CHAPTER 3

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3.1 Introduction

The methodology described in this chapter considers the environmental studies of the road construction site (Re-alignment of Federal Route 55, from Kuala Kubu Bharu to Fraser Hill) through the following procedures:

A) Site (Environmental) Audit

B) Management Review and discussion with the top management

C) Planning/Designing for a preliminary EMS for the project

3.2 Site environmental audit

This audit was carried out through site (i) interview, (ii) observation, (iii) compliance audit and (iv) monitoring at the project site.

3.2.1 Interview

These interviews were conducted based on 3-different levels of management at the project site. They are:

- Senior project management – on the management basis,
- Construction manager – on the operation and environmental basis, and
- Safety and health Manager – on the safety basis.

Three different sets of questionnaires were prepared and used to interview the above-mentioned people (A sample of the initial checklist is given in **Appendix 1**). The purposes of the interviews are to determine the project information or background and its current environmental management practices at the site such as general management, operation management and safety management.

3.2.2 Site observation

A site environmental checklist was drafted and used to obtain information on the activities carried out at the site. The site observation was also used to determine and identify the significant environmental impacts associated with its construction activities and its current mitigation measures in placed at the re-alignment road project. A list of the locations along the re-aligned road has been identified based on certain sections of road chainages (Ch), for example from as Ch1000 to Ch1500 (A sample of the initial checklist is given in **Appendix 2**). This is a standard landmark for road construction in Malaysia. The total stretch of the re-aligned road is from Ch0 (beginning chainage) to Ch 7800 (end chainage), 7.8km.

3.2.3 Compliance audit

This compliance audit was carried to determine the compliances status to the Environmental Quality Acts, 1974 and the additional DOE approved conditions. The details of the relevant Environmental Act and DOE approval conditions were explained in **Table 3.1**.

Table 3.1: Additional terms and conditions of approval stipulated by Department of Environment, Malaysia.

Condition Number	Description of terms and conditions
	SITE CLEARING AND EARTHWORK
1	Earthwork should be carried out in stages in line with phases of development.
2	Transport vehicles coming in and out of construction sites should avoid going through residential areas.
3	In clearing areas that is going to be flooded, existing vegetation cover should not be disturbed in order to help prevent soils being exposed to erosion agents, especially in areas with steep slopes. The time interval between clearing work and flooding of the area should be shortened.
4	Clearing and earthwork should be carried out only in areas that need to be developed. Exposed soils that are not going to be flooded should immediately be protected or be planted with cover crops with such methods like 'coconut mating' and 'hydroseeding'.
5	Excess soils should not be dumped outside of project site but should be used for the construction of bunds as boundary of the project site. These bunds should be compacted and stabilized and be immediately planted with cover crops.
	CONTROL AND MONITORING OF WATER QUALITY
6	Retention pond, silt trap and drainage system to drain surface water should be constructed prior to the commencement of earthwork. Discharge from silt traps into any streams and rivers should not contain more than 100 mg/L of suspended solids. The monitoring of suspended solid discharge from silt trap should be carried out at the commencement of earthwork activities.
7	Design of silt trap and retention pond should be certified by appropriate professional engineers at the design and the construction stage. Copies for approval and certification should be forwarded to Jabatan Pengairan dan Saliran Negeri Selangor and Jabatan Alam Sekitar.

Table 3.1 continued

Condition Number	Description of terms and conditions
8	Monitoring of water quality of Sungai Selangor should be carried out at the upper reaches and lower reaches of project perimeter during both the con-struction and operation phases. The parameters that should be monitored should include flow rate, dissolved oxygen, biological oxygen demand, cad-mium, suspended solids, oil and grease, and pH.
9	Disease control, especially those that could be transmitted through water and vector (*e.g.* typhoid, cholera, gastroenteritis and malaria), should be carried out as required by the Ministry of Health, Malaysia.
	CONTROL AND MONITORING OF AIR QUALITY
10	Open burning of vegetation remains and disposed construction materials are strictly prohibited.
11	Rock blasting work should be done using control methods such as control blasting and delay blasting. The quantity of explosive used should be limited to a minimum amount required for each blasting in order not to create vibration and fly rocks problem to areas surrounding the quarry site.
12	All sources that generate dust and cause air pollution should be equipped with an effective pollution control system. The following equipment should be incorporated in the quarry design plan: (i) All drilling equipment should be equipped with dust control system, (ii) All crusher equipment and screens should be enclosed or covered and be equipped with an effective suction system, (iii) Primary crusher, secondary crusher, tertiary crusher and all transfer points should be equipped with an effective sprinkler system, and (iv) The conveyer system should be completely enhoused and the transfer of rock materials should be through slotted chute.
13	All open stock piles should be dampened with water to avoid dust pollution
14	Water storage facility for the purpose of dust pollution control should be provided.
15	Quarry operation should be stopped immediately whenever there is breakdown of machinery or pollution control system, and the quarry should resume operation only when such breakdown has been rectified.

Table 3.1 continued

Condition Number	Description of terms and conditions
16	Ambient air quality for suspended particulate matter (PM10) should commence from the date of commencement of construction of the dam and quarry.
	CONTROL AND MONITORING OF NOISE LEVEL AND GROUND VIBRATION
17	Noise level should be controlled so as not to exceed 65 dBA during daytime hours and 55 dBA during nighttime hours measured from dam and quarry site boundary during construction phase and should not cause any disturbance to residences around.
18	Vibration from quarry operation should be controlled such that it does not exceed 5 mm/s at around quarry site boundary.
	MANAGEMENT OF SOLID WASTE
19	Solid waste including disposed construction materials should be gathered and disposed of at disposal site approved by Majlis Daerah Hulu Selangor
20	Disposal of vegetation remains is prohibited within impoundment area and areas near to stream channels.
	SAFETY CONTROL AND EMERGENCY
21	*Emergency Response Plan (ERP)* to manage whatever accidents or emergency should identify methods to evacuate nearby residents (in cases when it is necessary) and the report be prepared after consultation with the Police Department, Fire and Rescue Department, Local Authority and residents staying in the vicinity of the project sites.
	ADMISTRATION
22	Project proponent, before the commencement of earthwork, should appoint environmental consultant who should be responsible to every abatement and mitigating measures being implemented.
23	An officer who shall be responsible for matters relating to environmental management should be provided for in the organization structure.

A standard format was prepared and used for this compliance audit, which related the following activities/matters in line with the compliance with DOE approved conditions:

- **Site clearing and earthworks**. – to ensure the earthwork activities were carried out accordance to the conditions 1 to 5 as stipulated by the DOE. For example, site clearing should be carried out in stages and in areas that need to be developed, exposed slope need to be turfed, excess soil need to be well compacted and should not dumped outside the project, etc.
- **Control and monitoring of water quality** – to ensure all the mitigation measures of siltation control and water quality monitoring programs are in place that included the entire specification status in conditions 6 to 9 as stipulated by the DOE. For example, silt trap should provided before earth activity commenced, design and approval of silt trap, limiting value of silt trap to 100mg/l, river water quality monitoring parameters and programs, and disease control etc.
- **Control and monitoring of air quality** – as stated in the conditions 10 to 16. For example, open burning is prohibited, rock blasting method and quantity of explosive used at quarry, air pollution control system at quarry are functioning well, open stockpile should dampened with water, water storage facility, monitoring programs of ambient air quality etc.
- **Control and monitoring of noise level and ground vibration** – as stated in conditions 17 and 18 where the noise level should be controlled and should not exceeded 65 dBA during day time and 55 dBA during night time; vibration from the quarry operation should not exceeded 5mm/s.

- **Management of solid waste** – as stated in condition 19 and 20 that where the solid waste should dumped at the disposal site approved by Majlis Daerah Hulu Selangor and disposal of vegetation remain in the watercourse is prohibited.

3.2.4 Monitoring and analysis

The monitoring activities were conducted by two 2 groups, they are (A) Environmental Management Consultant (EMC) and (B) Site Independent Environmentalist (SIE), who engaged by the project proponent. The EMC established 13 river quality-monitoring stations at the project site. The basis for the selection of the sampling stations is based on the upper reaches (including the tributaries) and the lower reaches of Sungai Selangor, just outside the perimeter of the project area. The location of river water quality stations can be referred to **Figure 3.1**. The secondary monitoring results from EMC and SIE would be used for this research to check the current compliance status at the project site such as river water quality, air quality, noise and vibration quality and silt trap discharge quality. The details of each monitoring program are presented in the following section.

A Environmental Management Consultant (EMC)

EMC conducted a comprehensive monitoring scheduled on a monthly or twice a month basis as requested by the DOE that included river water quality, noise quality, vibration quality and air quality.

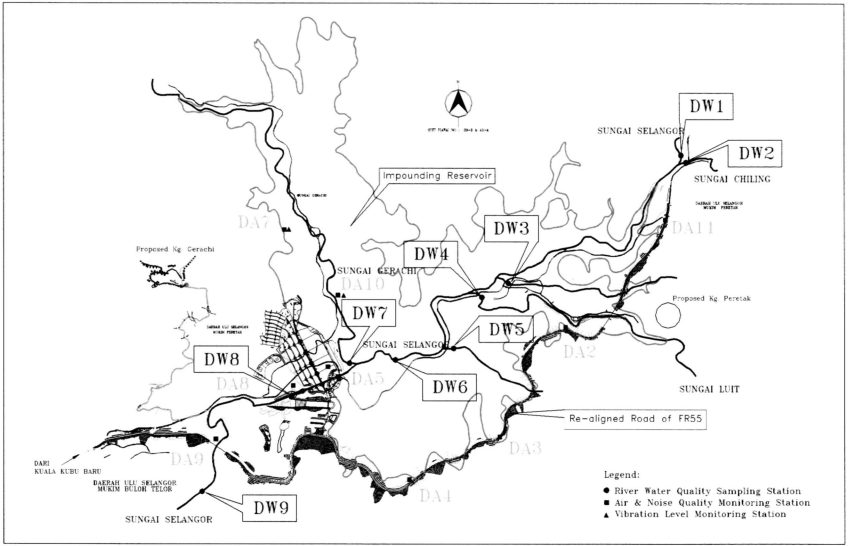

Figure 3.1: The locations of river water, air, noise and vibration quality monitoring stations within the re-aligned road project by EMC

River water quality

There are 13 river water-sampling stations along Selangor River and its tributaries such as Sungai Peretak, Sungai Ganggor, Sungai Luit and Sungai Gerachi. The samples were analysed at a accreditated laboratory for various chemical and physical parameters. The methods used in the analyses are mainly those detailed out in "Standard Methods For The Examination Of Water and Waste Water" (1995) 19th Edition, American Public Health Association (APHA). The parameters of the water quality that were monitored using the following method are:

- pH

pH of the river water was determined using a portable pH Meter, Model Sension 156.

- Dissolved Oxygen (DO)

DO in river water was carried out *in situ*, using a portable YSI Dissolved Oxygen Meter, Model 550.

- Biological Oxygen Demand (BOD)

The method used was APHA 5210B (APHA, 1995). The method consists of filling with sample, to overflow, an airtight BOD bottle of the specified size and incubating it at the specified temperature for 5 days. After adding seed, dissolved oxygen was measured initially and after incubation, and the BOD was computed from the difference between initial and final DO values.

- Total Suspended Solids (TSS)

EPA Method 160.2 was used in the determination of TSS (APHA, 1995). In the analysis, a well mixed sample of a known volume (200 ml) was filtered through a pre-weighed dried 0.45 μm glass fiber filter membrane (Whatman GFC filter paper) using a Millipore filtration unit. The filter paper was then dried in the oven at 103 – 105 °C. The weight of the filter paper and the residue was recorded. The non-filterable residue or the total suspended solid was then calculated by the formula presented below:

$$\text{Total Suspended Solid (mg L}^{-1}) = \frac{(A - B) \times 100}{C}$$

Where,

A = [weight of filter (or filter and crucible) + residue] in mg

B = weight of filter (or filter and crucible) in mg

C = ml of sample filtered.

- Ammonical Nitrogen (AN)

Ammonical Nitrogen was determined applying the USEPA approved Hach Method 8038. A yellow colour formed, utilizing various stabilizers and dispersing agents, is proportional to the ammonium concentration.

- Oil & Grease (O&G)

The method used was APHA 5520B. Dissolved or emulsified oil and grease was extracted from the water by intimate contact with trichlototrifluoroethane. The extract was analyzed by IR (infra-red) at the C-H vibrational stretch at 2850nm. The absorbance was compared with a standard curve to determine the concentration.

- *E.coli*

The method used was APHA-9223 B, which was a chromogenic substrate coliform test with multiple tube procedure. The water sample was pipetted into the test tubes containing the media (light yellow) for detection of *E.coli*. Normally, 3 dilutions x 5 tubes (5 tubes for each sample dilution) were used. The presence of Total *E.coli* after incubation (at 35 ^{o}C for 24 – 48 hours) was indicated by the fluorescence under a long wavelength ultraviolet lamp. The results obtained were confirmed by proceeding to test with kolvac reagent, where a red ring formed indicate a positive result. The positive results for each series was recorded and the numerical reading was obtained by referring to the MPN (Most Probable Number) table.

- Cadmium

The digestion method used for the heavy metal was USEPA Method 3010. This trace element was determined by the USEPA Method 200.7, i.e. using Inductively Coupled Plasma (ICP). The basis of the latter method is the measurement of atomic emission by optical spectroscopic technique. An ICP source consists of a flowing stream of argon gas, ionized by an applied radio frequency. This field is inductively coupled to ionized gas by a water-cooled coil surrounding quartz "torch" that supports and confines the plasma. During the analysis, samples were nebulized and aerosol produced was transported to the plasma "torch" where excitation occurred. High percentage of ionized atoms is characteristic of ionic emission spectra.

Silt trap discharge quality

The EMC carried out the silt traps discharge quality monitoring for its content of suspended solid in fortnightly basis. Total number of the silt traps within the project

site was 24 number. The location of the silt trap can be referred to **Figure 3.2**. About one liter of discharge flowing out from silt trap was collected for total suspended solid analyses. The method of total suspended solid analyses is similar with the above method of river water quality.

Air quality monitoring

A high volume air sampler (*THERMO ANDERSEN Total Suspended Particu-late High Volume Air Sampler – model 1100*) was used to collect total particulate present in the air for a 24-hour period at selected active sampling stations.

Another high volume air sampler (*THERMO ANDERSEN PM 10 High Volume Sampler – model 1200*) was used to collect fine dust particulates with dimensions < 10 micron present in the air for a 24-hour period at similar active sampling stations.

The filtration media for both samplers were predried in an oven and thereafter transferred to a desiccator to maintain its constant weight. After weighing, the filtration media were sealed for field sampling. During sampling, the filtration media was loaded into their respective high volume air samplers, and air was drawn through the filtration media *via* a pump maintained by a generator. The filtration media installed in the air samplers detained suspended particulates present in the air. After sampling, the filtration media was removed from the air samplers, and was sealed in plastic bags and was then brought back to the laboratory for weight determination. The difference in

weight of the filtration media before and after air sampling is the weight of suspended particulate matter present in the volume of air sampled.

Noise quality monitoring

Noise level was recorded using a precision Integrating Sound Level Data-logger (EXTECH - model: 40426), stationed at active work sites, as well as, at corridor areas and selected sampling stations viz. residential areas occurring in the vicinity of active work sites. The sound levels was recorded three times a day, i.e. twice during day-time, and once during night-time with each recording lasting 30 minute duration. The noise level recordings were then translated as LA_{eq} values using datalogger computer program.

During noise measurement, the noise meter was being mounted on a tripod at a height of about 1.2 m above ground level. In order to minimise the possibility of interference by the personnel making the measurement, a wind shield was placed over the noise meter microphone.

The Integrating Sound Level Data logger was calibrated acoustically using a Sound Level Calibrator set at 94 dB using the built-in function mode. The noise measurement was made using the time weighting characteristic of 'fast' and 'A' weighted decibel scale.

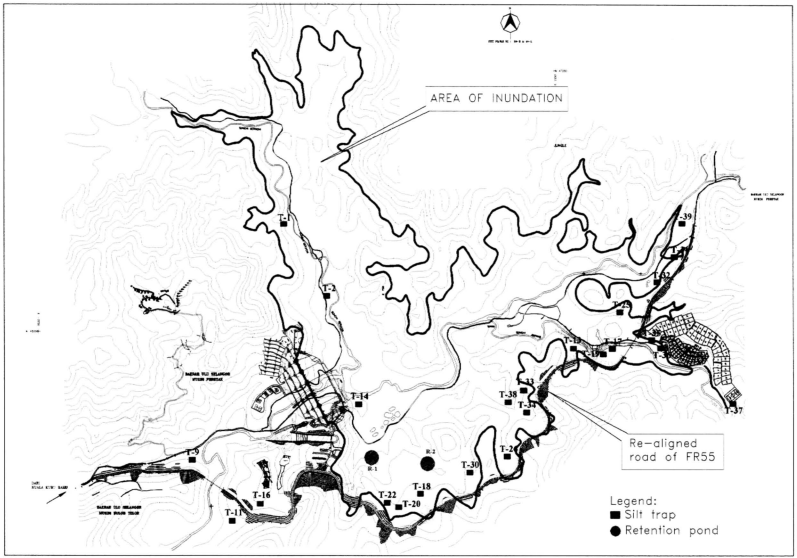

Figure 3.2: The locations of silt trap within the re-aligned road project.

Vibration monitoring

A vibration meter (*METRIX Vibration Meter – model 5500B*) was used to monitor ground vibration intensity. The meter was planted into firm ground at active work sites where heavy machinery are being used *viz.* quarry areas, and also at their corridor areas as well as at sensitive receptor area *viz.* residential area (Kampong Gerachi Jaya) for the purpose of measuring ground vibration intensity. The sampling points of air quality, noise and vibration level can be referred to **Figure 3.1**.

Monthly and twice a month silt-traps discharge quality monitoring (25 number of silt traps) for its content for total suspended solids, noise level and air quality monitoring in the active zone was done.

b) Site Independent Environmentalist (SIE)

In addition, the Site Independent Environmentalist (SIE) conducted environmental studies included a twice a week monitoring for river water quality and silt-trap discharge quality for its content of suspended solids (TSS) by using Calorimeter, model HACH DR 890. The TSS level of the water quality (river & silt trap's discharge) was determined *in situ* and at the same time the compliances of river quality and silt trap discharge quality with the condition stipulated by DOE was determined. The location of each sampling stations for river water quality and silt traps indicated in **Figures 3.1 and 3.2**, respectively, similar with the monitoring programs by the EMC, except some

additional river sampling stations were included, which were located at the upstream of each river or tributary.

3.3 Management review and discussion with the top management

A management review exercise was carried out through discussions with the management to assess the status of environmental management of the project in areas such as documentation, document control, type of training, employee's environmental awareness, emergency response procedure (ERP), Environmental Management Planning (EMP) and the system of communication between the top management and the employees. The result of the compliance audit and monitoring were tabulated and analyzed. A discussion with the top management of the project site was carried out to mitigate or to resolve the environmental issues that rose from the audit and management review. As a result of the discussion, the project proponent was able to establish a practical management system in terms of cost effectiveness as well as environmentally friendly.

3.4 Planning/Designing for a preliminary Environmental Management System for the project

A discussion with the management was carried out to develop a preliminary EMS for the re-aligned road project based on the five principles of ISO 14001, as discussed earlier in Chapter 2 (Literature Review).