENT

Project abandonment can occur at any stage of the development. If the project is abandoned during planning stage, there is less or no impact to the environment. It can cause relatedly small loss to the project proponent. However, if the Project is abandoned during the construction phase, it will not only cause greater monetary loss to the PP but also significant environmental impacts. The resultant impacts arise out of the development phase activities will pose a significant generation of waste and aesthetic impacts.