

CHAPTER 6.0

RECOMMENDED MITIGATION MEASURES

6.1 INTRODUCTION

In response to the potential impacts, mitigation measures have been identified to address all the identified significant impacts. Among these are structural and non-structural measures designed to abate the negative impacts on the environment. This chapter will discuss some mitigation measures that can be considered to eliminate or minimize the potential impacts generated from the project activities. Some of these mitigation measures should be taken into consideration at the planning, design stage and implementation stage of the proposed project.

- Pre-development (pre construction) phase;
- Development phase (construction) and;
- Post - development (post construction) phase.

6.2 PRE-DEVELOPMENT PHASE

6.2.1 Reconnaissance Survey, Site Inspection and Data Collection

Mitigating Measures:

It is recommended that proper surveying routes be identified to ensure minimal clearing or disturbance to the existing environment. Boreholes left after drilling are potentially hazardous to human residents. As such it is recommended that boreholes that are no longer useful to be filled with earth or sand to minimize any potential accidents. Boreholes can also be maintained for groundwater monitoring purposes, should there be a need for it.

6.2.2 Topographic Survey, Soil Investigation, Traffic Impact Assessment, Preliminary Environmental Impact Assessment and Design Stage

This phase activity which includes planning and design stage will not induce significant adverse impacts on the environment.

6.3 DEVELOPMENT PHASE

6.3.1 Site Clearing

Land clearing strips off the earth of vegetation and therefore causes the earth to be prone to erosion. Erosion can bring about a chain of events which eventually leads to among other water pollution and soil loss. As such, it is recommended that:

- Land clearing to be carried out in phases eg. Areas to be developed to be cleared first and vice versa. This will reduce frequency, time (period) and overall cleared land area exposed to direct weathering effects. Therefore, reducing air borne dust and erosion problems.
- Land clearing activities should best be carried out during non-monsoon seasons.
- Construction works to immediately start after land clearing activities.
- Areas cleared to be compacted as to minimize surface runoff during a downpour.
- Topsoil is to be stockpiled for reuse later in vegetation of the slopes.
- Access roads that are created for construction vehicle movement shall be paved either temporarily with crusher-run or sand.
- Slopes of temporary and permanent drains shall be covered with some form of erosion control method as recommended above.
- Sediment control measures like silt traps, retention ponds and weirs shall be in place at runoff outlets to control sediment discharge and increased flow.
- **Mulching** – It is the use of plant residue; saw dust, straws or other suitable material to cover the soil surface. It provides a high degree of erosion control and improves moisture availability to establishing plants. Mulch should cover 70 – 75 % of the soil surface to give adequate protection against erosion. This method could be applied on drain reserves and slopes near road reserves.
- **Revegetation (turfing)** – It is the one of the most effective methods for surface soil erosion control where a rapid establishment of dense grass cover is required. This method could be used to stabilize drainage lines, open areas and road reserves.

- **Vetiver grass** – It is a coarser, tough bunch grass that grows up to 1 metre wide at its base. It can thrive on a range of soil and that no known pests or pathogen attacks them. This method is used commonly for slope protection and streambank erosion control.
- **Fiber Sheet** – A plastic sheet of durable strength and specified thickness is used to cover bare areas. The limitation of this method is it covers small area and only for temporary surface protection.

6.3.2 Construction Of Temporary Access Roads

Mitigating Measures:

- Wheel washing bay and water trucks will be employed control dust. Water trucks shall be operated to keep the access road damp at all times. A washing bay shall be constructed at the entrances of the site to prevent earth from the construction vehicles from depositing onto the public road.
- Proper traffic signage and traffic management during construction work.

6.3.3 Transportation of Construction Materials and Machinery

Mitigating Measures:

Construction materials such as cement, bricks, piles, earth sand and aggregates are often transported to the project site by trucks. Spillage onto the existing road can lead to accidents and traffic jams.

- At least 2 traffic controllers has to be deployed at the ingress of the Project Development site at the road side, so as to minimize the traffic impact to the road users, particularly when lorries are re-entering the main road.
- Transportation vehicles should not be overloaded and granular loads should be properly covered to avoid dispersion and spillage.
- Other materials are to be fastened securely on the trucks to prevent accidental spillage.
- Machinery such as excavators, back pushers should not be allowed to be driven on the road but instead be transported by transporters to the designated areas within the project site.
- A monitoring programme for air pollution should be implemented during construction period.
- Warning and road signage that are of standard specifications should be erected at strategic locations along the related roads to warn public of possible traffic-related danger.
- A vehicle cleaning pit to be prepared so that dirt from site is not transferred to main roads.
- Working hours are also to be limited to official working days only.



6.3.4 Construction of Site Office, Workshop and Worker's Quarters

Mitigating Measures(Safety and Health):

Site office, workshop and workers' quarters are built for the convenience of the management team, contractors to carry out maintenance works as well as the welfare of the workers. It is therefore recommended that:

- The location of any site office, workshop and workers quarters are to be properly marked on the project map to allow for easier management and monitoring. The management of the project should be informed of any setting up of any such buildings (temporary or permanent).
- These structures shall not build near the rivers or waterways. However, proper drainage should be provided to channel surface runoff.
- Proper sanitary facilities such as flush toilets or and septic tanks to be provided at these facilities. Septic tanks are to be properly designed to cater to the population within the facility.
- Bunds are to be provided for diesel tanks at the workshops or any location to collect spillage and leakage (if any)
- Used oils and lubricants are to be collected, stored in drums and not discharged into the waterways. It is best reuse or disposed off at approved recovery plants by any contractor licensed by DOE.
- Upon completion of works, workers' quarters that are no longer occupied should be demolished. Septic tanks that were installed earlier should also be removed from the project site and the sewage should be disposed off in sewage treatment plant (STP).
- Fence up/hoarding appropriate locations susceptible to safety hazards.
- A monitoring programmed for water should be implemented during construction period.

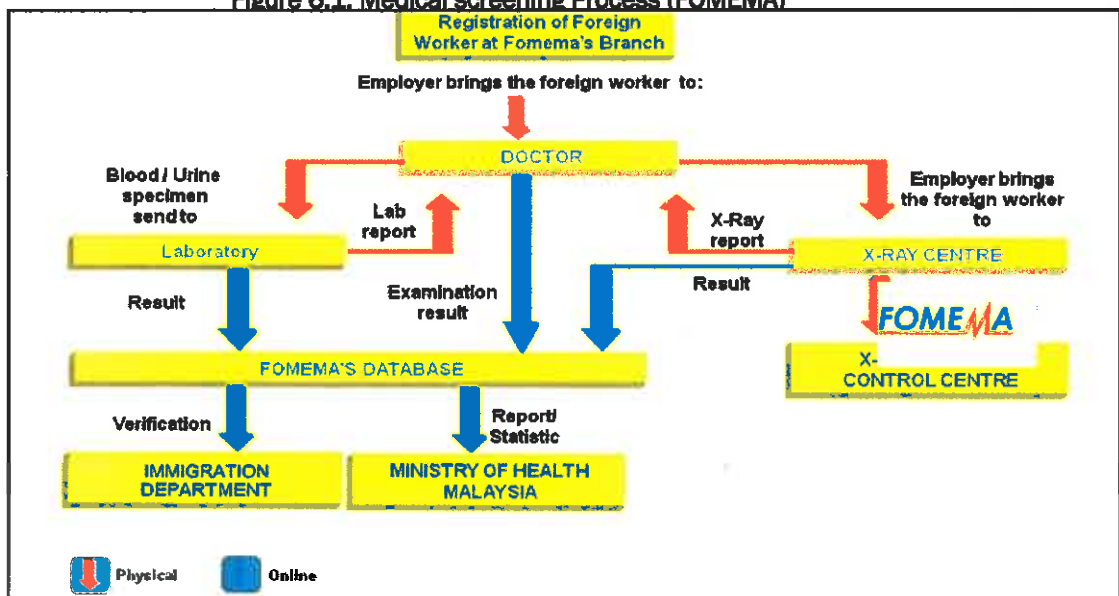
Mitigation measures for health issues are:

- Medical screening and immunisation of workers by Fomema Sdn Bhd was established in 1997 to manage and operate a mandatory foreign worker health screening system in Peninsular Malaysia. FOMEMA Sdn Bhd is owned and operated by Pantai FOMEMA and Systems Sdn Bhd, a member of Khazanah Nasional Bhd group. The screening program determined by the Ministry of Health. This program is under Section 9, Subsection 1 (c), 155 of the Immigration Act 1959/63. This can circumvent the spread of contagious diseases brought in by foreign workers
- Use Site Inductions and Tool Box Talks to communicate the environmental and safety requirements to all personnel.
- Minimize possibility of pest breeding and the spread of pest-related diseases.
- A good housekeeping program should be well planned and coordinated, and become customary practice. Housekeeping is a continuous process that should involve everyone on a job site. The best time to clean up is immediately after the debris has been created. Minimize solid waste spillage during collection, transportation and disposal at the Project site. Setting up of washing and cleaning facilities for workers in the construction site and encouraging them to maintain personal hygiene.
- Fogging at active working areas.





Figure 6.1: Medical screening Process (FOMEMA)



Source: FOMEMA Sdn Bhd (http://www.fomema.com.my/html/med_screen.html)

Figure 6.2: Example of Proper Management Workers Quarters



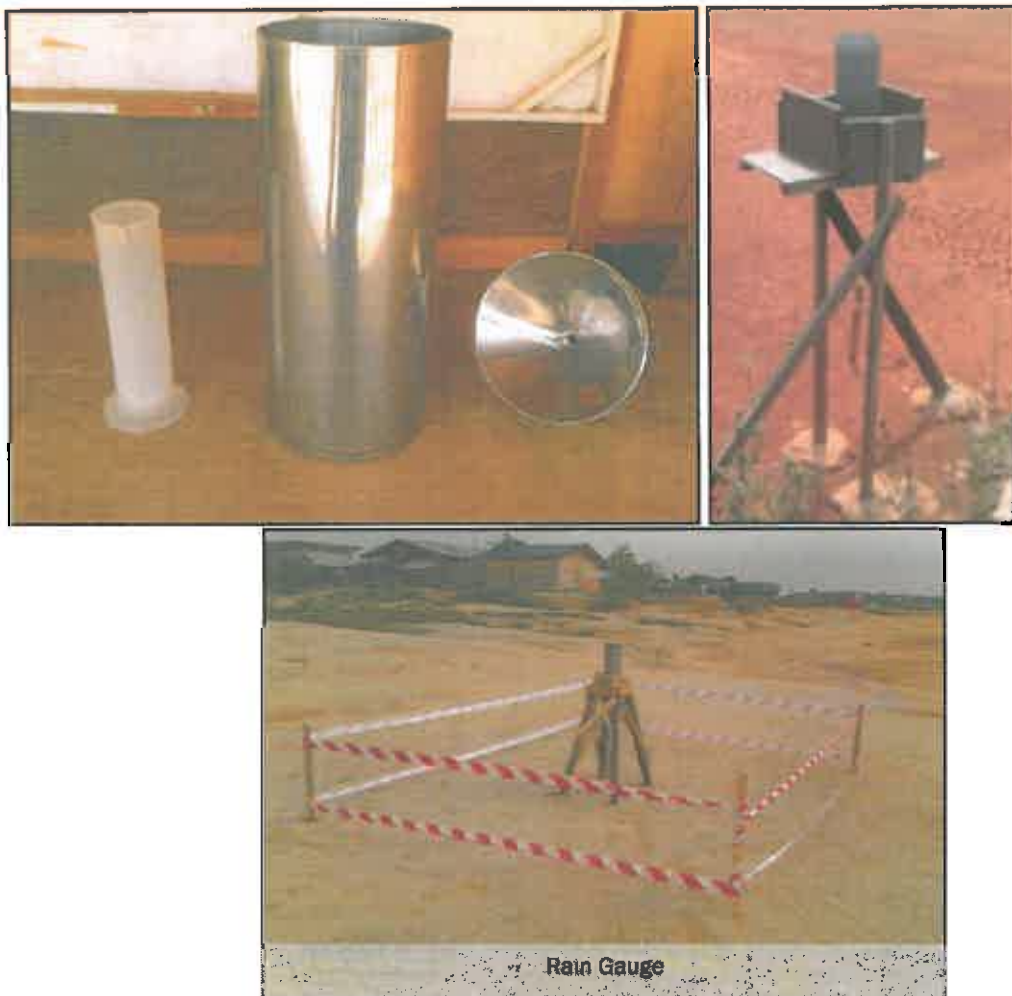
Figure 6.3: Example of Improper Management Workers Quarters



6.3.5 Earthworks

Mitigation measures

- Installation of sediment traps along water drainages, including fascines, silt fences, and vegetation traps to control the suspended solid problem.
- Proper maintenance for all machinery and vehicle to reduce the noise level and prevent the occurrence of oil leaking that cause water body contamination.
- Installation of proper sound barriers and (or) noise containments, with enclosures and curtains at or near the source equipment (e.g. crushers, grinders, and screens).
- Supervision operates against highest water level which can happen were being anywhere critical section during excavation.
- Monitoring of water quality parameters at specified intervals is necessary. Proper containment of displaced spoil material is required around the filling perimeter in the form of bundings or revetments.
- Rain Gauge should be installed at open area in project site.



The Erosion, Sediment and Control Plan will be prepared by the engineer and must be implementing by the contractor during the construction work. The perimeter temporary drain will be construct along the site and the sediment basin will be construct at final discharge of the diversion channel and will be maintained at regular period. All surface runoff water from interface area shall be channelled out to the sediment basin via perimeter drain. All perimeters drain shall be maintained regularly especially during monsoon season to prevent water pollution and flooding at the downstream and around the works area.

A sediment trap is a small temporary ponding area, usually with a gravel outlet, formed by excavation or by construction of an earthen embankment. Its purpose is to collect and store sediment from sites cleared or graded during construction. It is intended for use on small drainage areas with no unusual drainage features and projected for a quick build-out time. It should help in removing coarse sediment from runoff.

The effectiveness of silt trap is usually based 80% effectiveness to ensure that total suspended solid are within the effluent discharge limit. Below are several activities that can ensure 80% effectiveness.

- To be effective, sediment traps need to be periodically maintained.
- Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.
- Inspect outlet area for erosion and stabilize if required.
- Inspect trap banks for seepage and structural soundness, repair as needed.
- Inspect outlet structure and spillway for any damage or obstructions. Repair damage and remove obstructions as needed.
- Inspect fencing for damage and repair as needed.
- Inspect the sediment trap for area of standing water during every visit.
- Corrective measures should be taken if the BMP does not dewater completely in 72 hours or less to prevent vector production.
- Sediment that accumulates in the BMP must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the trap capacity. Sediment removed during maintenance may be incorporated into earthwork on the site or disposed of at an appropriate location.
- Remove vegetation from the sediment trap when first detected to prevent pools of standing water and subsequent vector production.
- BMPs that require dewatering shall be continuously attended while dewatering takes place.
- Dewatering BMPs shall be implemented

EROSION CONTROL MEASURES DURING EARTHWORKS

Contractor shall be instructed to carry out the following erosion control measurement:

- Provide protection covers such as vegetation and plastic sheets on exposed areas.
- Earthworks should be confined to periods of low expected precipitation.
- As small an areas as practical should be exposed and graded at a time. The size of the area will depend on the potential erodibility of the soil and the time required stabilizing the area after grading is completed.
- All earthworks exceeding 1.5 m in height or depth shall not be cut or cleared until the site is ready to be worked.
- Clearing and grading should be done with care to protect and maintain previously installed temporary control measures.
- Fills should be placed in horizontal layers and the faces of the fill slopes should be maintained as filling progresses. The materials to be used and the degree of compaction shall be clearly specified.
- Where it is intended that cleared ground is to be planted, the area should be landscaped and the planting carried out as soon as possible, even prior to the completion of the whole work.
- Trees and other vegetation should not be cut or cleared until the earthwork site is ready to be worked. The cleared ground shall be re-vegetated (turfed) within three months after commencement of earthworks during the dry season and within one month after commencement of earthworks during the wet season.
- Maximum gradient of cuts shall vary with soil texture. However, measures taken should ensure that slumping will not occur.
- Unsuitable materials and surplus earth shall be disposed off in designated spoil tips. If additional disposal areas (spoil tips) are required, the contractor shall be responsible for identifying these disposal areas to be approved by the Site Officer.
- On no account should cleared vegetation and debris be deposited or pushed into watercourses, streams, or rivers.

- Holes and cavities resulting from clearing, grubbing, de-stumping, and de-rooting shall be backfilled with acceptable materials and compacted to approximate densities of adjacent areas.
- The surface of batters or terraces exposed after earthworks represent a special and severe case. While the surface may be protected by a number of measures, the resistance of the batter to erosion will be determined primarily by the engineering design. Batters must be designed to satisfy stability criteria. For stable soils, batter slopes should not be steeper than 2(H):1(V).
- Cut and fill slopes should be fertilized (if appropriate) and regularly irrigated to encourage faster growth. Development should proceed with minimum disturbance of any planted areas and temporary control measures.
- There shall be no obstruction or interference with the natural waterways. Where a road is to be cut across a river or stream, bridges and culverts as prescribed by the enforcement authority shall be constructed and maintained according to specifications.

Figure 6.4: Erosion Control Measures during Earthworks – ESCPs section



WORK METHOD STATEMENT FOR IMPLEMENTING ESCP

Prior to commencement of site-clearing works, contractors shall carry out the following tasks:

- a) Setting out of the proposed site.
- b) To identify the location of existing vegetation that needs to be preserved.
- c) To identify existing streams which require to be diverted.
- d) To inform and clarify the workers on their tasks and responsibilities to ensure minimum land disturbance.

POLLUTION CONTROL MEASURES DURING EARTHWORKS

All stockpiles area will not be located within 5m of hazard areas, including the likely areas of high velocity flows such as waterways, paved areas, and driveways.

- Dust Control:- During windy weather, large, unprotected areas will be kept moist (not wet) by sprinkling with water to keep dust under control. In the event water is not available in sufficient quantities, soil binders and/or dust retardants will be used or the surface will be left in a cloddy state that resists removal by wind.
- The sediment basin will:
 - a) Be constructed where shown on the approved earthworks plan.
 - b) Be flocculated before discharge occurs (unless the design event is exceeded)
 - c) Have one or more pegs placed on the floor to clearly indicate the level at which design capacity occurs and when sediment will need to be removed.
- The stored contents of the sediment basin will be treated with gypsum or other flocculating agent where they contain more than 50 mg/l of suspended solids. Treatment will be as follows:
 - a) lower suspended solids to less than 50 mg/l within 24 hours of filling
 - b) the basin will then be allowed to stand 36 to 48 hours for flocculated particles to settle
 - c) the basin will then be drained so that full storage capacity is regained without discharging sediment from the site
- Sediment removed from any trapping device will be disposed of in locations where further erosion and consequent pollution to down slope lands and waterways will not occur.

- Water will be prevented from directly entering the permanent drainage system unless it is relatively sediment free (i.e. the catchment area has been permanently landscaped and/or any likely sediment has been treated in an approved device). Nevertheless, storm-water inlets will be protected.
- Temporary erosion and sediment control structures will be removed only after the lands they are protecting are stabilized.

WASTE MANAGEMENT CONTROL MEASURES DURING EARTHWORKS

- Acceptable waste storage bins will be provided for any concrete and mortar slurries, paints, acid washings, lightweight waste materials, and litter. Clearance services will be provided at least weekly.

MONITORING AND MAINTENANCE OF BMPs DURING EARTHWORKS

- A maintenance programme for the control facilities shall be prepared that includes plans for the removal and disposal of materials from the control facilities in the project area.
- All erosion and sediment control measures shall be constructed and maintained by the Contractor.
- Any water discharged from sediment traps and/or sediment basins shall comply with ambient standards for TSS and turbidity for the designated beneficial use of the receiving water into which water from traps or basins is discharged.
- The receiving water could be a drain, stream, river, pond, lake, or estuary. The standard for five classes of beneficial water use based on the Proposed Interim National Water Quality Standard (INWQS) for Malaysia (DOE, 1985).
- Water quality monitoring must be carried out on a regular basis with all results submitted to the state offices of the DOE.
- The Contractor shall provide all necessary temporary drainage for keeping the site and other areas free of standing water.
- Waste storage bins will be emptied as necessary. Disposal of waste will be in a manner approved by the Supervising Engineer and in accordance with local regulations.
- Proper drainage of the site will be maintained. To this end, drains (including inlet and outlet works) will be checked to ensure that they are operating as intended, especially that:
 - a) no low points exist which can overtop in a large storm event
 - b) areas of erosion are repaired (e.g. lined with a suitable material) and/or velocity of flow is reduced appropriately through the construction of small check dams or installing earth banks and/or diversion drains upslope
 - c) blockages are cleared (these might occur because of sediment pollution, sand/soil/spoil being deposited in or too close to them, or breaching by vehicle wheels, etc)
- Sand/soil/spoil materials placed closer than 2 m from hazard areas will be removed. Such hazard areas include any areas of high velocity water flows (e.g. open drains and gutters), paved areas, and driveways.
- Recently stabilized lands will be checked to ensure that the erosion hazard has been effectively reduced. Any repairs will be initiated as appropriate.
- Excessive vegetation growth will be controlled through slashing or mowing.
- All erosion and sediment control measures will be kept in good working condition until all earthwork activities are completed and the site stabilised. In particular, attention will be given to:
 - a) recent works, to ensure that they have not resulted in diversion of sediment-laden water away from them
 - b) degradable products, to ensure they are replaced as required
 - c) sediment removal, to ensure the design capacity or less remains in the settling zone
- Any pollutants removed from the sediment basin will be disposed of in areas where further pollution to down slope lands and waterways should not occur.
- Additional erosion and sediment control works will be constructed as might become necessary to ensure the desired protection is given to down slope lands and waterways, i.e. alterations to the ESCP will be made where it proves inadequate in practice or is subjected to changes in conditions at the work site or elsewhere in the catchments.

SITE INSPECTION AND MAINTENANCE ESCP

- A self-auditing programme will be established based on an Inspection Checklist. A site inspection using checklist will be made by the Supervising Engineering.
 - i. At least weekly (on Monday)
 - ii. Immediately before site closure.
 - iii. Immediately following any rainfall event that has caused runoff.
- The self audit will include records of:
 - i. The condition of every BMP used
 - ii. Maintenance requirements (if any) for each BMP
 - iii. Rainfall depths, duration and times

- iv. Time, date volume and type of flocculants added to sediment basin.
- v. Recording the site where sediment is disposed
- vi. Forwarding a signed duplicated of the completed inspection Checklist to the project manager/developer for their information.
- In addition, a suitably qualified person will be required to oversee the installation and maintenance of all erosion and sediment control measures condition until all earthwork activities are completed and stabilized. In particular, attention will be given to;
 - Recent works, to ensure that they have not resulted in diversion of sediment-laden water away from them.
 - Degradable products, to ensure they are replaced required.
 - Sediment removal, to ensure the design capacity or less remains in settling zone.
- Any pollutants removed from the sediment basin will be disposed of in areas where further pollution to down slope lands and waterways should not occur.
- Additional erosion and sediment control works will be constructed as might.

ENVIRONMENT OFFICER (EO) DUTY

Environment Officer (EO) shall be appointed which fully responsible related to environment management and control measure throughout the project. Complete Officer Information need to be submitted to DOE 14 days before site clearing begin. The duties of officer are:

- i. During earthwork and construction stages:-
 - a) Supervising erosion control and sediment on site as set on ESCP and EMP
 - b) update the site diary
 - c) update the rainfall records
 - d) take and record readings of rain gauge
 - e) Carry out inspection on pollution control measures and BMPs structure erosion and sediment control (including perimeter drain, check dam, silt trap, wash through, and slope protection.)
 - f) Organize site meeting for every two week with project developer and contractor.
 - g) Carry out in-situ measure parameter for suspended solid and turbidity in release point within 30 minutes after the rain. If the rain exceeds 24 hours, measurement shall be carried out once every day. (the failure to comply these conditions should be recorded with secure and reasonable grounds).
- ii. Operation Stage – ensure an effective of implementation on all control measure by ensuring good housekeeping and anything that related to environmental management.

6.3.6 Construction of Sub-Structure and Super-Structure

- Formworks need to be properly sealed to prevent loss of cement slurry, which can affect concrete strength.
- All the construction materials must be properly stored, labeled and handled to avoid any leaking. If involve petroleum or lubricant, it should stored on impervious surface and away from fuel storage.
- Machinery and other equipment must regularly maintain to avoid any leakage or handle by trained personnel.
- Continuous on site supervision for noise control for overall construction activities for environmental management.
- Limit piling works to day time 8:00am – 6:00pm. If possible, hydraulic pressed piling, bored piling or other less noisy methods can be used instead of drop hammer.
- Noise pollution can be also reduced with the provision of hoardings, or buffer zones (layer of trees and landscaping).
- Reduce airborne dust levels by spraying water on access roads.
- Construction should practice the 'SAFETY FIRST' concept, to ensure that safety is never compromised. Personal Protective Equipments (PPE) should be worn by all personnel that enter the site. There should be regular health and safety checks carried out to maintain a safe and healthy working atmosphere on site.

[illegible]

Site Preparation					
1	Have the clearing and grubbing operations been performed on the correct limits?				
2	Have debris and ash been disposed of properly?				
3	Have ditches/temporary earth drain been installed to direct runoff away from the work area before the earthwork is started?				
4	Has the stripping operation removed all of the topsoil and organic materials?				
5	Have utilities been located?				
6	Having existing structures been removed?				
7	How debris has been properly disposed?				
ii) Excavation					
8	Is excavation occurring in areas as directed by the Approved plan?				
9	Are the excavation grades and slopes uniform and do they meet the requirements of the specification in contract?				
10	Are excavated materials being properly segregated and stockpiled?				
11	Is Slaking expected for the project and if unexpected has the Engineer/Authority been notified?				
iii) Embankment					
12	Is the borrow material/imported material being obtained from off site?				
13	Has proper testing of the borrow material/importer material been performed and has the material been approved by the Engineer?				
14	If unsuitable material were found during excavation: has the Engineer been notified?				
15	Is the foundation free of water?				
16	Where required, has soil stabilization/modification procedures been performed?				
17	Is the embankment surface approximately horizontal but sloped for drainage?				

ID#	Issue	Date		Remarks
		Yes	No	
36	Are sediment controls in place at site perimeter and storm drains outlets?			
37	Is the water from the construction site adequately prevented from directly entering the permanent drainage system unless it is relatively sediment free (i.e. the catchment area has been permanently landscaped, and/or any likely sediment has been treated)?			
38	Are the sediment controls measures routinely inspected and the sediment is effectively retained from the stormwater runoff from the construction site?			
39	Is there any evidence that the sediment is leaving the construction site without adequately treated?			
40	Are on-site channels, inlet and outlet are adequately stabilized and protected?			
41	Do all operational storm drainage inlets have adequate inlet protection?			
42	Are stormwater conveyance channels adequately stabilized, protected and lined with suitable material at busy eroded stretches?			
43	Are stormwater conveyance channels, culvert, conduit, roadside ditches toe of slopes etc adequately stabilized and with proper inlet/outlet protection and energy dissipater?			
44	Are the outlet of sediment basins and sediment traps are adequately stabilized with proper outlet protection and energy dissipater?			
45	Are adequate check dam/rock weir or any others energy dissipater method which are used to reduce the erosive effects of stormwater conveyance channels.			
46	Are temporary stream crossings of non-erodible material installed where possible?			

No.	Item Description	Yes	No	Remarks
18	Is the moisture-density of the compacted fill as specified?			
19	Are field density tests accurately compiled in the standard method and specification as per contract?			
20	Do fills consisting of soil and rock mixtures contain sufficient amounts of soil to fill voids and is compaction adequate?			
21	Are fill slopes uniform and do they meet the requirements of the approved plan?			
22	Erosion and Sediment Controls Measures-ESCP			
22	Is the clearing of the construction area carried out in phases?			
23	Are the areas which designated to be preserve of the existing vegetation intact, is not disturbed?			
24	Are all erosion control devices in-place and functioning in accordance with the erosion control plan?			
25	Are all temporary stockpile or construction material located in approved areas and protected from erosion?			
26	Are soil stockpiles adequately stabilized with seeding and/or sediment trapping measures?			
27	Have all denuded areas requiring temporary or permanent revegetation been stabilized? Seeded? yes/no Mulched? yes/no Graveled? yes/no			
28	Does permanent vegetation provide adequate stabilization?			
29	Are all exposed slopes protected from erosion through the implementation of acceptable soil stabilization practices?			
30	Are finished cut and fill slopes adequately stabilized?			
31	Is there any evidence of erosion of cut or fill slope?			
32	Have sediment-trapping facilities been constructed as a first step in stripping and grading?			
33	For perimeter sediment trapping measures are earthen structures stabilized?			
34	Are retention basins, sediment trap, sediment fence/barrier and check dam/rock toe installed where needed as per ESC Plan?			
35	Are sediment basins, sediment traps, sediment fence/barrier and check dam/rock toe properly maintained, repairs and sediments was regularly removed and debris as per ESC Plan maintenance schedule?			

Chapter 6: Recommended Mitigation Measures

Figure 6.6: BMPs Implementation at site
Examples Proposed Silt Fence



Examples Proposed Oil Tank Storage



Examples Proposed Hoarding



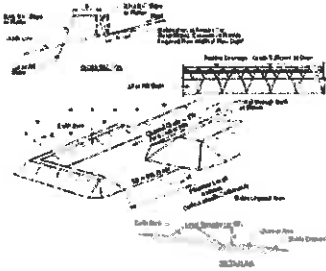
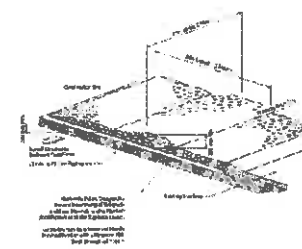
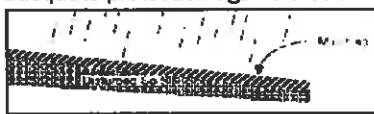

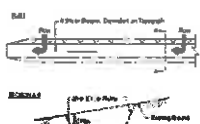
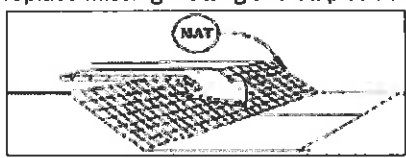

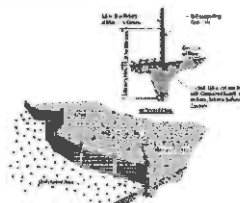
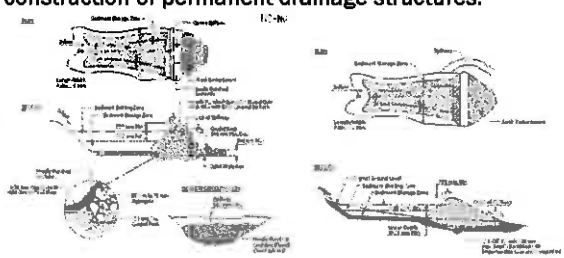
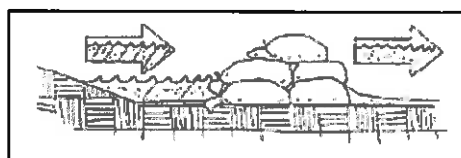
Examples Proposed Sediment Basin



Examples Proposed Wash Trough



Figure 6.7: Proposed Erosion Sediment Control Plan at the Proposed Project

Method	
<p>Earth bank are used divert run-off water to a desired location. Periodic inspection and maintenance must be provided after each rain event. Refer Appendix 39B. Standard Drawing MSMA SDI-5</p> 	<p>Construction Access Stabilization will reduce the erosion and dust. All the access road, subdivision roads, parking areas, and other on-site vehicle transportation routes should stabilised immediately after grading and frequently maintained to prevent erosion and control dust. Refer Appendix 39B. Standard Drawing MSMA SDI-4</p> 
<p>Mulching – It is the use of plant residue; saw dust, straws or other suitable material to cover the soil surface. It provides a high degree of erosion control and improves moisture availability to establishing plants. Mulch should cover 70 – 75 % of the soil surface to give adequate protection against erosion.</p> 	<p>Re-vegetation (turfing) – It is the one of the most effective methods for surface soil erosion control where a rapid establishment of dense grass cover is required. This method could be used to stabilize drainage lines, open areas and road reserves.</p> 
<p>Temporary diversion channel/earth drain is used to divert off site runoff from stabilised areas around the disturbed area and redirect runoff into sediment basin. The sediment basin need inspect weekly and after each rainfall and remove all the sediment builds up in the channel. Refer Appendix 39B. Standard Drawing MSMA SDI-6</p> 	<p>Geotextiles And Mats – Typically suited for permanent site stabilisation, but may be used for temporary stabilisation of highly erosive soils. Easy to maintenance, re-anchor loosened matting and replace missing matting and staples as required.</p> 
<p>A sediment fence will trap by intercepting and detaining small amount sediment from disturbed areas during construction and decreasing the velocity of flow (up to 15 l/s) in swales and small diversion channels. Suitable to use along the perimeter of site, around temporary stockpiles and below the toe of cleared channels.</p>  	<p>Sediment Basin is structure form by excavation and/or construction embankment across a water way or other suitable location. Its purpose is to collect and store sediment from sites cleared and/or graded during construction or for extended periods of time before reestablishment of permanent vegetation and/or construction of permanent drainage structures.</p> 
<p>A sand bag barrier can be implement as a sediment fence and using as a temporary sediment trap and a diversion channel. Maintenance requirement are inspect after each rainfall and remove the sediment when it reaches 150mm in depth.</p> 	

Source: Extract and modification from Urban Stormwater Management Manual (Manual Mesra Alam -MASMA), Drainage and Irrigation Department Malaysia 2001.

6.3.7 Construction of Infrastructure and Utilities Development

i. Roads/Traffic

Mitigating Measures (During Construction)

Construction materials such as cement, bricks, piles, earth sand and aggregates are often transported to the project site by trucks. Spillage onto the existing road can lead to accidents and traffic jams. It is therefore essential that mitigating measures are applied at the different stages in order to avoid nuisance and undesirable effects to local resident's area.

• **Air Quality:**

- a. In dry seasons, sprinklers will be used on the roads at the construction sites to reduce the dust content in the air. All unpaved roads used by vehicles are recommended to be watered at least twice a day, and more frequently on dry days to prevent dust generation.
- b. During construction, water trucks or sprinkler systems shall be used to keep all areas of vehicle movement damp enough to prevent dust from leaving the site. At a minimum, this would include wetting down such areas in the later morning and after work is completed for the day and whenever wind exceeds 15 miles per hour.
- c. Provisions shall be made prior to and during watering of the site to prevent water runoff from leaving the site.
- d. Vehicles carrying earth or sand should be covered (with tarpaulin or canvas) to prevent these granular materials from air borne or spilling onto the existing road.
- e. Cover or wet construction materials such as sand to prevent dust nuisance. Also minimize cleared areas to those that are needed for construction.
- f. A vehicle cleaning pit to be prepared so that dirt from site is not transferred to main roads.
- g. Limit removal of vegetation and a rehabilitation program of the site and associated infrastructure following construction.
- h. A monitoring programmed for air pollution should be implemented during construction period.
- i. Fence up/hoarding appropriate locations susceptible to safety hazards.
- j. Spillage of earth, sand, aggregates on the existing roads are to be removed as soon as possible for the convenience of existing traffic users.
- k. Good housekeeping and proper maintenance of equipment are to be observed to reduce unnecessary dust and other air emission. In particular, control systems employed for controlling dust should be ensured of their efficiency.

• **Noise Quality:**

- a. Use equipments that have low noise emissions as stated by the manufacturers
- b. Use equipment that is properly fitted with noise reduction devices such as mufflers.
- c. Operate noise generating equipment during regular working hours so as to reduce the potential of producing noise during night hours.
- d. Though the increase in traffic volume during the construction stage of the proposed project is insignificant, safety will be an important consideration for the vehicles leaving and entering the access road. Appropriate road signs should be put up to alert the road-users.

• **Traffic nuisance:**

- a. Proper Traffic Management should be implemented.
- b. Machinery such as excavators, back pushers should not be allowed to be driven on the road but instead be transported by transporters to the designated areas within the project site.
- c. Control of speed limit to 60km/h to avoid any speeding, excessive gas emission and excessive noise.
- d. Warnings Signage: There are several warning signs that used to slow down the vehicle and as a reminder to drivers to be more alert and careful when approaching the construction site. Warning and road signage that are of standard specifications should be erected at strategic locations along the related roads to warn public of possible traffic-related danger.
- e. Working hours are also to be limited to official working days only.
- f. Temporary Traffic Guard: The use of temporary traffic guard will be required when the vehicle in and out to the site is high, especially when construction site faced with the main route. Temporary traffic guard will act to control the traffic by using several tools including the use of the flag or hand signals. Temporary traffic guard usually is a construction worker. Temporary traffic guard is required to wear safety of life jackets, helmets and signal flare.

- g. **Yellow Line:** The use of yellow lines at the construction site will guide road users during the current traffic that need to be followed. The use of the yellow line is usually when the works involve widening the road and this will disrupt traffic flow.
- h. **Traffic Cone:** Traffic cones are usually used to divert the flow of traffic. The use of traffic cones and striped triangles are to assist the sight, especially during rain and in the dark. Traffic cone is also used together with cautious tape.
- i. **Temporary Road Barricades:** The use of temporary road barrier is effective to divert the traffic, especially when it comes to construction of new roads. In addition, the road barrier is effective to warn motorists to slow down and be alert when the construction site.
- j. **Caution Tape:** Warning tape is used to prevent vehicles or people from through the construction site. Warning tape is a warning that only certain people are allowed to pass through.
- k. **Traffic Control Bollard:** Pillars of the traffic control used at the boundary of the site as a sign / reminder to road users that traffic is adjacent to the construction site. Pillars of the traffic control will be removed and relocated after construction is completed.

Figure 6.8: Traffic Control Measures during Construction Periods



ii. Drainage systems

Mitigating Measures (During Construction)

- Control at Source Method can be used to design the drainage on the site. The design must follow the specification that required in MSMA.
- Create more catchments areas within development.

iii. Sewage Treatment Plant/Sewerage Reticulation System

Mitigating Measures (During Construction)

- The proposed project will be design with IWK and JPP standard. The wastewater will be discharge to sewerage reticulation and directly to main STP.

- Domestic waste water produce by population need to be processed in sewage treatment plant designed follow certain capacity. Sewage treatment plant will operate all the time to ensure effluent comply A's standards before being discharged to river. However, if that plant is unable operating affectively, disconcerting smell will producing apart from giving effect bad to population health and aquatic life in river nearby.

iv. Water Reticulation System, Electrical Power Distribution and Telecommunications Systems

Mitigating Measures (During Construction)

- The potential contamination of subsurface soil and groundwater may arise as a result of leaks due to corrosion or structural failures of the proposed sewerage system. To avoid this from happening, all construction materials as prescribed for the proposed works shall be in accordance with MS 1228 and approved by Sewerage Service Department.

6.3.8 Disposal of construction wastes

Mitigating Measures

- Construction waste generated should also be removed from the site and disposal off at any approval to landfills. Illegal dumping of wastes into the rivers is not allowed.
- Workers camp shall be demolished from the site and all the demolition wastes shall be disposed off at the approved dumping site.
- Visual impacts and odor problem due to waste.
- Wastes should be removed periodically from the project site and not only when the construction is at its end. This is to ensure that pollutants from the construction wastes are not leached into the waterways during a downpour.
- Scheduled Waste:
- Scheduled wastes shall be stored in drum/container to be stored, durable and which are able to prevent spillage or leakage of the scheduled wastes into the environment.
- Each drum/container has to be properly labeled and recorded.
- Each drum/container has to be kept at storage facility.
- Areas for the storage of the drum/container shall be designed, constructed and maintained adequately in accordance with the guidelines prescribed by the Department of Environment to prevent spillage or leakage of scheduled wastes into the environment.
- Drum/Container containing scheduled wastes shall always be closed during storage except when it is necessary to add or remove the scheduled wastes.
- All the drum/container containing scheduled waste shall be transfer or move by the registered contractors by Department of Environment (DOE) and adhered to license condition issued by DOE.

6.3.9 Abandonment

Mitigating Measures

- Abandonment during the planning stage would not result in any significant environmental impacts as the proposed project involved reclaiming an open sea area such that there would be no requirement for site clearing. Abandonment during the operational stage requires the project proponent to consider plans for the removal or disposal of temporary structures and facilities. Abandonment plans need to be addressed
- Abandonment occurs during operational stage, the physical impact is not as severe because utilities and facilities had been set up. This site would be more manageable. However, if it is left attended for a long time, the site would also cause problems as abandonment during construction stage as facilities falls apart. Economically would be as devastating as the abandonment would mean loss of jobs for those who worked at the proposed site.
- All construction wastes are to be disposed off properly and leftover construction materials are to be returned or sold off. This is to avoid any unwanted mishaps from occurring.
- Then the project site should be sealed up (entrance should be blocked/locked)

POST- DEVELOPMENT PHASE

6.4.1 Landscaping

As such it is recommended that measures such as landscaping be carried out. Besides enhancing the aesthetic value of the area, proper landscaping is also effective as pollution control measures. Plants can absorb carbon dioxide, sun ray and also function as sound barriers, thus reducing the level of pollutants and excessive noise levels within the area.

Mitigating Measures

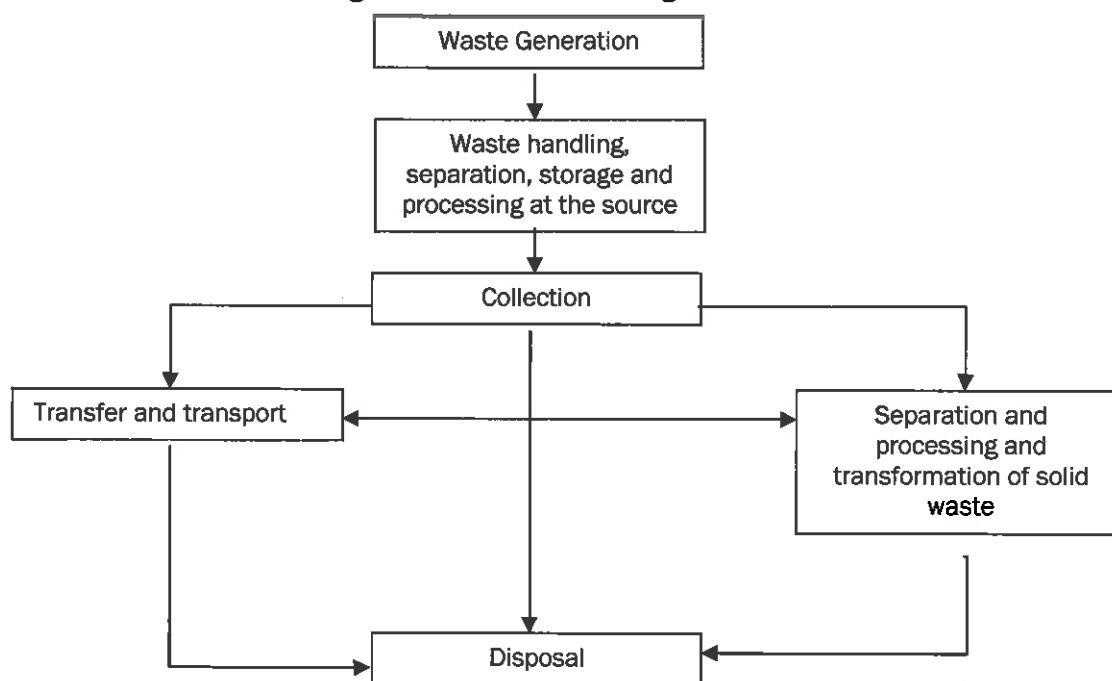
- The decision to use any vegetation for landscaping purposed should be referred to state landscape authority as well as local authorities. This is because maintenance of landscapes will be carried out by the local authorities and as such; only suitable landscaping plants which require minimal maintenance and functional shall be consider. Types of trees and shrubs to be planted should be referred to the local council or technical department like Public Works Department (JKR), etc. in order to determine the appropriate trees are planted.
- Do not over fertilize and over pesticide the trees and shrubs planted. This is to reduce the contaminants that are leached into the ground and surface runoff.

6.4.2 Solid Waste Disposal

Mitigating Measures

- Recycling programs around the communities can maximize the amount of waste that is diverted from disposal. Recycling projects can be encouraged to make this entire development a more environmental friendly and sustainable.
- The other alternative are to dispose the solid waste is to provide centralized composting park. 3R campaign needs to be implemented by occupants.
- The recycle centre community can be located same with composting park. Composting is nature's way of recycling organic materials and its reduce the amount of waste you create in your yard and kitchen by converting it into a useable soil amendment.
- Cooperation between developer and SWM in decision of schedule and management of solid waste disposal.
- Daily collection provision of centralized waste collection center.

Figure 6.9: Solid Waste Management



6.4.3 General maintenance (Infrastructure and Utilities)

Mitigating Measures

Mitigations measures that can be implemented are:

i. Roads/Traffic (During Operation & Maintenance)

- The main concern of the road structure is water. Therefore the water must quickly and efficiently be rid away from the road structure. This means that the chamber of the surface, the slope of the shoulders, the side drains and cross drainage structures need not only to be constructed effectively but also need to be constructed effectively. It shall keep in a condition that will permit the free run off the water away from the road. This means that the road once constructed has to be looked after on a regular basis. This is why maintenance is so important and is the core of a functional road network.
- Proper road maintenance contributes to reliable transport at reduced cost, as there is a direct link between road condition and vehicle operating costs. An improper maintained road can also represent an increased safety hazard to the user, leading to more accidents, with their associated human and property costs.
- Road maintenance activities: Three main categories, namely routine works, periodic works, and emergency works. This activity involves the general maintenance works that are carried out for the convenience of traffic users such as cutting of roadside grass (if any), maintaining signage and road furniture (barriers, street light etc). Contractors are normally engaged for this activity and minimal disturbance to the traffic can be anticipated.

Input from Traffic Impact Assessment¹

Accessibility to the Proposed Development

The access points of the development has been planned to facilitate access from various directions without causing a major increase in traffic on the study area road network. Therefore it is proposed that the development traffic be equipped with an internal road network equipped with its own main access points. **Figure 6.10** shows the proposed major access point to the development.

Recommendation

The recommendation of the traffic study is as follows:

Medium Term (Year 2021)

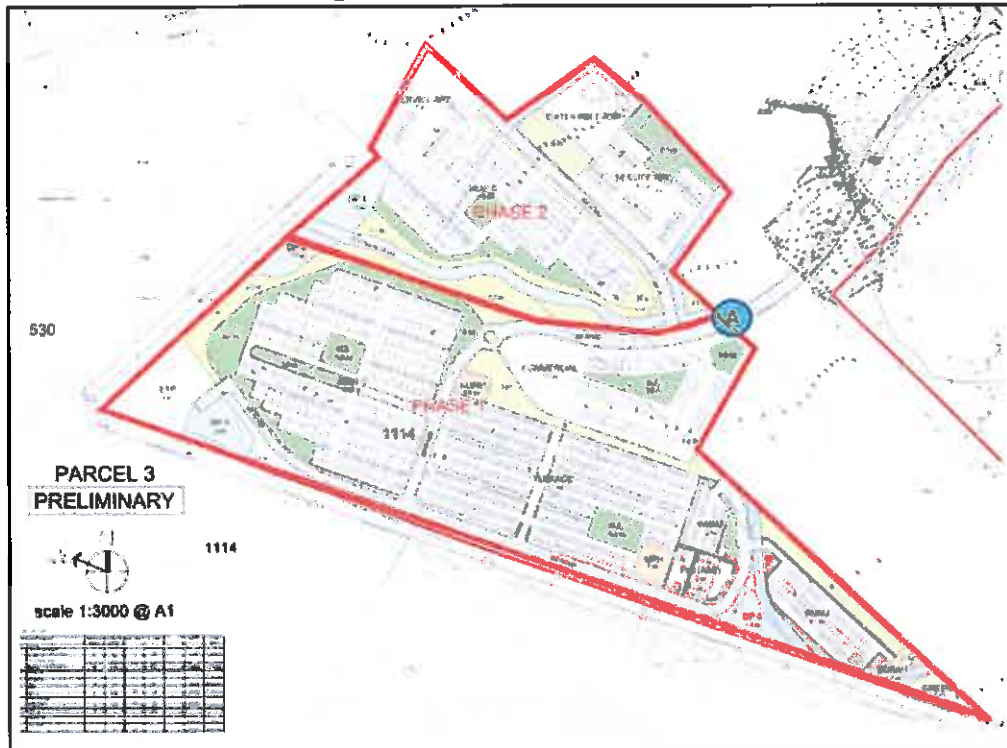
- ❖ Proposed main access via the proposed dual-3 lane (marked as A in **Figure 6.10**).
- ❖ Proposed 2 new roundabouts for a better traffic dispersal to the residential area as shown in Appendix A

Long Term (Year 2026)

- ❖ Proposed new signalized junction 1 (J1) as shown in Appendix B

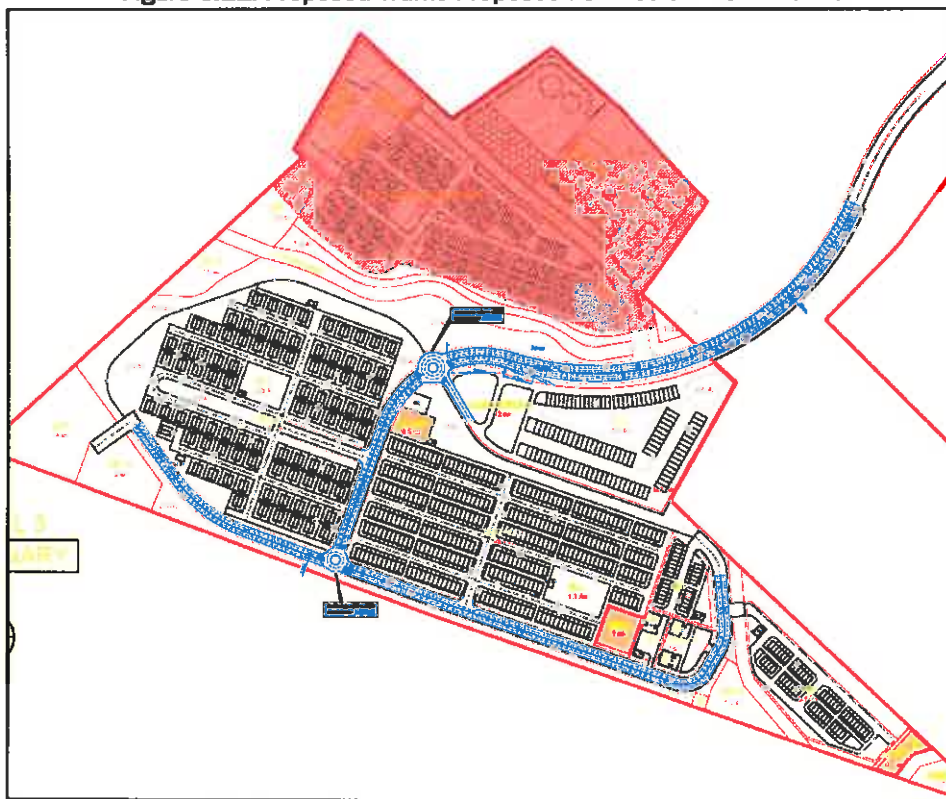
Source: Extracted From Traffic Impact Assessment Study For Pembangunan Bercampur Di Atas Lot 663, Lot 664, Lot 804 – Lot 807, Lot 1114, Lot 917 & Lot 920, Mukim Pulau, Daerah Johor Bahru, Johor By Perunding Trafik Klasik Sdn Bhd, 2013

Figure 6.10: Proposed Access Point



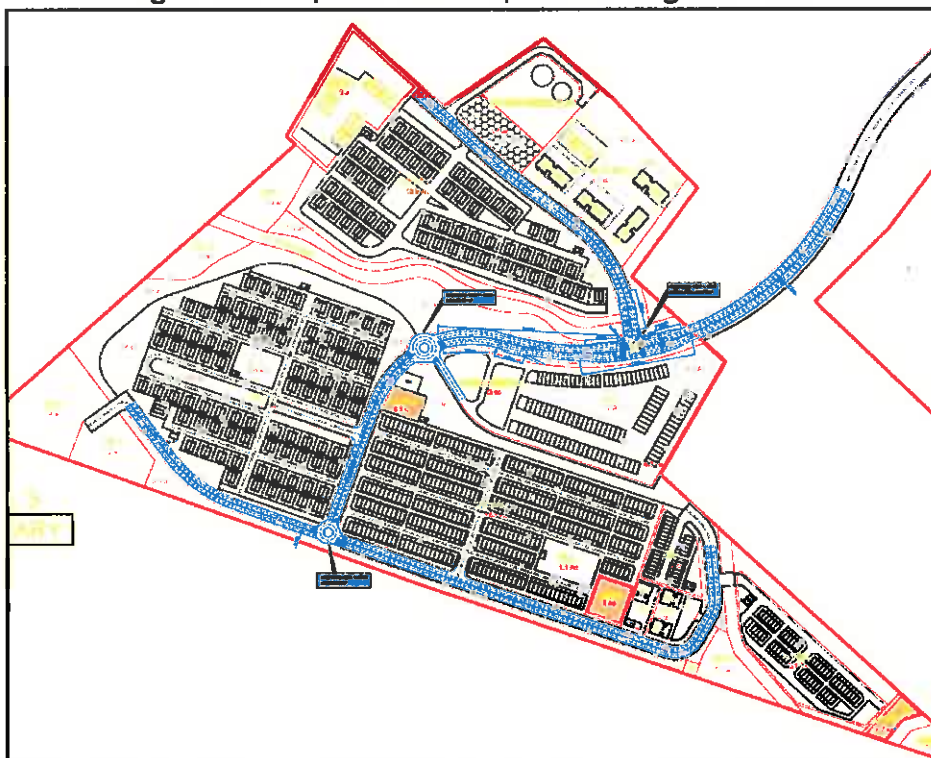
Source: Extracted From Traffic Impact Assessment Study for Pembangunan Bercampur Di Atas Lot 663, Lot 664, Lot 804 – Lot 807, Lot 1114, Lot 917 & Lot 920, Mukim Pulau, Daerah Johor Bahru, Johor By Perunding Trafik Klasik Sdn Bhd, 2013

Figure 6.11: Proposed Traffic Proposed For Medium Term Period



Source: Extracted From Traffic Impact Assessment Study for Pembangunan Bercampur Di Atas Lot 663, Lot 664, Lot 804 – Lot 807, Lot 1114, Lot 917 & Lot 920, Mukim Pulau, Daerah Johor Bahru, Johor By Perunding Trafik Klasik Sdn Bhd, 2013

Figure 6.12: Proposed Traffic Proposed For Long Term Period



Source: Extracted From Traffic Impact Assessment Study for Pembangunan Bercampur Di Atas Lot 663, Lot 664, Lot 804 – Lot 807, Lot 1114, Lot 917 & Lot 920, Mukim Pulau, Daerah Johor Bahru, Johor By Perunding Trafik Klasik Sdn Bhd, 2013

ii. Drainage systems

- Maintenance of drains will be critical in order to prevent blockage in the drainage channels and reduce flooding. In Particular, overflows for the drainage system must be cleared and properly maintained so as to minimize or prevent backflows in the system during peak flows.
- Regular maintenance for the main drain and sub drain to avoid clogging/trap of rubbish at the manhole/culvert.

iii. Sewage Treatment Plant/Sewerage Reticulation System

Mitigating Measures

- A regular maintenance to ensure STP is working effectively.
- Regular monitoring programs of discharged water quality are to be carried out and submitted to DOE for verification.
- The potential contamination of subsurface soil and groundwater may arise as a result of leaks due to corrosion or structural failures of the proposed sewerage system. To avoid this from happening, all construction materials as prescribed for the proposed works shall be in accordance with MS 1228 and approved by Sewerage Service Department.

STP System

Basically, all raw sewage will be collected at the pump sump and transferred to the treatment tank, which consists of two major treatment compartments, i.e. aeration and sedimentation compartments. Biological processes are used to convert the finely divided and dissolved organic matter in sewage into flocs and inorganic solids that can be removed in the sedimentation tank. The aeration compartment house of aeration equipment required to sustain healthy microorganisms by transferring natural oxygen into liquid and ensure complete mixing in the tank. After aeration, liquid is assisted to settle in a sedimentation tank. Activated sludge settled at the bottom of the sedimentation tank is transferred back to the aeration tank by a recycle pump. Supernatant liquid from the sedimentation tank is collected in a weir trough and discharged as treated effluent of the plant. Sludge concentration in the aeration compartments is maintained by diverting excess sludge into the sludge dewatering facilities for further treatment. A mechanical dewatering facility is provided and the treated sludge cake shall be regularly taken out for off site disposal.

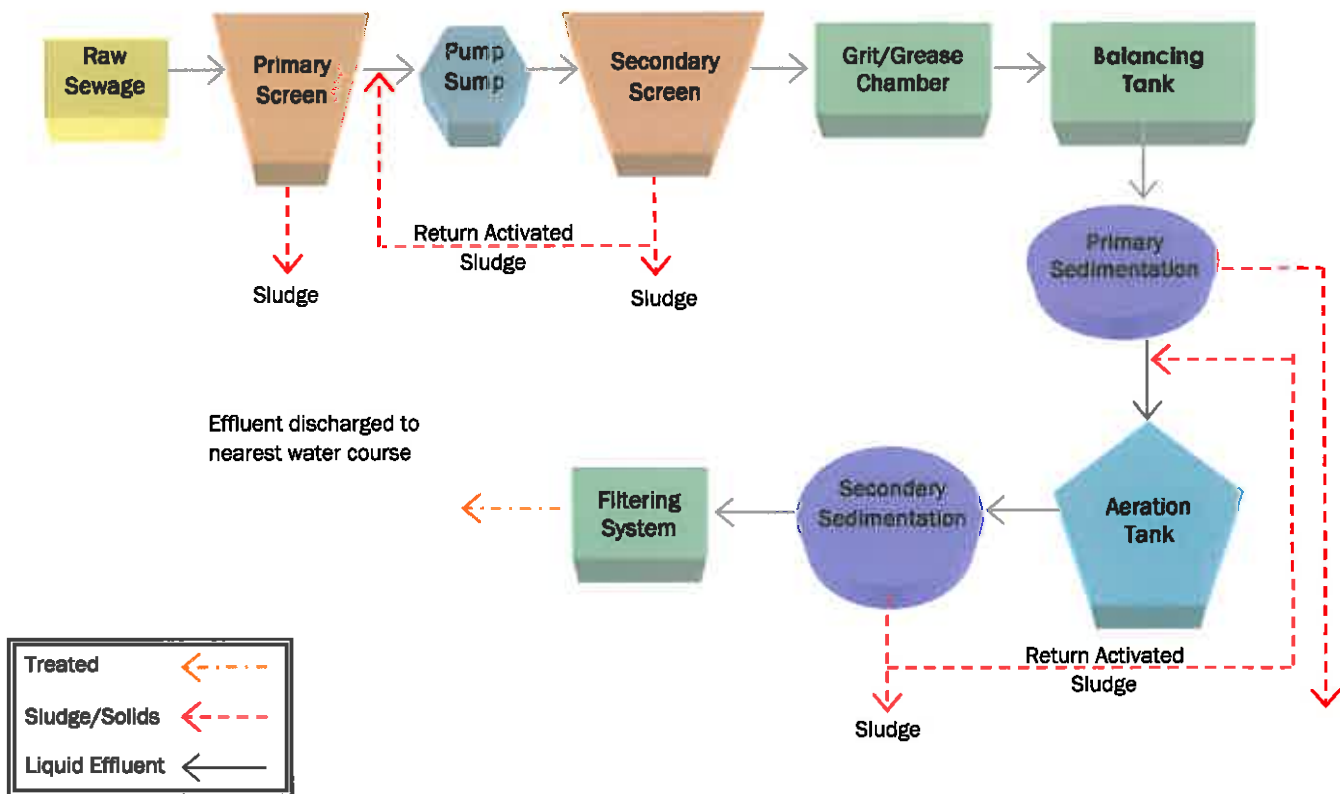
Sludge/Sullage Management

There are mainly two types of sewerage systems/services in Malaysia. The premises' sewerage systems are either connected to a public sewage treatment plant or have an individual septic tank.

Waste water system (sludge/sullage) need to be designed with effectively where waste water resultant from residence, business or restaurant having channel perfectly follow guideline that is set by involved agency. For illegal wastewater discharge, developer can observed through random field inspection work, which can include Closed Circuit Television (CCTV) Inspection, sampling testing, flow monitoring, and inspections or through reports made by citizens. Other than that, public awareness shall be regularly practiced on the new proposed township.

Based on current practice, waste water would be channeled out to drainage system after sludge/ sludge process. However, this process will not treat that waste water fully before out to drainage system prepared. Effect from that, result water content discharged to drain will tarnish near river. Hence, manipulation concept this release will continue to be channeled to sewage manufacturing plant without discharged to near drainage system.

Figure 6.13: Typical Sewage Treatment Process



Sources: Indah Water Consortium

Figure 6.14: Sludge/Sullage Treatment



Sources: Indah Water Consortium

iv. Water Reticulation System, Electrical Power Distribution and Telecommunications Systems

- The potential contamination of subsurface soil and groundwater may arise as a result of leaks due to corrosion or structural failures of the proposed sewerage system. To avoid this from happening, all construction materials as prescribed for the proposed works shall be in accordance with MS 1228 and approved by Sewerage Service Department.
- Measures such as integrity examination of materials immediately prior to pipe laying, proper supervision of construction and field testing of the components for water-tightness will minimize the risk of corrosion and leakage of pipes.
- Regular maintenance of these facilities is needed to make sure that daily residential, commercial and industry activities are not carried on smoothly. The proposed site lies within the infrastructure and utilities planned in the area are sufficient to cater the projected demand as a result of development. It will be potentially generate disconnected of power supply such as electrical and telecommunication to surrounding area.

Organizations including those involved in the operation of a development activities should establish an EMP to address schedules, resources and responsibility for complying with the requirements set by the DOE. The Environmental Quality (Prescribed Activities) (EIA) Order 1987 listed out 19 categories which must incorporate an environmental management plan (EMP) in their report. EMP provides a process by which the project proponent can identify significant environmental aspects that should be addressed. The EMP should be implemented during the construction phase by either the main contractor or the client.