Section 6
Potentially Significant Impacts and Mitigation Measures During The Construction Stage

SECTION 6 : POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES DURING THE CONSTRUCTION STAGE

6.1 INTRODUCTION

This section of the report examines the potentially significant impacts that could arise during the pre-construction and construction phases of the Project. The impacts are assessed in terms of magnitude, prevalence, duration and frequency of occurrence whichever is applicable, and their consequences. This section also discusses the mitigation measures which can be implemented to ensure the adverse impacts are kept to a minimum.

6.2 SENSITIVE RECEPTORS

The receptors of the potential impacts from the Project would include all the various communities and land uses located along the alignment, which have been identified and described in **Section 4.4** of this report.

6.3 POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES DURING PRE-CONSTRUCTION STAGE

The main potentially significant impacts expected during pre-construction stage are related to the following activities:

- Land and property acquisition
- Utilities relocation

6.3.1 Land and Property Acquisition

The land and property acquisition is an important issue during pre-construction stage because of the potentially large number of land and properties that may be acquired for the Project. During the feasibility study and in the preliminary designs, the Project has planned such that land acquisition is kept to as little as possible. However, given that the LRT3 traverse very built-up areas, there may still be properties that need to be acquired.

The Project Proponent has identified that about 339 lots may be acquired based on the provision LRT3 alignment (**Table 6-1**).

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Table 6-1 Breakdown of Potentially Affected Lots by Segment

Segment	MBPJ	MBSA	MPK
Segment 1: Bandar Utama Station – Persada PLUS Station	20	-	-
Segment 2: Station 3 Station – Bandar Raja Station	-	45	-
Segment 3: Kawasan 17 Station – Johan Setia Station	-	-	274
Total	**339**		

Source: Feasibility Study for the Proposed Light Rail Transit Line 3 (Bandar Utama to Klang), 2014

Out of 339 lots, 20 lots are located within the MBPJ area and 45 lots within the MBSA area and 274 lots within the MPK area (including 165 lots of agricultural land for the depot) may be acquired.

The largest number of acquisition is expected in Segment 3 mainly due to the large area required for the construction of the depot. For Segment 3, critical area in terms of potential social and economic impacts is at Kawasan 17 area and along Jalan Meru due to acquisition of the houses and commercial premises since these are long established areas (49 lots). For Segment 1, most of the premises likely to be acquired are those fronting the SPRINT Highway.

For Segment 2, the potential impacts as a result of acquisition is expected to be the least since about half lots that are likely to be acquired are mainly open space, road reserve areas and institutional land.

Potential impacts from acquisition and relocation

Based on the engagements (FGDs and case interviews) conducted with the residential, commercial as well as other specific groups, acquisition and relocation are major concerns raised.

- For residential areas, acquisition would result in displacements to the affected residents especially for the long established residential areas. Often there are psychological, emotional and impacts that make it difficult for the people to uproot and move elsewhere, particularly for established residential areas. Once their properties have been acquired, the affected people will have to relocate and in the process leads to:

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- Disruption to their lifestyle – not able to relocate to a similar property due to lack of availability or affordability.
- Disintegration of the community – relocation of property owners could cause loss of existing community linkages, community cohesion and social interaction.

- This may be problematic for those who have resided in established neighbourhoods such as Shah Alam and Kawasan 17 area in Klang. The participants are worried and want some form of assurance that they would not be directly impacts by acquisition because any relocation could affect the social integration in the community which they have built over the years.

- For business owners whose business premises may be acquired, the impacts are significant, especially those who have been in operation for a long time. Acquisition would result in disruption of their business due to the need move elsewhere. For some, this could affect them in the long term due to the difficulty in re-establishing the business in a new area. This may cause a problem for the business owners along Jalan Meru.

- Another concern is the potential relocation of three Hindu shrines at Kawasan 17 area as they are not the land owners. They are worried that they will not be compensated if they are asked to relocate elsewhere and further away from the existing location. This could adversely affect the social and cultural welfare of the affected communities as these institutions are integral to the cultural and social values of the larger communities. It is to be noted that each of the temple have been around for more than 30 years and have a large number of followers.

Management measure to minimise impacts from acquisition

The proposed mitigating measures are based on a combination of concerns from the engagements and measures that have been implemented and proposed the Project Proponent. The proposed measures include:

a) Establishing a special team to manage acquisition and relocation matters. For this purpose, a “Compensation and Relocation Programme” is proposed. This is important due to the low level of trust associated with efforts taken by private companies. As it does not affect many, not many are privy to the terms and conditions outlined in the compensation plan. Only impacts households or individuals will know the exact terms and conditions.

b) Develop general procedures and terms in relation to compensation and relocation. These documents should be made available to the public so that they can understand the technicalities better.

c) Comprehensive information shall be provided to the affected parties to enable them to understand that the process can be fair to all affected and are within legal boundaries.

d) Due notice and assistance shall be given to the affected parties, giving ample time for them to make alternative plans to manage their properties and minimise any inconveniences.

e) Maintain continuous engagement with the potentially affected parties to address and attend to any queries to the whole spectrum of acquisition and relocation exercise. Individual engagement which is more personalised and sensitive is proposed for the affected parties to reduce their perceived fears and dismay. Very often, many are prone to rumours and incorrect information which would heighten their fears and concerns, thereby affecting any objective decisions and reactions. Such engagement is crucial for those whose premises may be acquired such as at Kawasan 17 and Jalan Meru areas. For those who are likely to be relocated (the Hindu shrines at Kawasan 17), they have requested during the engagement session, to be relocated within the vicinity since their followers are staying within the surrounding areas.

6.3.2 Utilities Relocation

Before the main construction works commence, utilities located along the alignment will first be relocated. 32 potential relocation works have been identified during preliminary utilities survey. Out of 32 relocations, 24 are TNB transmission line and 8 are water pipeline (**Figure 6-3a** and **Figure 6-3b**). The actual number of utilities relocation will be determined once the exact location of the piers have been finalised.

Potential impacts from relocation of utilities

The major impacts will be public safety such as surrounding residential population as well as safety of the workers population directly involved in the utilities relocation works. Some of the construction risks related to utilities relocation works have been identified as follows:

- Exposed utilities wires/cables from relocation exercise from human error/negligence
- Vehicular accident from temporary closure of road, road diversion, speed and loss of parking space
- Flooding of the construction area from heavy rain or clogged drainage system
- Occupational and safety hazard from heavy machinery and working within enclosed areas

Measures to minimise risks from utilities relocation

The measures to minimise risks from utilities relocation include:

- Relocation to be carried out at night time and implement traffic diversion if required.
- Usage of appropriate signboards during relocation works
- Eliminate all possible ignition sources near to the work area
- Safety requirement for fire-fighting and explosion to be provided at the work site during the construction
- First aid kits must be well prepared and available
- Workers involved must be trained in first aid and emergency procedures
- Implement emergency response plan, evacuation to assemble point

6.4 POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES DURING CONSTRUCTION STAGE

The major work components during the construction stage are:

- Construction of viaducts and elevated stations
- Underground works (tunnel guide way and underground station)
- Depot construction

Viaduct and station construction are the major components of the elevated works and involves the construction of columns, pier and launching of pre-cast segmental box girder. Major activities that will be carried out as part of underground works will consist of tunneling (cut and cover method) and construction of the underground station.

The main impacts and activities during the construction phase are summarised in **Table 6-2**.

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Table 6-2 Potential Impacts during Construction Stage

Potential Impacts	Activities
Traffic congestion	• road diversion, closure and lane reduction for viaduct and station construction • construction vehicles transporting excavated materials (from underground works), construction materials and equipment/machineries
Public safety (residents, workers, road users and adjacent building)	• vehicular accident from temporary closure or diversion of roads, transportation of waste and construction material and equipment • occupational and safety hazard from use of heavy machineries, malfunction of machinery and equipment, working at height and confined space
Increased noise level	• piling works • construction of viaduct and elevated stations • use of high noise generating machineries such as generator sets, power tools, hydraulic breaker and grinding and cutting equipment
Increased vibration level	• underground and piling works
Soil Erosion and Sedimentation	• site clearing and earthworks from depot construction • sedimentation from excavation at elevated section
Air pollution	• earthworks • movement of construction vehicles
Waste generation	• site office and workers camp • site clearing
Economic benefits	• economic growth, job creation, other multiplier effects and tax revenues to Government would accrue during the construction period.

6.5 TRAFFIC CONGESTION

Traffic congestion due to construction works is one of the most important potentially significant impacts. As seen from other mass rapid transit projects in the city, construction works can often lead to congestion along roads where the works are being carried out. Since LRT3 mainly runs along the major roads and highways, the construction works could potentially result in traffic congestion.

Traffic congestion during the construction phase is also one of the most important concern raised by stakeholders during the FGDs and dialogue sessions (**Section 5-3**).

6.5.1 Traffic Impacts due to Station Construction

The major impact caused by the proposed construction works for stations involves reduction in terms of lane width and working area being located on the road shoulder. This reduction in lane width and road shoulder would cause an impact in terms of reducing capacity of carriageways. Insufficient road capacity will cause temporary bottleneck that disturb smooth flow of vehicles. In addition, traffic safety risk will arise as the result of reduction in lane width and road shoulder closure. Vehicles will have to fit into narrower lanes and motorcyclists will find difficulties to maneuver in traffic. Construction traffic access to the site imposes safety risk to the road users, especially the vulnerable road users such as pedestrian, bicyclists and motorcyclists. This is especially a concern if the access roads used are local streets residential areas or near schools.

Segment 1: One Utama Station to Persada PLUS Station

Most of the stations in this segment are situated in the residential and commercial areas. The first three stations, i.e. One Utama, Damansara Utama and Tropicana, are located on local streets with low capacity. These local roads provides access to the residents staying in Damansara Utama and Bandar Utama (**Table 6-3**). Construction traffic access via these local roads may create congestion problem and safety issue to the residents. The other three stations, i.e. Lien Hoe, Dataran Prima and Persada PLUS are expected to have construction work on NKVE. This could reduce capacity on the highway which may create temporary bottlenecks that cause congestion. During construction, the expressway is expected to have a service level of LOS E. In such a case, long queue and delay would be expected for the regular users. Damansara Utama, Bandar Utama, Tropicana, Taman Bukit Mayang Emas and Sunway Mas Commercial Centre are most likely to be affected (**Table 6-3**).

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Table 6-3 Potentiak Impacts During Station Construction (One Utama to Persada PLUS Station)

Station	Construction Access Road	Issues	Impact
• One Utama • Damansara Utama	1. Jalan SS 21/42 2. Jalan SS 21/13 3. Lebuhraya Damansara – Puchong	1. Narrow local access street (Jalan SS 21/42 & Jalan SS 21/13). 2. Heavy traffic on Damansara – Puchong Highway.	1. Traffic safety concern for residents in Jalan SS 21/42 & Jalan SS 21/13 due to constrcuction traffic. 2. Expected congestion on Lebuhraya Damansara – Puchong due to traffic bottlenecks.
Tropicana	1. Jalan Tropicana Selatan 1 2. SPRINT Highway	1. Jalan Tropicana Selatan 1 • Narrow (20ft) local access road. • Only access for construction from SPRINT Highway. • Only access to Merchant Square from SPRINT Highway. 2. SPRINT Highway • Heavy traffic • Near to Damansara Toll • No direct access from Klang/Shah Alam to construction site.	1. Jalan Tropicana Selatan 1 • Congested • Delayed 2. SPRINT Highway • Congested • Delayed
• Lien Hoe • Dataran Prima	NKVE Highway	NKVE Highway • Only access for construction • Heavy traffic • No direct access from Sg Buloh to construction site.	NKVE Highway • Congested • Delayed

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Table 6-3 Potentiak Impacts During Station Construction (One Utama to Persada PLUS Station) (Cont'd)

Station	Construction Access Road	Issues	Impact
Persada PLUS	1. NKVE Highway 2. Jalan Lapangan Terbang Subang	1. NKVE Highway • Only access for construction • Heavy traffic • No direct access from Sg Buloh to construction site. • Near to Persada PLUS Toll 2. Jalan Lapangan Terbang Subang • Heavy Traffic • Main road for Seksyen U1-U10 to Federal Highway.	1. NKVE Highway • Congested • Delayed 2. Jalan Lapangan Terbang Subang • Congested • Delayed

Segment 2: Station 3 to Bukit Raja Station

The stations on this segment are located mostly on the major arterial roads in Shah Alam area, such as Persiaran Kerjaya, Persiaran Sukan, Persiaran Dato' Menteri and Persiaran Permai. The analysis of roadway volume-to-capacity indicates that the traffic condition on these roads will deteriorate during construction stage. Hence, residents staying in Seksyen 1-12 of Shah Alam are most likely to be affected during LRT3 construction.

The construction of SIRIM and UiTM stations on Federal Highway is expected to worsen its level of service which is already performing poorly at existing condition. Being a major highway connecting Shah Alam /Klang to Petaling Jaya/City Centre, it will cause prolonged delay to the highway users. Queues could develop and spillback to supporting roads and interchanges connecting to it, such as Persiaran Dato' Menteri, Persiaran Selangor, Persiaran Raja Muda, Jalan Padang Jawa, Jalan Sg Rasau and Jalan Batu Tiga Lama (**Table 6-4**).

There is an underground station in this segment, i.e. Persiaran Hishamuddin station. The major road adjacent to the station is Persiaran Hishamuddin. The underground works will result in reduction of capacity of Persiaran Hishamuddin being the major arterial road in Shah Alam.

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Persiaran Hishamuddin station is to be constructed using cut and cover method with expected duration of 24 months. Impact of the roadside construction is likely to be significant if proper mitigation strategies are not implemented. Effectively, reduction in lane width and road shoulder would cause an impact on the capacity of the carriageway. It is expected to reduce the service level of Persiaran Hishamuddin and Persiaran Dato' Menteri from LOS C (**Table 6-9**).

The deterioration of roadway performance is expected to create congestion and long queue. Queues will spillback to the nearby supporting road which causes additional delay to users. These roads are Persiaran Kayangan, Persiaran Damai, Persiaran Bandar Raya and Persiaran Masjid. The roundabout of PersiaranKayangan/Persiaran Hishamuddin/Persiaran Dato' Menteri is a major roundabout/collector that serves the area of Seksyen 2-12 and D'Kayangan of Shah Alam. As such, the roundabout could not be closed for construction work. This will cause traffic re-distribution that gives a wider impact on all major roads in that area. However, closure of one approach leg at one time (i.e. Persiaran Hishamuddin) is allowable for the construction. Traffic rerouting or diversion is implemented to ensure minimal impact on the closure.

The Persiaran Hishamuddin station is located along Persiaran Hishamuddin and Kayangan Roundabout, which is primarily a residential catchment with schools and playgrounds. The schools in the locality include SMK Seksyen 11, SMA Tinggi Tengku Ampuan Jemaah and SK Seksyen 13. As a residential catchment interspersed with sizable number of schools and children's playgrounds, it is essential that various precautionary and safety measures are taken in planning the movement of traffic, specifically the movement of trucks associated with the construction of the station.

In addition, the significant impacts are expected due to the usage of trucks during the construction period. For instance the construction of the station at Persiaran Hishamuddin would require certain trucks to transport earth and excavated material to the dumping area. It is estimated that at least 10 trucks will be used during the peak excavation phase. The 10 trucks in operation during this period can be assumed to make an average of 5 trips per day resulting in approximately 50 truck-trips per day.

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Table 6-4 Potential Impacts During Station Construction (Station 3 – Bukit Raja Station)

Station	Construction Access Road	Issues	Impact
• Station 3 • Temasya • Glenmaire	1. Persiaran Kerjaya 2. Jalan Hakim U1/24 Junction	1. Persiaran Kerjaya • The road is single 2 lane road. • Heavy traffic 2. Jalan Hakim U1/24 Junction • To near to the junction • The junction is performing poorly (LOS F) during peak hours.	1. Persiaran Kerjaya • Congested • Delayed • Long queue 2. Jalan Hakim U1/24 • Congested
• Persiaran Hishamuddin • Section 14	1. Persiaran Hishamuddin 2. Persiaran Kayangan 3. Bulatan Kayangan	1. Persiaran Hishamuddin • Dual 2 carriageway • Heavy traffic 2. Persiaran Kayangan • Dual 2 carriageway • Heavy traffic • Main access to federal highway • SMK Seksyen 11 3. Bulatan Kayangan • The main roundabout for Shah Alam	1. Persiaran Hishamuddin, Persiaran Kayangan and Bulatan Kayangan • Congested • Delayed
• SIRIM • UiTM	Federal Highway	Federal Highway • Heavy traffic • No direct access from Kuala Lumpur	Federal Highway • Delayed
I-City	1. Persiaran Permai 2. Persiaran Kayangan	1. Persiaran Permai • Dual 2 carriageway • Heavy traffic • Near to shop lot • Main access for Uitm student to their apartment. 2. Persiaran Kayangan • Heavy traffic • Only access to the site • Near to entrance to UiTM	1. Persiaran Permai and Persiaran Kayangan • Congested • Delayed for UiTM student • Long queue

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Table 6-4 Potential Impacts During Station Construction (Station 3 – Bukit Raja Station) (Cont'd)

Station	Construction Access Road	Issues	Impact
Bukit Raja	1. Lebuh Keluli 2. Lebuhraya Selat Klang	1. Lebuh Keluli • Dual 2 carriageway • Near to the junction to exit to Lebuhraya Selat Klang 2. Lebuhraya Selat Klang • Heavy traffic	No issue

Segment 3: Kawasan 17 to Johan Setia Station

The stations of Segment 3 are situated on major arterial and/or collector/distributor roads in Klang area, i.e. Jalan Meru, Jalan Langat, Persiaran Tengku Ampuan Rahimah and Jalan Klang Banting (**Table 6-5**).

Jalan Meru is one of the major arterial roads in Klang area. It is busy as it serves several commercial and residential developments. There are several schools along the road, i.e. SK Satu, SMK Meru and SMK Tinggi. The road is performing at LOS C and is rather congested due to pick-up and drop-off activities. During construction stage, it is expected that the congestion level would worsen. Construction traffic (with heavy vehicles) poses safety risk to the vulnerable road users such as pedestrians, bicyclists and motorcyclists.

Jalan Jambatan Kota serves the major administration and commercial developments in Klang area. There are Klang Local Authority, Klang District Office, Prima Klang Avenue, Sri Kota Medical Centre and others along or in the vicinity of the road. The road is expected to deteriorate to LOS F during construction which indicates that the roadway (with reduced lane width or shoulder) could not accommodate existing traffic during construction. Prolonged queues and delays could happen.

Jalan Langat is also one of the major arterials in Klang area. It serves many residential areas, such as Taman Sri Andalas, Taman Bayu Perdana, Taman Desa Utama, Bandar Bukit Tinggi, Taman Pelangi Indah, Taman Indah, Taman Selatan, Taman Palm Grove, Taman Chi Liung, Bandar Botanic and etc. It also serves the commercial areas, such as GM Klang Wholesale City, AEON and Tesco. Besides, there is a hospital, i.e. Hospital Tangku Ampuan Rahimah situated along the road. The road also serves several schools in the vicinity, such as SM Batu Unjur, SM Teknik Klang and SK Batu Unjur.

The residents in this area are likely to be affected during LRT3 construction. Jalan Langat is expected to have deteriorate road condition during construction while construction traffic poses safety risk to the vulnerable road users in the area.

Table 6-5 Potential Impacts During Station Construction (Kawasan 17 – Johan Setia Station)

Station	Construction Access Road	Issues	Impact
Jalan Meru	Jalan Meru	• Congestion on Jalan Meru. • Traffic safety risk for neighboring schools due to construction traffic.	• Increased congestion level and cause prolonged delay. • Traffic accident involves vulnerable road users might occur.
Klang	Jalan Jambatan Kota	• Congestion due to high traffic volume.	• Increased level of congestion and deteriorated road level of service. • Prolonged queue and delay expected.
Sri Andalas	Jalan Langat	• Heavy traffic on Jalan Langat. • A major arterial road in the area that serves residential and commercial development, as well as schools.	• Bottlenecks created due to reduced lane width and capacity • Prolonged delay and queue expected.

6.5.2 Traffic Impacts due to Viaduct Construction

The major impact caused by the construction of viaducts involves reduction in terms of lane width and working area being located on the road shoulder. Although there is no station proposed on the road, but the construction of viaduct would cause similar impacts due to reduced lane width and shoulder. Insufficient road capacity will cause temporary bottleneck that disturb smooth flow of vehicles. In addition, traffic safety risk will arise as the result of reduction in lane width and road shoulder closure.

Segment 1: One Utama Station to Persada PLUS Station

The viaduct alignment of Segment 1 passes through residential areas and major highways in Damansara and Bandar Utama area. It crosses some local road which are the major access road for residents in the Damansara Utama, e.g. Jalan SS 21. In addition, it crosses SPRINT Highway and NKVE which are two major highways in the area. It is expected that the construction activities near or on these highways could cause traffic congestion and delays. Queues are expected to spillback to the vicinity supporting roads (**Table 6-6**).

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Table 6-6 Potential Impacts During Viaduct Construction (One Utama to Persada PLUS Station)

Viaduct Segment	Construction Affected Road	Issues	Impact
One Utama - Damansara Utama	1. Jalan SS 21 2. Damansara – Puchong Highway (LDP)	1. Jalan SS 21 • Narrow (20ft) local access road. • Near to residential houses. 2. Damansara – Puchong Highway • Heavy traffic	1. Jalan SS 21 • Impose safety risk to vulnerable users in the neighbourhood. 2. Damansara - Puchong Highway • Congested • Delayed
Damansara Utama - Tropicana	1. SPRINT Highway 2. Lebuh Bandar Utama Interchange	1. SPRINT Highway • Heavy traffic • To many slip in – slip out 2. Lebuh Bandar Utama Interchange • Heavy traffic • Near to SK Bandar Utama Damansara, the British International School of Kuala Lumpur, WAWASAN Open University (WOU), and SMK Sri Angsana 2	1. SPRINT Highway • Congested • Delayed 2. Lebuh Bandar Utama Interchange • Delayed • Long Queue
Tropicana - Lien Ho	NKVE Highway	1. NKVE Highway • Heavy traffic • Currently on construction • Adjacent to Lien Ho Tower	1. NKVE Highway • Congested • Delayed

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Table 6-6 Potential Impacts During Viaduct Construction (One Utama to Persada PLUS Station) (Cont'd)

Viaduct Segment	Construction Affected Road	Issues	Impact
Lien Ho - Dataran Prima	NKVE Highway	• Heavy traffic • Currently on construction • At the middle of ingress and egress of PETRONAS station	• Congested • Delayed
Dataran Prima - Persada PLUS	1. NKVE Highway 2. Jalan Lapangan Terbang Subang	1. NKVE Highway • Heavy traffic • Currently on construction • To near to Toll 2. Jalan Lapangan Terbang Subang • Heavy traffic • Currently on construction	1. NKVE Highway • Congested • Delayed • Long queue 2. Jalan Lapangan Terbang Subang • Congested • Delayed

Segment 2: Station 3 to Bukit Raja Station

The viaduct alignment of Segment 2 passes through the major arterial roads in Shah Alam, such as Persiaran Kerjaya, Persiaran Sukan, Persiaran Dato' Menteri and Persiaran Permai (**Table 6-7**). The construction activities could potentially cause congestion and delay to the users in Seksyen 1-12 of Shah Alam. The alignment construction along Federal Highway is expected to further worsen its level of service which is already performing poorly at existing condition. Being a major highway connecting Shah Alam /Klang to Petaling Jaya/City Centre, it will cause prolonged delay to the highway users. Queue would develop and spillback to its supporting roads and interchanges connecting to it, such as Persiaran Dato' Menteri, Persiaran Selangor, Persiaran Raja Muda, Jalan Padang Jawa, Jalan Sg Rasau and Jalan Batu Tiga Lama.

The roundabout of Persiaran Hishamuddin/Persiaran Kayangan in the vicinity of underground viaduct construction of Persiaran Hishamuddin station is one of the major intersection that connects the internal arterial roads to the external highways. As such, the roundabout could not be closed for construction work. This will cause traffic re-distribution that gives a wider impact on all major roads in that area. However, closure of one approach leg at one time (i.e. Persiaran Hishamuddin) is allowable for the construction. Traffic rerouting or diversion is implemented to ensure minimal impact on the closure.

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Table 6-7 Potential Impacts During Viaduct Construction (Station 3 – Bukit Raja Station)

Viaduct Segment	Construction Affected Road	Issues	Impact
Station 3 -Temasya	Persiaran Kerjaya	Persiaran Kerjaya • The road is single 2 lane road. • Heavy traffic	Persiaran Kerjaya • Congested • Delayed • Long queue
Temasya - Glenmarie	Persiaran Kerjaya	Persiaran Kerjaya • The road is single 2 lane road. • Heavy traffic	Persiaran Kerjaya • Congested • Delayed • Long queue
Glenmarie -Stadium Grand Central	1. Persiaran Kerjaya 2. Persiaran Sukan	1. Persiaran Kerjaya • The road is single 2 lane road. • Heavy traffic 2. Persiaran Sukan • Heavy traffic • Single 2 lane road	1. Persiaran Kerjaya and Persiaran Sukan • Congested • Delayed • Long queue
Stadium Grand Central - Persiaran Hishamuddin	1. Persiaran Hishamuddin 2. Persiaran Kayangan 3. Bulatan Kayangan	1. Persiaran Hishamuddin • Dual 2 carriageway • Heavy traffic 2. Persiaran Kayangan • Dual 2 carriageway • Heavy traffic • Main access to Federal Highway • SMK Seksyen 11 3. Bulatan Kayangan • The main roundabout for Shah Alam	1. Persiaran Hishamuddin, Persiaran Kayangan and Bulatan Kayangan • Congested • Delayed

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Table 6-7 Potential Impacts During Viaduct Construction (Station 3 – Bukit Raja Station) (Cont'd)

Viaduct Segment	Construction Affected Road	Issues	Impact
Persiaran Hishamudin - Seksyen 14	1. Persiaran Hishamuddin 2. Persiaran Kayangan 3. Bulatan Kayangan	1. Persiaran Hishamuddin • Dual 2 carriageway • Heavy traffic 2. Persiaran Kayangan • Dual 2 carriageway • Heavy traffic • Main access to federal highway • SMK Seksyen 11 3. Bulatan Kayangan • The main roundabout for Shah Alam	1. Persiaran Hishamuddin, Persiaran Kayangan and Bulatan Kayangan • Congested • Delayed
Seksyen 14 - SIRIM	1. Federal Highway 2. Persiaran Dato' Menteri	1. Federal Highway • Heavy traffic • No direct access from Kuala Lumpur 2. Persiaran Dato' Menteri • Dual 2 carriageway	1. Federal Highway • Delayed 2. Persiaran Dato' menteri • Delayed
SIRIM - Uitm	Federal Highway	• Heavy traffic • No direct access from Kuala Lumpur	• Delayed
Uitm - I-City	1. Persiaran Permai 2. Lebuh Keluli	1. Persiaran Permai • Heavy traffic • Main access to UiTM back gate 2. Lebuh Keluli • No issue	1. Persiaran Permai • Congested • Delayed 2. Lebuh Keluli • No issue
I-City- Bukit Raja	1. Lebuh Keluli 2. Persiaran Bukit Raja	1. Lebuh Keluli • No issue 2. Persiaran Bukit Raja • KPJ Klang Specialis Hospital	

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Segment 3: Section 17 to Johan Setia Station

The viaduct alignment of Segment 3 passes through residential areas and major highways in Klang. It crosses several highways and major roads. Lane width and shoulder reduction is expected during construction of viaducts. Construction traffic movement and access to the site causes temporary stopping of traffic that creates bottleneck and queue. When the viaduct passes through residential area, local roads that serves the residential will be impacted. Congestion is unlikely a serious issue, but the existence of construction traffic (such as heavy vehicles) on these roads poses safety risk to the vulnerable road users such as pedestrian, bicyclists and motorcyclists (**Table 6-8**).

Table 6-8 Potential Impacts During Viaduct Construction (Kawasan 17 – Johan Setia Station)

Viaduct Segment	Roadway	Issue	Impact
Bukit Raja-Section 17	Lebuhraya Selat Klang	A major highway dispersing traffic from Federal Highway to Klang area	• Reduced lane width causes bottlenecks. • Road performance deteriorates and slowing moving traffic expected.
Section 17-Jalan Meru	1.Jalan Pekan Baru 38 2. Jalan Kelicap 41 3. Jalan Kelicap 44	• Local street and access road to residential area • Nearby school area • Access to construction traffic to residential area.	• Construction traffic poses traffic safety risk to residents and school children. • Traffic congestion expected to worsen due to reduced lane width and shoulder in which waiting traffic (by parents) are used to use them.
Jalan Meru-Klang	1.Jalan Raja Bot/Jalan Sireh 2.Persiaran Sultan Ibrahim 3. Jalan Meru/Jalan Kapar roundabout	Major road/intersection with heavy traffic.	Prolonged delay and queue expected.
Klang- Taman Selatan	1. Bulatan Simpang Lima	Major roundabout with heavy traffic.	Deteriorate traffic congestion at roundabout may lead to gridlock. Expected long delay and queue.

SECTION 6 : POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES DURING THE CONSTRUCTION STAGE

Table 6-8 Potential Impacts During Viaduct Construction (Kawasan 17 – Johan Setia Station) (Cont'd)

Viaduct Segment	Roadway	Issue	Impact
Taman Selatan-Bandar Botanik	Jalan Langat	• Heavy traffic on Jalan Langat. • A major arterial road in the area that serves residential and commercial development, as well as schools.	• Bottlenecks created due to reduced lane width and capacity. • Prolonged delay and queue expected.
Bandar Botanik-Johan Setia	Jalan Langat/Lebuhraya Shah Alam Interchange	Major interchange for traffic from/to Kuala Lumpur.	Congestion level is expected to escalate. Prolonged queue and delay expected at the interchange.

6.5.3 Traffic Impacts due to Depot Construction

The LRT3 depot will be constructed near the Johan Setia station on Jalan Langat. Jalan Langat is a dual 3 carriageway major arterial in Klang. The construction of depot in this location could cause congestion to road users. Long delay and queue spillback to the supporting roads will most likely to occur. In addition, the construction traffic would pose traffic safety risk and concern to the road users and residents in the neighbourhood area.

Jalan Langat serves several residential areas such as Bandar Bukit Tinggi 3, Taman Bayu Emas, Taman Pendamar Indah, Kg Johan Setia and Taman Sijangkang Jaya. The existence of lorries and trucks bringing construction machinery and material into/out from the site causes traffic congestion to Jalan Langat. It also poses risk to the venerable road users on Jalan Langat such as pedestrians, motorcyclists and cyclists. It is estimated that at least 20 trucks will be used during the excavation phase. The 20 trucks in operation during this period can be assumed to make an average of 6 trips per day resulting in approximately 120 truck-trips per day.

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Table 6-9 Level of Services

LRT3 Station	Road Between Station	No. of lanes for existing condition	Capacity Veh/hr	Existing v/c ratio (worst case)	No. of lanes during construction	Capacity during Construction	Construction Stage Vol/Cap Ratio	Level of Congestion
One Utama	Lebuhraya Damansara-Puchong	6	12,000	0.88D	6	10,800	1.04F	High
Damansara Utama	Jalan 5	1	1,700	0.27 A	1	1,400	0.32 A	Low
Tropicana	New Klang Valley Expressway	3	6,000	0.89 D	3	5,100	1.05 F	High
Lien Hoe								
Dataran Prima								
Persada PLUS								
Station 3	Persiaran Kerjaya	4	7,200	0.55 C	4	6,000	0.66 C	Medium
Temasya								
Glenmarie								
Stadium-Grand Central	Persiaran Sukan	4	7,200	0.62 C	4	6,000	0.74 C	Medium
Persiaran Hishamuddin	Persiaran Hishamuddin	2	3,600	0.62 C	2	3,000	0.74 C	Medium
Section 14	Persiaran Dato' Menteri	2	3,000	0.45 B	2	2,400	0.56 C	Medium
Sirim	Federal Highway	6	12,000	1.04 F	6	10,200	1.22 F	High
UiTM								
I-City	Persiaran Permai	4	7,200	0.49 C	4	6,000	0.59 C	Medium
Bukit Raja	Lebuh Keluli	4	7,200	0.67 C	4	6,000	0.80 C	Medium
Kawasan 17	Persiaran Bukit Raja	4	7,200	0.31 B	4	6,000	0.37 B	Low
Jalan Meru	Jalan Meru	6	7,200	0.60 C	6	6,000	0.72 C	Medium
Klang	Jalan Jambatan Kota	6	10,800	0.86 D	6	9,000	1.03 F	High
Taman Selatan	Persiaran Tengku Ampuan Rahimah	6	10,800	0.51 C	6	9,000	0.61 C	Medium
Sri Andalas								
Tesco Bukit Tinggi	Jalan Langat	6	10,800	0.46 C	6	9,000	0.55 C	Medium
AEON Bukit Tinggi								
Bandar Botanik								
Johan Setia	Jalan Klang Banting	3	3,600	0.58 C	3	3,000	0.70 C	Medium

6.5.4 General Management Measures To Minimise Traffic Congestion

Minimising congestion and traffic disruption during the construction phase is one of the most important measure to minimise the adverse impacts from this Project. Given the length of the LRT3 (36 km) and its potential to affect a large number of roads, it is crucial that traffic management is carried out in a comprehensive manner.

The following measures shall be adopted for the entire project :

- The number of lanes on the major roads shall be maintained wherever possible. Any reduction lanes (only when unavoidable and when all other alternatives have been exhausted) shall be designed to facilitate contra flow options. For instance, a two-way 4 lane road shall minimally be reduced to 3 lanes, with the centre lane operating as a contra lane for the heavier movement during peak hour.

- Sufficient warning signs and flagmen shall be provided at all workstations to facilitate better control of traffic flow. All traffic management devices and temporary/warning signs shall be maintained to ensure maximum effectiveness in terms of traffic management.

- The movement of trucks shall be restricted to off-peak periods, meaning that trucks should only be allowed to move in and out of the construction site between 10 am and 4 pm, and between 8 pm and 6 am for night works at permissible work zones. With this restriction, it is anticipated that the peak hour loading would be about 20 trucks per hour. It is essential that the truck routing at the locality is planned to avoid the sections of Persiaran Kayangan that fronts the existing schools in the area.

- Adequate safety and warning signs need to be placed to cater not only for vehicular traffic movement but also for the movement of pedestrians in the locality, particularly when pedestrians come into conflict with construction vehicles. A detailed Traffic Management Plan shall be prepared for all stations to address issues relating to construction vehicle access, private vehicle displacement, rerouting options, road closure, acceleration-deceleration lane, signage, signalisation, pedestrian movement and pedestrian crossing, amongst other issues of concern during construction. Introduction of additional pedestrian crossing facilities such as temporary pedestrian crossing signals should be considered where appropriate.

- Adequate tow-trucks and emergency response teams shall be provided with a maximum response time of 15 minutes to avoid major congestion problem in the event of any breakdown.

6.5.5 Specific Management Measures To Minimise Traffic Congestion

The specific management measures carried out during construction of stations and viaducts is shown in **Table 6-10**. It is anticipated that with these mitigation strategies, the traffic congestion impact would be minimised.

Table 6-10 Specific Mitigation Strategies for Selected Road Sections

Road Adjacent to Station	Mitigation Strategies
Lebuhraya Damansara-Puchong	• Provide direct access from LDP. • To implement traffic safety measure for truck access.
New Klang Valley Expressway	• Flagman to control and manage traffic on-site. • To install proper traffic signage for advice and warning.
SPRINT Highway	• To install traffic signage for advice and warning of construction traffic and activities. • Proper demarcation of construction areas with barriers.
Persiaran Kerjaya	• Flagman for traffic control especially during trucks access. • To add 1 temporary lane to the road to relieve congestion.
Persiaran Hishamuddin	• Construction work to be carried out in stages to avoid full closure of road and/or roundabout. • Traffic diversion plan to provide alternative access and ease congestion.
Persiaran Dato' Menteri	• Proper traffic control and management on site to reduce congestion.
Federal Highway	• Traffic control on site to reduce bottlenecks and congestion. • Traffic information announcement and advice to road users for diversion to alternative roads or/and mode.
Persiaran Permai	• Alternative diversion route is required for Uitm students • Safety measure to be carried out during truck access.
Jalan Jambatan Kota	• Proper traffic control on site to ensure safety and smooth flow of traffic. • Demarcation of construction boundary with barriers.
Jalan Meru	• Traffic diversion to reduce demand and delay. • Flagman to control traffic during access of construction traffic.

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Table 6-10 Specific Mitigation Strategies for Selected Road Sections (Cont'd)

Road Adjacent to Station	Mitigation Strategies
Jalan Langat	• Installation of barriers for construction areas. • To place directional traffic signage for advice of slow speed.
Lebuhraya Selat Klang	• Proper on-site traffic control and traffic diversion plan.
Jalan Pekan Baru 38/Jalan Kelicap 41/Jalan Kelicap 44	• To find alternative access to avoid access from local roads.
Bulatan Simpang Lima	• Proper diversion plan on site and avoid closure of approaches. • To place traffic signage for advice of road construction activities.
Jalan Langat/Lebuhraya Shah Alam Interchange	• Fine tuning of traffic signal to improve traffic throughput.

6.6 NOISE IMPACTS

Noise impacts from the construction works are anticipated at the following locations:

- Stations;
- Viaduct piers along entire alignment
- Underground works
- Depot construction

Noise generation during construction stage is anticipated from earth moving equipment (dozers, tractors), heavy vehicles (lorries), diesel generator sets and piling works.

Equipment and vehicles noise sources are fairly mobile, and the noise generated is usually transient in nature. The only exception to this are diesel generator sets, power tools (jack hammers, etc.) and construction vehicles on site. These noise sources are however localised to specific locations where they are used.

Noise generated from construction activities is usually perceived by most residents as intrusive in nature (as compared to an adjacent industrial facility or even existing road traffic) due to the situation where the construction noise is a new noise source (disturbance) introduced into an existing community.

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Construction of piers supporting the elevated section of the Project is anticipated to require piling. Piling vibrations and noise represent potential areas of concern as confirmed from past experiences in the construction of the original LRT (Ampang and Kelana Jaya Lines) as well as the MRT1 project currently under construction.

Construction works are progressive in stages along the entire alignment. It is therefore inevitable that there are issues of concern for noise and vibration affecting residential receivers (and commercial as well) in close proximity to the alignment.

Noise from construction activities shall comply with recommended noise limits as stipulated in DOE's Guidelines for Environmental Noise Limits and Control (2007), Annex A, Schedule 6 (**Table 6-11**). Due to the fluctuating nature of construction noise, limits are prescribed for a continuous equivalent noise level and a maximum threshold (defined by the instantaneous maximum L_{max}). The L_{max} limit typically applies to piling and other transient peaks.

Table 6-11 Maximum Permissible Sound Level Of Construction, Maintenance and Demolition Works By Receiving Land Use

Receiving Land Use Category	Noise Parameter	Day Time 7.00 am - 7.00 pm	Evening 7.00 pm - 10.00 pm	Night Time 10.00 pm - 7.00 am
Residential (Note 2 **)	L_{90}	60 dBA	55 dBA	* (Note 1)
	L_{10}	75 dBA	70 dBA	*
	L_{max}	90 dBA	85 dBA	*
Commercial (Note 2 **)	L_{90}	65 dBA	60 dBA	NA
	L_{10}	75 dBA	70 dBA	NA
Industrial	L_{90}	70 dBA	NA	NA
	L_{10}	80 dBA	NA	NA

Source: DOE Planning Guidelines for Environmental Noise Limits and Control 2007

Table 6-12 tabulates typical sound power levels for construction equipment. These equipment typically have sound power levels above 100 dBA. Depending on proximity of the construction sites and activities noise emitted to the adjacent receiver could range from L_{10} of 65 dBA to 80 dBA. The L_{90} levels are usually dependent on other noise sources prevalent at the receiver. Piling noise from impact drop hammers in particular could result in noise levels approaching or even exceeding the above recommended L_{max} levels.

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Table 6-12 Typical Sound Power Levels for Typical Construction Equipments

Equipments	Typical Sound Power Level (dBA)
Hydraulic Breaker	122
Bulldozer	115
Typical Lorry	110
Concrete Mixing Truck	109
Bore Piling Activities	100
Generator with Minimal Enclosure	100
Cutting and Grinding Equipment	98

Diesel generator sets are often the highest continuous noise source in construction sets (and also with diesel exhaust pollution affecting air quality on site). Diesel generators shall be required to be an integral type fitted an acoustics enclosure and silencers on air intake and exhaust.

Other potential noise sources are from heavy vehicles and earth moving equipment. Noise disturbance from these vehicles and equipment are anticipated and should be mitigated from administrative control to minimise the impact. Vehicles transporting construction materials should be arranged for arrival at site during off peak hours day time hours, and to avoid night time hours.

Noise and vibration from piling works represent a particular source of concern with significant impact to the neighbors. Piling instantaneous noise from could potentially exceed 95 dBA for impact drop piles, and as such shall be avoided. The use of low noise piling methods is required to ensure minimal impact to the neighbors in noise sensitive land use. Compliance to the maximum permissible noise limits for construction at residential land use, and in particular the L_{max} levels shall require the use of bored piles or injection piles. It is also necessary to restrict piling activities to day time only (and to include restrictions during weekends and public holidays).

Noise propagation and potential disturbance from construction of viaduct piers fronting residential houses were evident from the noise modeling undertaken and as observed from measurements in the MRT1 project.

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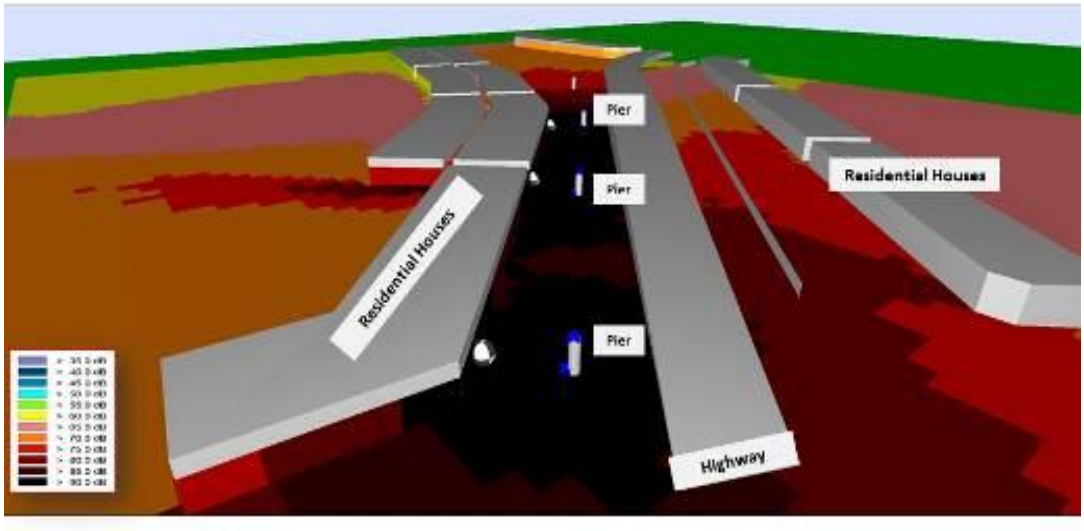
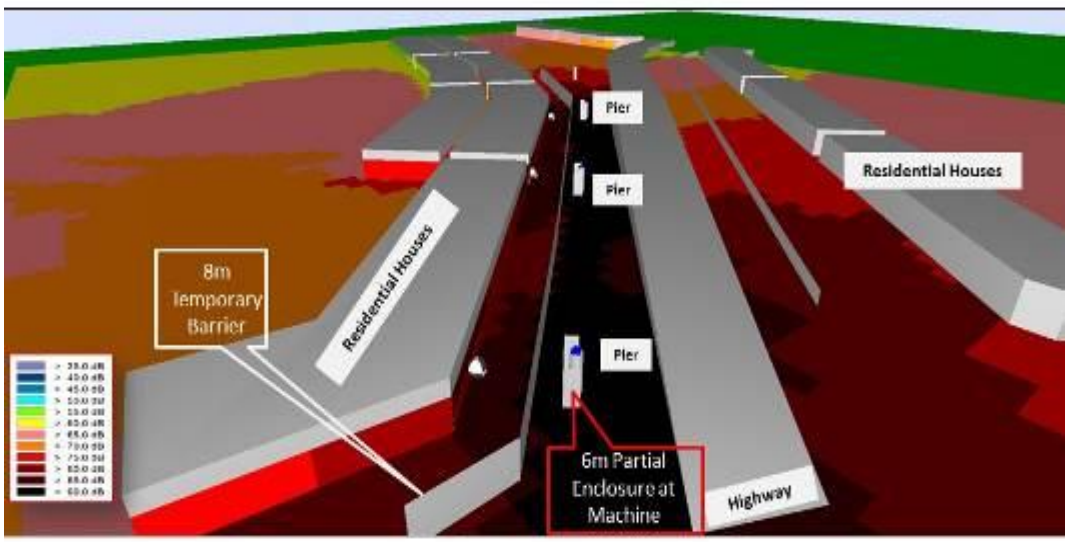
Chart 6-1 shows noise propagation (based on 3 D noise modelling from piling of 3 piers fronting houses with cumulative effects of highway noise) without mitigation measures. It was evident that noise levels above permissible limits if there are no mitigation measures undertaken. **Chart 6-2** shows noise propagation for the same construction scenario when noise mitigation measures (in the form of a 6 m to 8m temporary noise barrier and partial enclosure shielding the piling machine) are implemented.

Chart 6-1 Noise Propagation from Construction of Piers (Without Mitigation)



L_{A10} Noise from 3 nos. Bore Piling – Without Mitigation

Chart 6-2 Noise Propagation from Construction of Piers (With Mitigation)



L_{A10} Noise from 3 nos. Bore Piling – With Mitigation (8m barrier and partial enclosure at piling machine)

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Additional impacts relating to traffic congestion with increased noise impact may are also likely. The increase in absolute noise levels may not necessarily be very significant, although the subjective perception may suggest otherwise due to increased frustration of associated with the traffic congestion in the neighborhood. Experiences from elsewhere has shown that increased traffic volume but with average vehicle speeds being lower in a traffic jam had similar noise levels when there are no traffic jams but with lesser number of vehicles travelling at higher speeds due to an unrestricted flow of traffic.

Notwithstanding whether the noise levels are significantly increased due to road traffic congestions, it is nevertheless necessary to minimise local road traffic disturbances due to construction of the LRT3 tracks and stations. Road traffic diversions and traffic management shall be required to minimise adverse impact relating to the environment and inconvenience to the affected community and general public.

Management measure to minimise noise impacts

An item of highest concern during the construction stage as confirmed from past and current experiences of the LRT Ampang and Kelana Extension Lines and the MRT1 relates to noise and vibration arising from piling during the construction along the entire alignment, especially at the piers and stations in close vicinity to residential areas.

The management measures to minimise the noise impacts include:

- Piling Method

Noise and vibration mitigation during construction in general requires the use of low energy low impact equipment and construction work process. Piling shall be bored piles, injection piles and other low noise low impact piling methods. There shall be no impact hammer drop piles to be used in the Project.

Even with the use of bored piles, high noise and vibration often occur (as evident from the LRT Extension and MRT1 construction sites) when chiseling is used to drill through hard rocks. Another common source of noise during bore piling also occurs during the shaking process to clear compacted soil and mishandling.

In summary the use of bored and injection piles are recommend together with use of low noise diesel generator sets for lower noise and vibration impact to the environment.

- Temporary Noise Barrier

Construction work sites at noise sensitive areas shall require the installation of temporary acoustic noise barriers which are double skinned panels with acoustic absorption infill and perforated on the work side of minimum 8m height. These barriers should not be confused with the conventional metal hoarding as used in most construction sites for boundary hoarding.

Examples of temporary acoustic noise barriers are found in several of the MRT1 construction sites (at the MRT Underground Station sites as well as work sites of the viaduct areas fronting residential areas for example Pinggiran Zaaba in Taman Tun Dr Ismail and Maluri MRT Southern Portal for example).

For general construction activities on the ground noise disturbance to the neighbours shall be minimised to within all practical means. At LRT Stations, noise barriers shall be installed prior to commencement of construction works any permanent noise barriers planned for the station areas (for example car parks, and perimeter boundary) such that noise from construction to adjacent neighbours could be screened. **Plates 6-1** to **6-4** shows examples of temporary acoustic barriers that can used to minimise noise levels.

Similar acoustic rated temporary noise barriers shall be installed at noise sensitive locations (particularly Damansara Utama areas of Jalan SS 21/13, Jalan SS 21/28, jalan SS 21/42 etc., Jalan Tropicana Selatan area and Persiaran Dato' Menteri. Similar requirements are also required at areas whose existing baseline levels are below 60 dBA (for example residential areas of Jalan Kelicap, Jalan Pekan Baru 38, Jalan Meru-1 and Bandar Botanic).

At the above mentioned sensitive locations mitigation of adjacent the equipment and work process are also required (**Plates 6-5** to **6-6**).

- Equipment

Other high noise sources in construction are from diesel generators sets and earth moving vehicles. Diesel generator sets used in residential areas shall be a low noise type (i.e. to come as an integral unit) enclosed in an acoustics enclosure and fitted with silencers at exhaust and air intake. Earth moving equipment shall also be low noise emission type. In addition to the above control of noise emissions at source, there shall also be a restriction of operating hours of earth moving vehicles.

- Monitoring Programme

To ensure that piling (and other construction activity) does not result in a disturbance, noise levels shall be continuously monitored during piling activities to confirm compliance to DOE acceptance limits for construction activities in residential areas.

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Plate 6-1

Example temporary acoustic barrier for construction site

Plate 6-2

Example temporary acoustic barrier for construction site

SECTION 6 : POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES DURING THE CONSTRUCTION STAGE

	**Plate 6-3** Example temporary acoustic barrier for construction site
	**Plate 6-4** Example temporary acoustic barrier for construction site

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	**Plate 6-5** Partical closure for piling machine
	**Plate 6-6** Partial movable light weight enclosure for movable equipment

6.7 VIBRATION

Vibration during the construction phase is a concern, particularly from piling activities. Excessive vibrations in close proximity to vibration sensitive structures may indeed result in concerns of potential structural damage. Recommended environmental vibration limits are given in the DOE the Guidelines for Environmental Vibration Limits and Control (2007). Vibrations limits for human response in buildings for short term exposure to vibration are given in the Guidelines Annex A, Schedule 6 as follows:

For Residential Land Use ***Day time: Curve 8 to Curve 16***
Night Time: Curve 4

("Curve 1" is based on the vibration perception threshold for human response).

Annex A, Schedule 2 of the Vibration Guidelines recommends vibration limits for damage risk in buildings for short term vibration exposure (**Table 6-13**).

Table 6-13 Limit For Damage Risk In Buildings From Short Term Vibration

Type of Structure	Vibration Velocity V_i [mm/s] at foundation (as defined by the respective rating curves of Figure 1)	Vibration Velocity V_i [mm/s] at plane of floor of uppermost full storey (all frequencies)
Industrial buildings and buildings of similar design	Curve C	40
Commercial building, dwelling and buildings of similar design and/or use	Curve B	15
Structures that, because of their particular sensitivity to vibration, do not correspond to those listed above, or of great intrinsic value (e.g. residential houses, or buildings that are under preservation order)	Curve A	8

Source: DOE Planning Guidelines for Vibration Limits and Control in Environment, 2007

Typical vibrations from bored piles as measured at approximately 10m from the piling point are shown in the **Chart 6-3**. The figure gives a vibration versus time plot demonstrating transient vibration excursions during casing driving, with short term vibrations of up to 4.5 mm/s (Curve 4.5).

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Chart 6-3 Typical Vibration from Bored Piling in Malaysian Construction Works (Penang Bridge widening works)

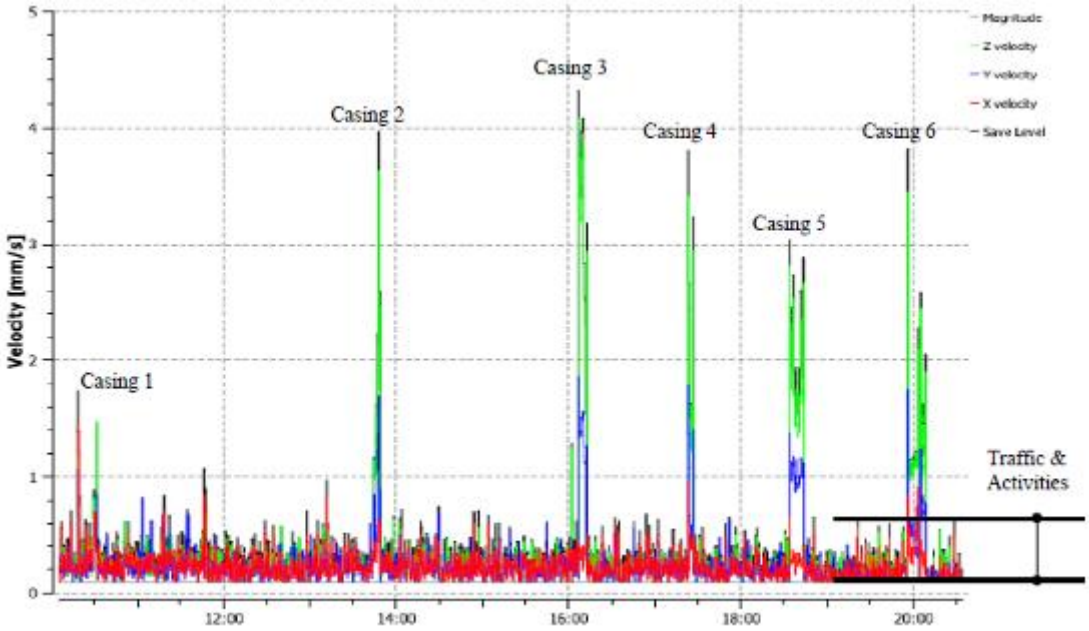
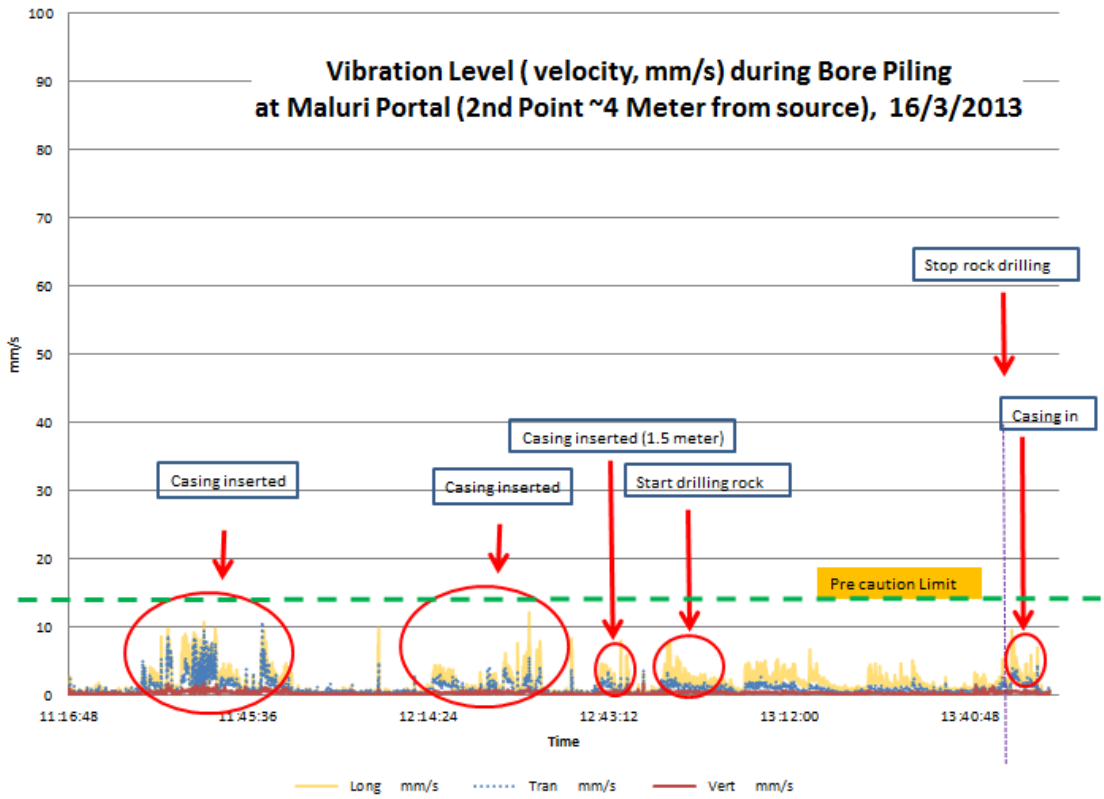


Chart 6-4 Measured vibration from bored piling in MRT1 Project



With bored piles and other similar low impact piling methods, vibrations from piling are anticipated to comply with limits recommended for human response in buildings.

The vibrations while within recommended limits for human response in residential buildings are nevertheless expected to be fellable (perceivable) to human touch, and are significantly higher than normal road traffic and human activities noted in the background vibrations plotted.

Management measures to minimise vibration levels

Issues related to vibration need to be considered in the planning and execution of construction works and in particular piling.

Vibration levels to sensitive receptors can be minimised using low impact energy methods (typically bore piling).

Even with the use of bored piling, excessive transient vibrations are often generated during chiseling (used during bore piling when encountering rocks), casing extraction and mishandling during setting up of the piles and casings. Mishandling of piles and casings are simple on site management to avoid unnecessary free fall of casings and inherent banging noise as a result of mishandling.

Chiseling in particular should also be avoided at location in close proximity to residential receptors.

Where feasible, trenches could be considered to minimise surface wave propagation from piling and other ground-borne vibration impacts (heavy vehicles road traffic).

The use of diaphragm sheet piles should also be considered in construction sites with longer construction period (typically at the Stations and underground work sites) to address potential soil settlement that may occur which consequently may affect nearby buildings. Complains of cracks in buildings and in particular houses which are inherently more susceptible to soil settlement are often blamed on piling vibrations- although the feelable vibrations may only be a secondary cause since the piling vibrations are immediately perceivable by receptors, whereas the soil settlement (being the primary cause) is not so readily observed.

- Monitoring Programme

To ensure that piling (and other construction activity) does not result in a disturbance, vibration shall be continuously monitored during piling activities in residential areas. Results of this monitoring shall be reported in the monthly submissions to DOE.

During critical phases involving high impact activities (for example during piling and blasting if any) soil settlement and vibration monitoring shall be undertaken so that there are monitoring records to be correlated against construction activities.

This monitoring and reporting is particularly important and absolutely necessary as it shall be used in the assessment and resolution of potential complaints or disputes and litigation and insurance claims relating to disturbances and damages from the construction works. The importance of this monitoring cannot be over-emphasised based on the experience of the current LRT extension lines and MRT1 project.

6.8 PUBLIC SAFETY

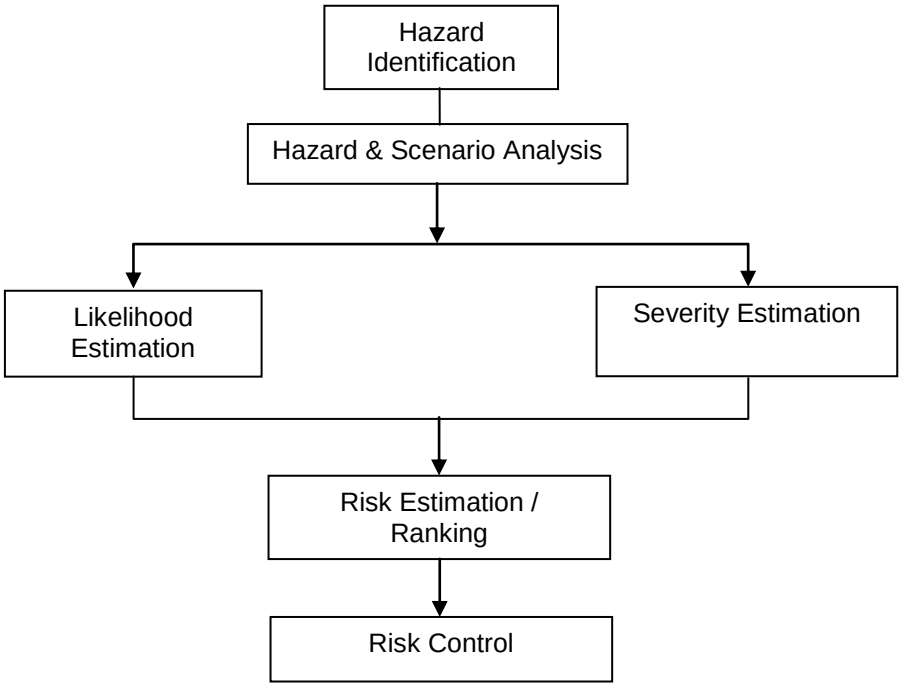
Significant sections of the LRT3 route (especially Segment 1 and 2) will traverse through densely populated areas. The construction of the Project may pose risks to public safety and road users.

The Project Proponent has conducted a preliminary risk assessment for the. The assessment include identification of hazards, risk assessment and identification of risk mitigation measures (**Chart 6-5**) associated with the proposed Project including the construction of underground and elevated alignment, the stations and depot facilities.

The risk assessment was based on the Guidelines for Hazard Identification, Risk Assessment and Risk Control (HIRARC), 2008 published by the Department of Occupational Safety and Health (DOSH). The approach in the risk assessment was based on the following stages:

- Hazard Identification – to identify all major potential hazards of construction of the Project;
- Frequency Estimations – to determine the likelihood of the hazards/ rates of occurrence;
- Consequence Estimation – to estimate the severity of the damage due to the hazards; and
- Risk Estimation and ranking – integration of frequencies and consequences to produce a ranking through risk matrix.
- Risk Control – proposed of mitigation measures to reduce and minimise the potential hazards.

Chart 6-5 HIRARC Methodology



6.8.1 Hazard Identification

Hazard identification is the first and most important step in any hazard analysis. This step involves the systematic identification of hazardous events, their potential causes and consequences of such events.

Project Proponent has identified 25 major construction activities that poses hazard to workers and public based on the construction stages. The construction activities cover from ground excavation, pier column construction, gantry launching, and up to segments and parapet installation.

6.8.2 Likelihood and Severity Estimation

Based on the hazards identified, the likelihood and severity of the hazards were estimated. Rating value of 1-4 is used to quantify the likelihood or severity of the activity where value 1 indicates the event to be unlikely happen/minor injury while value 4 indicates the event to certainly happen /to cause fatality (**Table 6-14**).

The likelihood and severity of each construction activities that was identified were rated based on criteria in **Table 6-14**. The estimation was based on the past experience and analysis. The rated result is tabulated in **Table 6-14**.

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Table 6-14 Likelihood and Severity Categories

Likelihood	Description	Rating	Severity	Description
Most Likely	The most likely result of the hazard/event being realised	**4**	Catastrophic	Numerous fatalities, irrecoverable property damage and productivity
Possible	Has a good chance of occurring and is not unusual	**3**	Fatal	Approximately one single fatality major property damage if hazard is realised
Conceivable	Might be occur	**2**	Serious	Non-fatal injury, permanent disability
Remote	Has not been known to occur	**1**	Minor	Disabling but not permanent injury

Table 6-15 Likelihood and Severity Score of the Potential Hazard Identified

Activity	Description (Construction Activities)	Score		
		Likelihood	Severity	Rank
1	(a) Excavation Works at buffered zone	3	2	6
	(b) Excavation Works near to public area	3	3	9
2	(a) Formworks at Buffered zone	3	2	6
	(b) Formworks near to public area	3	3	9
3	Hot Works	3	2	6
4	(a)(i) Concreting of Pile Cap at buffered zone	3	2	6
	(a)(ii) Concreting of Pile Cap near to public area	3	3	9
	(b)(i) Concreting of Pier Column at buffered zone	4	2	8
	(b)(ii) Concreting of Pier Column near to public area	4	3	12
	(c) Concreting of Portal near to public area	4	3	12
5	(a)(i) Scaffolding Erection and Operation at buffered zone using A-frame system	4	3	12
	(a)(ii) Scaffolding Erection and Operation at buffered zone using Modular system	3	2	6
	(b)(i) Scaffolding Erection and Operation near to public area using A-frame system	4	3	12
	(b)(ii) Scaffolding Erection and Operation near to public area using Modular system	3	2	6
6	Working at Height	4	3	12
7	P112 Segment Stitching	1	2	2
8	(a) General Lifting Work at buffered zone	4	2	8
	(b) General Lifting Work near to public area	4	4	16
9	(a) Launching gantry installation work at buffered zone	2	2	4
	(b) Launching gantry installation work near to public area	2	2	4
10	(a) Launching gantry load test at buffered zone	2	2	4
	(b) Launching gantry load test near to public area	2	2	4

SECTION 6 : POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES DURING THE CONSTRUCTION STAGE

Table 6-15 Likelihood and Severity Score of the Potential Hazard Identified (Cont'd)

Activity	Description (Construction Activities)	Score		
		Likelihood	Severity	Rank
14	Bearing Grouting	3	2	6
15	(a) SBG Launching Works at buffered zone	4	2	8
	(b) SBG Launching Works near to public area	4	2	8
16	Segment Launching of P112	3	3	9
17	Launching SBG by using Segment Erector	3	3	9
18	Tendon Stressing	3	2	6
19	(a) Maintenance of LG &SE at buffered zone	4	2	8
	(b) Maintenance of LG &SE near to public area	4	2	8
20	Stitching P53-P54 Mid Span	1	2	2
21	Span Adjustment	4	3	12
22	U-Beam Launching from P254-P272	3	2	6
23	(a) RC Parapet Installation using backhoe at buffered zone	4	2	8
	(b) RC Parapet Installation using backhoe near to public area	4	3	12
24	(a) Installation of RC parapet using crane at buffered zone	3	3	9
	(b) Installation of RC parapet using crane near to public area	3	4	12
25	Installation of Spun Pile by Using JIP Machine (Stn 5)	4	2	8

Source: Prasarana Malaysia Berhad, 2014.

6.8.3 Risk Evaluation

After carried out the frequency and consequence estimation for each activity, risk evaluation was carried out. Risk was calculated using the following formula:

Risk = Likelihood x Severity

The construction activities can be summarised into 4 categories, i.e. low risk (1 – 4 score), medium risk (5 – 8 score), high risk (9 – 12 score) and very high risk (13 – 16) score (**Table 6-16**).

Table 6-16 Risk Matrix

	Likelihood			
Severity	**1**	**2**	**3**	**4**
1	-	-	-	-
2	7, 20	9(a), 9(b), 10(a), 10(b), 13(a)	1(a), 2(a), 3, 4(a)(i), 5(a)(ii), 5(b)(ii), 14, 18, 22	4(b)(i), 8(a), 15(a), 15(b), 19(a), 19(b), 23(a), 25
3	-	-	1(b), 2(b), 4(a)(ii), 16, 17, 24(a)	4(b)(ii), 4(c), 5(a)(i), 5(b)(i), 6, 11, 12, 21, 23(b)
4	-	-	24(b)	8(b)

SECTION 6 : POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES DURING THE CONSTRUCTION STAGE

The lifting of construction material near public areas poses very high risk during construction while excavation works, formwork and pile cap, column and portal concreting near to public area, scaffolding erection using A-frame system, delivery of SBG and span adjustment poses high risk.

Medium risk activities include excavation works, formwork and pile cap concreting at buffered area, hot works, SBG launching, bearing grouting, tendon stressing and installation of spun piles. Segment stitching and launching gantry installation poses low risk during construction.

Occupational and safety hazard during construction poses higher risk as it involve lifting of construction material, workers working at height, using heavy machinery and crane. In areas involving construction of stations, bigger working space is required as there is a need to provide laydown areas, cabins, material storage, etc. Here, the probability for accident to occur is also high.

Based on the DOSH statistic for occupational accidents, construction sector is one of the sectors which recorded the highest number of fatalities. Most cases reported involved falling from high places and crushed by heavy machinery where investigation found that it was mainly due to inadequate provision of safe work procedures. Public safety is of a major concern if public are near to the working site and may be injured from accidental dropped objects. Thus, Project Proponent shall put extra effort in ensuring public safety is taken care.

<u>Management measure to minimise risk to public safety</u>

The following measures shall be implemented to minimise the risks to public safety:

- Contractor or sub-contractors involved in the Project shall prepare a detailed Project Safety and Health Plan based on guidelines issued by DOSH. This document shall be submitted to Project Proponent and relevant authorities for approval prior construction works. The Project Safety and Health Plan shall include:

    a) Procedures and care for ensuring equipment and machinery used are safe for usage; proper handling and housekeeping at the construction site; and proper scaffolding and safety belt are used.

    b) Identification of competent personnel to carried out utilities relocation, scaffold erection, and workers handling crane and heavy machinery.

    c) Emergency Response Plan for construction. The formulation of the ERP shall include public participation as the LRT3 Line traverse though high density area.

- All the measures proposed in the Project Safety and Health Plan shall be fully implemented by all the parties involved.

- Project Proponent shall establish a central safety and health committee to coordinate the implementation of Project Safety and Health Plan. This committee shall comprise of a team of competent safety personnel from each contractor and subcontractors. Safety and health officer shall be appointed to monitor and implement the programme.

- Safety inspection by Project Proponent to the construction site shall be conducted regularly. Indicators such as near miss, accidents and injuries including traffic accident due to the construction shall be recorded and reported to the State DOSH Office.

- In order to minimise the risk from occupational and safety hazard, all the workers prior entering the site or working at the site shall attend the safety and health training provided by DOSH or by the appointed Contractor.

- Workers shall be trained in safety working procedures including first aid and dealing in emergency situation. Safety drill shall be carried out to check the effectiveness of the safety training.

- Working hours for construction site shall be avoided during peak period, i.e. 5.00 am – 9.00 am and 4.30 pm – 7.30pm. This is to ensure safety of public is safeguard as construction activities is control during the peak period.

Contractors or sub-contractors to strictly adhere and fully implement the approved traffic management plan. Adequate signboard shall be well placed. Inspection shall be carried out during heavy storm event to ensure no New Jersey Barriers are blown off/wash off during the period. Immediate action shall be taken if this happened.

6.9 AIR QUALITY

Air quality, particularly elevated dust levels, is a concern during the construction stage. During earthworks, particularly at the depot and underground works, dust levels could potentially increase. The major sources of dust include site clearing activity and movement of construction vehicles. The main construction activity that of concern is the development of depot area at Johan Setia and the underground stretch, about 2km, between Bulatan Stadium and Section 14 Station along Persiaran Hisahmuddin and Persiaran Dato' Menteri.

At the Johan Setia depot, it is anticipated that the construction activities will be staggered over a period of 36 months, involving major land clearing and earthworks as most of the land is still being vegetated and relatively low lying.

The cut and cover construction method will be employed for the underground section. Fugitive dust will be generated along the right of way of the alignment particularly by the excavation activities and, machinery and vehicle movement. It is anticipated that the construction work of this stretch will be carried out progressively along the 2 km stretch over 24 months.

The following section discusses the potential TSP pollution that could be potentially generated from the construction activities.

6.9.1 Methodology

The AERMOD air quality model developed by AERMIC (American Meteorological Society (AMS) and United States Environmental Protection Agency (US EPA) was used. AERMOD is an air dispersion model that incorporates concepts such as planetary boundary layer theory and advanced methods for handling complex terrain. For this modelling exercise, the following assumptions were made:

- The EF assumes that construction activity occurs 30 days per month;
- The emission rate, EF, for uncontrolled emission was calculated to be 4.58 E-5 g/m^2/s (based on US EPA AP-42)
- The construction activity is carried out between 8 am to 8 pm daily;
- All of the areas within the construction site emit at the same emission rate;
- Emissions are constant from the beginning to end of a construction project;
- The emission rate for uncontrolled release of pollutant;
- The emission release height is at 1 m; and
- A width of 8 m was assumed for the cut and cover construction method along the underground stretch.

TSP dispersion to the surrounding was modelled for several scenarios at the depot and underground stretch :

- **Worst case scenario** – This worst-case scenario assumed that the heavy construction activities throughout the whole development area at one time.

- **Sub phases scenario** – During actual construction period, the heavy construction particularly land clearing and backfilling will be carried out progressive in phases or smaller parcels. Hence, the development area was sub-divided into phases.

- **Management control scenario** – Two control methods for fugitive dust i.e. Primary Rehabilitation and Revegetation. The recommended reduction factor as documented in the **"**National Pollutant Inventory: Emission Estimation Technique Manual for Fugitive Emissions Version 2.0 (January 2012)" by the Australian Government: Department of Sustainability, Environment, Water, Population and Communities is 30% and 90% respectively. This reduction factor was adopted as currently there is no published reduction factor available for Malaysia.

The meteorological data used in the AERMOD modelling input were collected from the Subang Airport Meteorological Station. Local topography (i.e. ground elevation above mean sea level) can have a significant influence on the dispersion of air pollutants and was also input into the model. The rural mode was chosen as roughness parameter in view of the terrain and land use of the depot area, while the urban mode was chosen for the underground stretch inconsideration of the urbanised land use pattern along the concern alignment.

6.9.2 Results

The result of the modelling exercise for the preliminary scenario with the assumption of 24-hours heavy construction period for the depot and the underground stretch (**Table 6-17a – 6-17c** and **Chart 6-6 – 6-9**)

From the Air Dispersion Modelling exercise, it could be determined that if the whole Development Area for the Depot are cleared in total, the TSP dispersion will have significant impact to the nearest population namely rural settlements and residential area along the Jalan Johan Setia located northern part of the Project Site.

The ground level concentrations of TSP for uncontrolled emission for 24-hours and annual averaging times were predicted to exceed the recommended limits prescribed in the MAAQG of 260 µg/m^3 and 90 µg/m^3 respectively. The predicted levels reduced significantly when the development area is developed in phases and limited.

For the underground stretch, it was observed that there will be three concern areas (namely around roundabout of Persiaran Sukan-Persiaran Hishamuddin-Persiaran Bulatan, around roundabout of Persiaran Kayangan-Persiaran Hishamuddin-Persiaran Dato' Menteri and certain stretch of Persiaran Dato' Menteri along Sekyen 11) along the proposed underground alignment where the cut and cover construction method will be carried out mainly due to the topography of the area. Hence, it is recommended that adequate attention being given at the hotspots to ensure that possible nuisance created by the fugitive dust generation that may be experienced by the residential properties along this alignment is given due attention.

SECTION 6 : POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES DURING THE CONSTRUCTION STAGE

Table 6-17a Predicted Maximum Average Incremental Concentration of TSP (in µg/m^3) during Construction of Johan Setia Depot (24-Hour Averaging Time)

Development Area	24-hours Averaging Time						
	MAIC (Within Project Site)			MAIC (Beyond Project Site Boundary)			MAAQG
	Uncontrolled	Mitigated 1 (30% reduction)	Mitigated 2 (90% reduction)	Uncontrolled	Mitigated 1 (30% reduction)	Mitigated 2 (90% reduction)	
Worst-case Scenario Total Development Area	1,000 - 2,500	800 - 2,000	150 – 260	260 - 2,500	260 - 2,000	30 - 260	260
Sub-phases Scenario Phase 1	260 - 1,500	260 - 1,000	30 - 150	260 - 1,500	260 - 1,000	30 - 150	
Phase 2	400 - 1,500	260 - 1,000	30 - 150	260 - 1,500	260 - 1,000	30 - 150	
Phase 3	260 - 1,500	260 - 1,000	30 - 150	260 - 1,500	260 - 1,000	30 - 150	

Note: MAIC = Maximum Average Incremental Concentration
Uncontrolled = No mitigation measures,
Mitigated 1= Control efficiency of 30% reduction based on Table 6: Percentage Reduction to Emission Factors with Control Systems as recommended by Environment Australia (National Pollutant Inventory: Emission Estimation Technique Manual for Fugitive Emissions [January 2012])
Mitigated 2 = Control efficiency of 90% reduction based on Table 6: Percentage Reduction to Emission Factors with Control Systems as recommended by Environment Australia (National Pollutant Inventory: Emission Estimation Technique Manual for Fugitive Emissions [January 2012])
MAAQG = Malaysian Ambient Air Quality Guidelines

= Exceed MAAQG
= Within MAAQG

SECTION 6 : POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES DURING THE CONSTRUCTION STAGE

Table 6-17b Predicted Maximum Average Incremental Concentration of TSP (in µg/m^3) during Construction of Johan Setia Depot (Annual Average)

Development Area	Annual Average						
	MAIC (Within Project Site)			MAIC (Beyond Project Site Boundary)			MAAQG
	Uncontrolled	Mitigated 1 (30% reduction)	Mitigated 2 (90% reduction)	Uncontrolled	Mitigated 1 (30% reduction)	Mitigated 2 (90% reduction)	
Worst-case Scenario Total Development Area	100 - 700	100 - 500	20 - 80	90 - 700	90 - 500	10 - 60	90
Sub-phases Scenario Phase 1	90 - 500	90 - 400	10 - 50	90 - 500	90 - 300	10 - 40	
Phase 2	90 - 500	90 - 400	10 - 60	90 - 500	90 - 300	10 - 40	
Phase 3	90 - 500	90 - 300	10 - 50	90 - 500	90 - 300	10 - 40	

Note: MAIC = Maximum Average Incremental Concentration
Uncontrolled = No mitigation measures,
Mitigated 1= Control efficiency of 30% reduction based on Table 6: Percentage Reduction to Emission Factors with Control Systems as recommended by Environment Australia (National Pollutant Inventory: Emission Estimation Technique Manual for Fugitive Emissions [January 2012])
Mitigated 2 = Control efficiency of 90% reduction based on Table 6: Percentage Reduction to Emission Factors with Control Systems as recommended by Environment Australia (National Pollutant Inventory: Emission Estimation Technique Manual for Fugitive Emissions [January 2012])
MAAQG = Malaysian Ambient Air Quality Guidelines

= Exceed MAAQG
= Within MAAQG

SECTION 6 : POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES DURING THE CONSTRUCTION STAGE

Table 6-17c Predicted Maximum Average Incremental Concentration of TSP (in µg/m^3) during Construction of Underground Stretch (24-Hour Averaging Time and Annual Average)

Parameter	24-hours Averaging Time				Annual Average			
	Uncontrolled	Mitigated 1 30% reduction	Mitigated 2 90% reduction	MAA-QG	Uncontrolled	Mitigated 1 30% reduction	Mitigated 2 90% reduction	MAA-QG
Dust	Max: 915.7 CH13400 – 13820, CH14380 – 14560, CH15040 - 15460	Max: 641.0 CH13500 – 13720, CH14440 – 14520, CH15280 - 15400	Max: 91.6 -	260	Max: 308.3 CH13360 – 13720, CH14340 – 14380, CH14420 – 14640, CH15040 - 15460	Max: 215.8 CH13400 – 13720, CH14420 – 14540, CH15280 - 15460	Max: 30.8 -	90

Note: MAIC = Maximum Average Incremental Concentration
Uncontrolled = No mitigation measures,
Mitigated 1= Control efficiency of 30% reduction based on Table 6: Percentage Reduction to Emission Factors with Control Systems as recommended by Environment Australia (National Pollutant Inventory: Emission Estimation Technique Manual for Fugitive Emissions [January 2012])
Mitigated 2 = Control efficiency of 90% reduction based on Table 6: Percentage Reduction to Emission Factors with Control Systems as recommended by Environment Australia (National Pollutant Inventory: Emission Estimation Technique Manual for Fugitive Emissions [January 2012])
MAAQG = Malaysian Ambient Air Quality Guidelines

= Exceed MAAQG
= Within MAAQG

SECTION 6 : POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES DURING THE CONSTRUCTION STAGE

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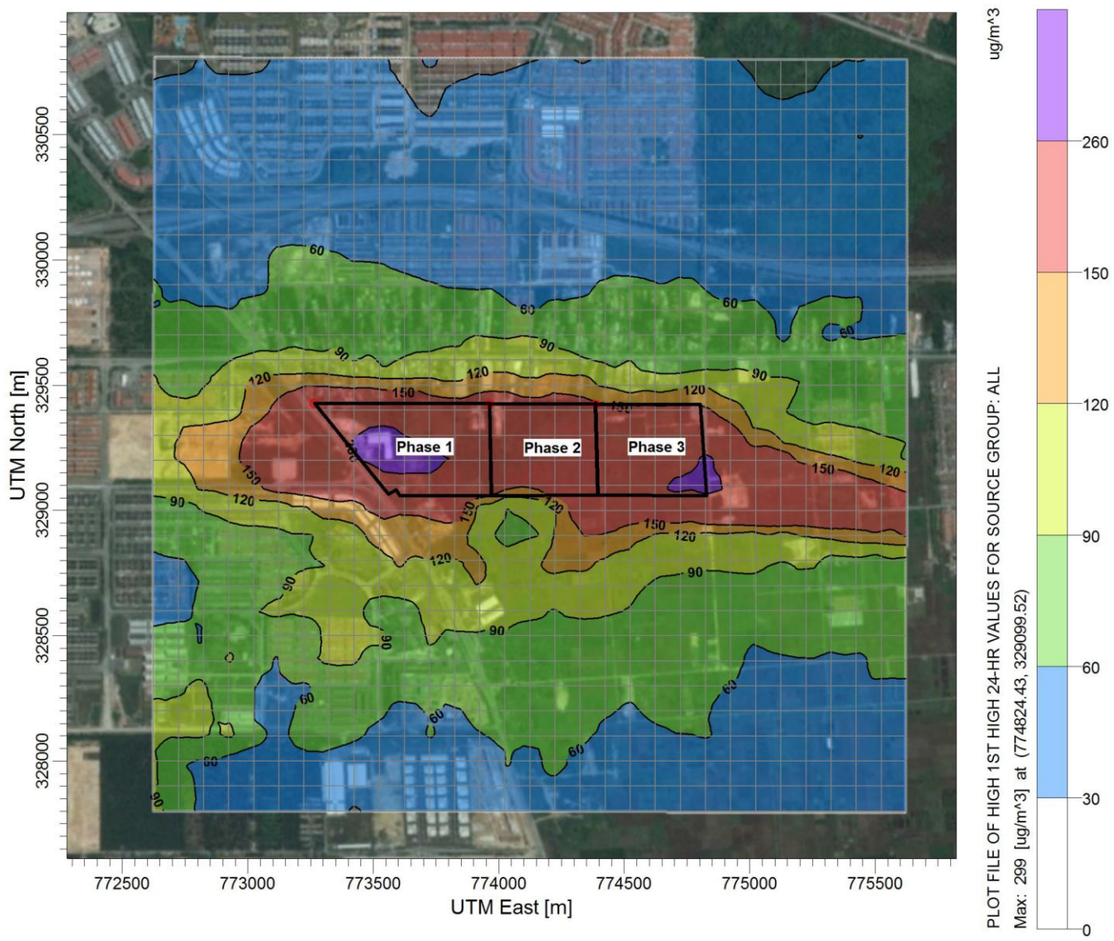
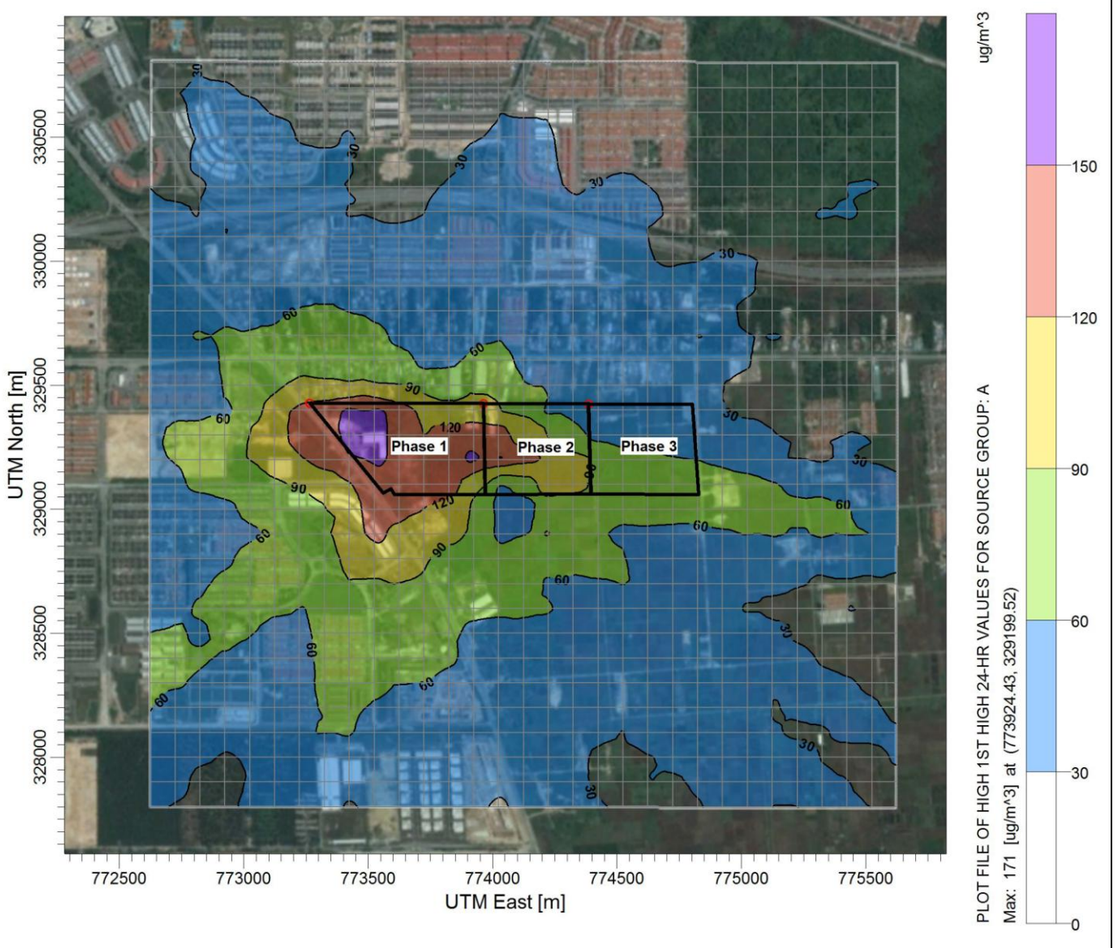
SECTION 6 : POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES DURING THE CONSTRUCTION STAGE

Chart 6-6 Predicted 24-Hours Maximum Average Incremental Concentration of TSP for Depot Area (90% Reduction)



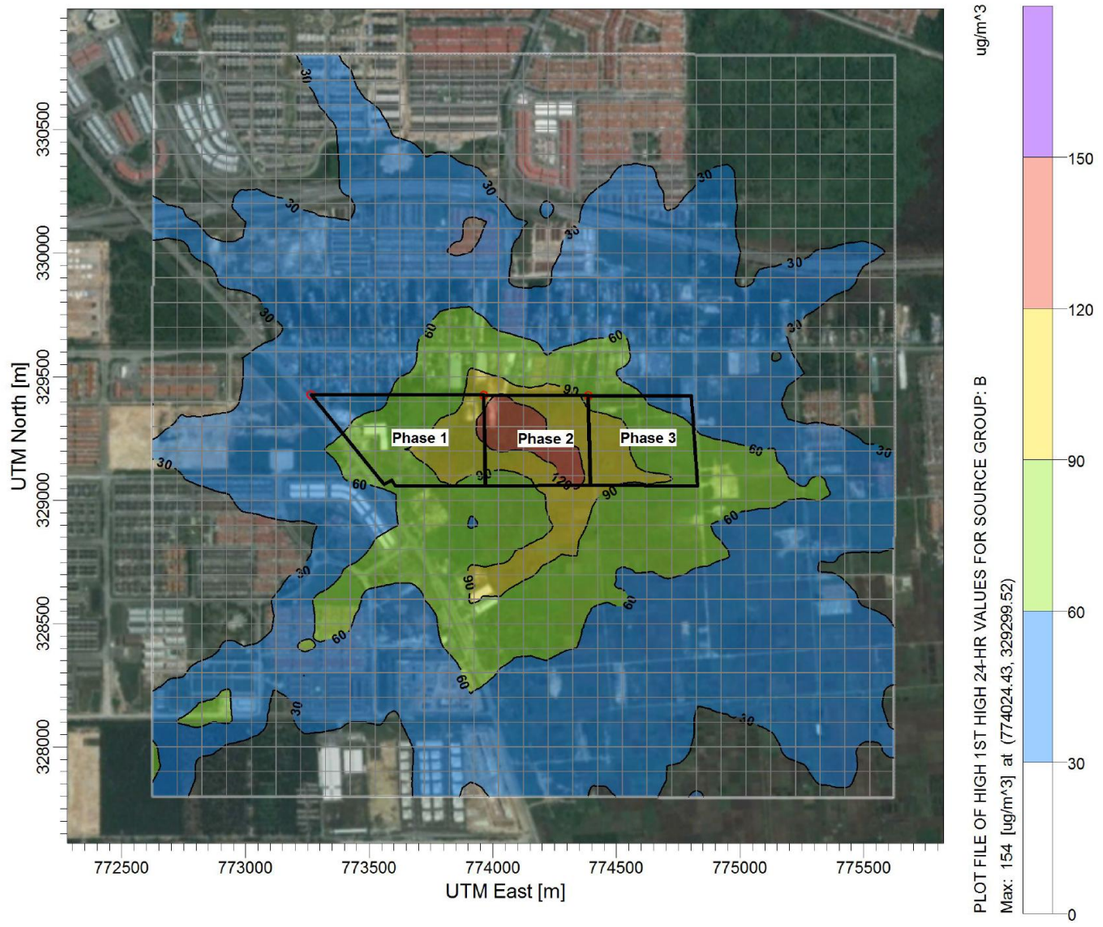
Worst Case Scenario



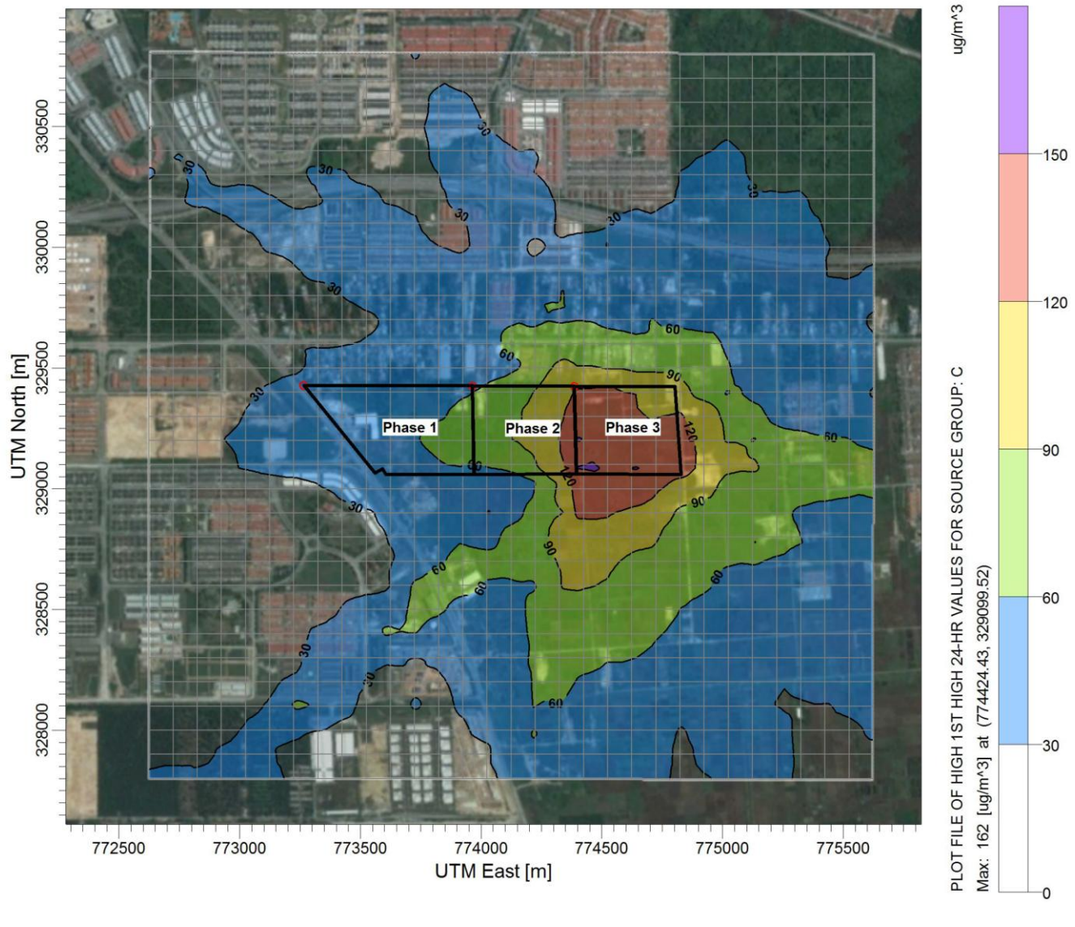
Sub Phasing Scenario - Phase 1

SECTION 6 : POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES DURING THE CONSTRUCTION STAGE

Chart 6-6 Predicted 24-Hours Maximum Average Incremental Concentration of TSP for Depot Area (90% Reduction) (Cont'd)



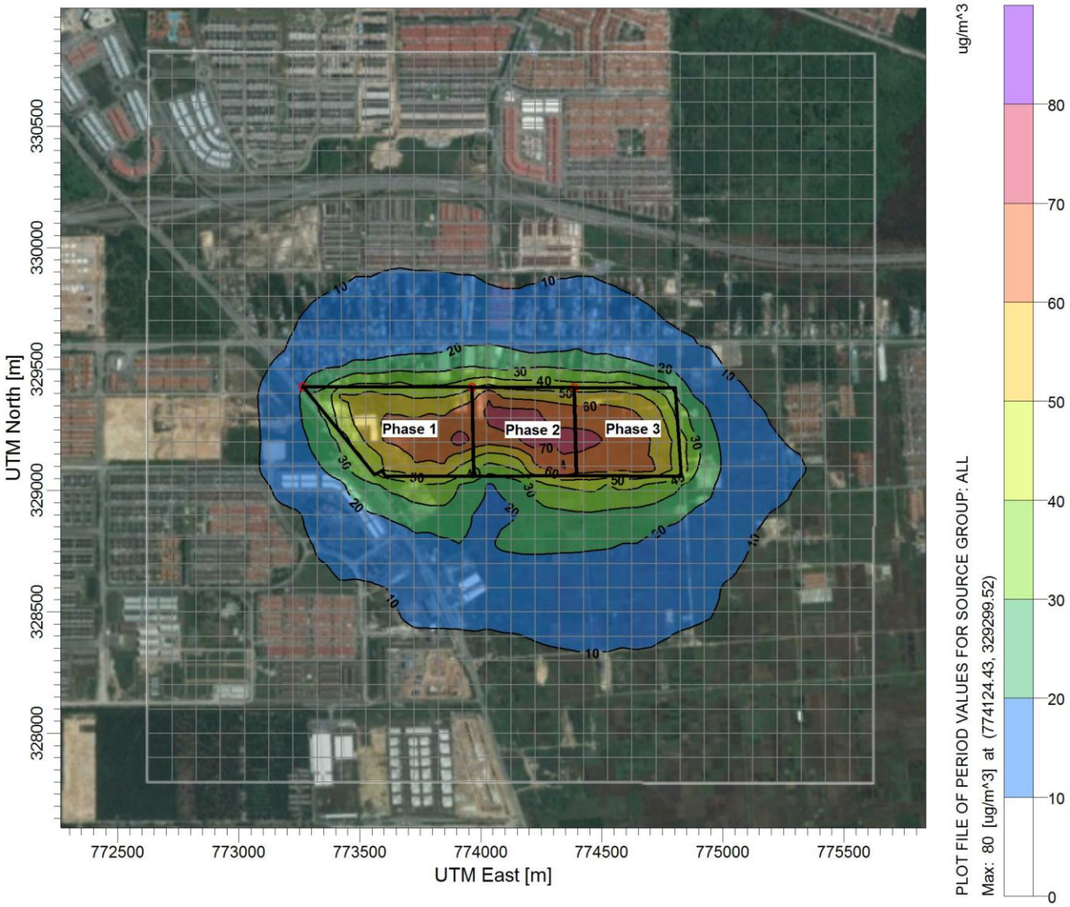
Sub Phasing Scenario - Phase 2



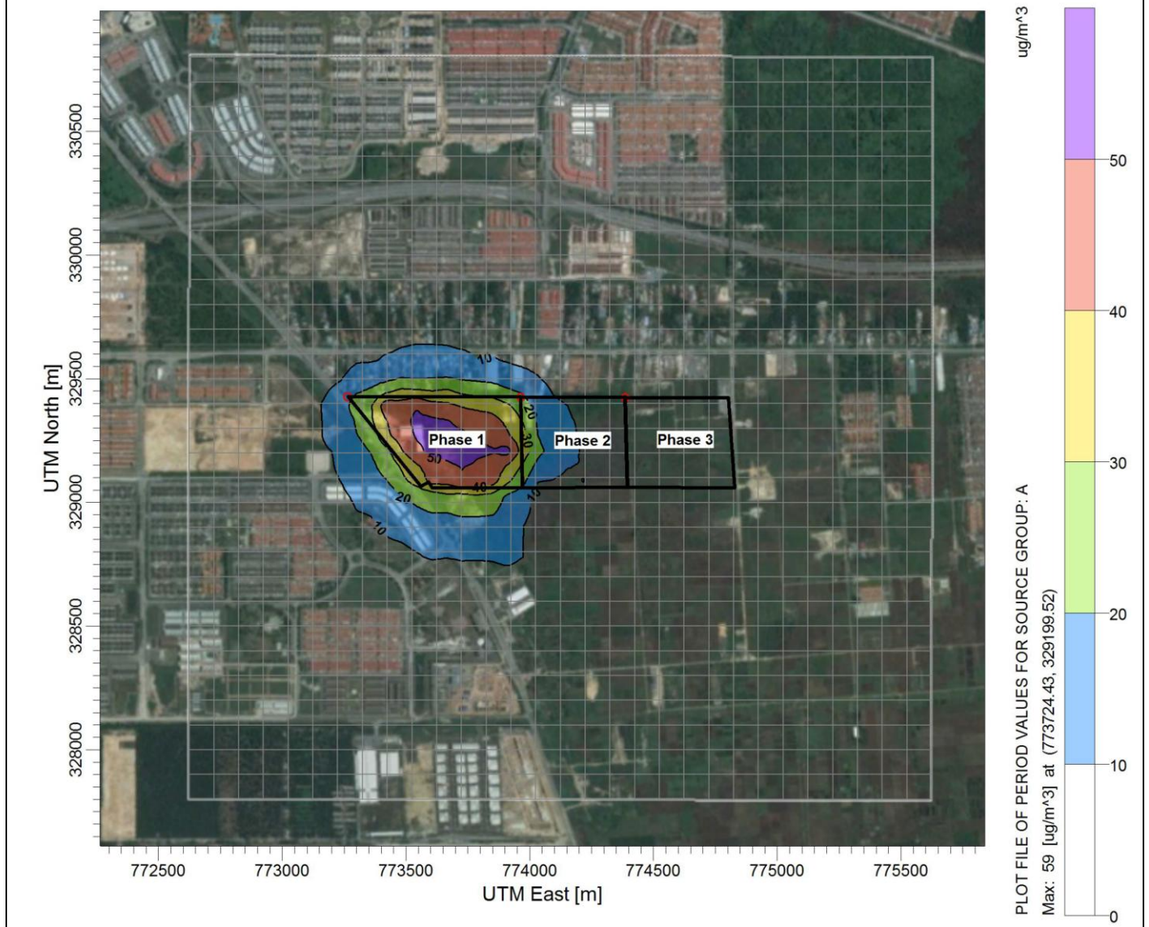
Sub Phasing Scenario - Phase 3

SECTION 6 : POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES DURING THE CONSTRUCTION STAGE

Chart 6-7 Predicted Annual Maximum Average Incremental Concentration of TSP for Depot Area (90% Reduction)



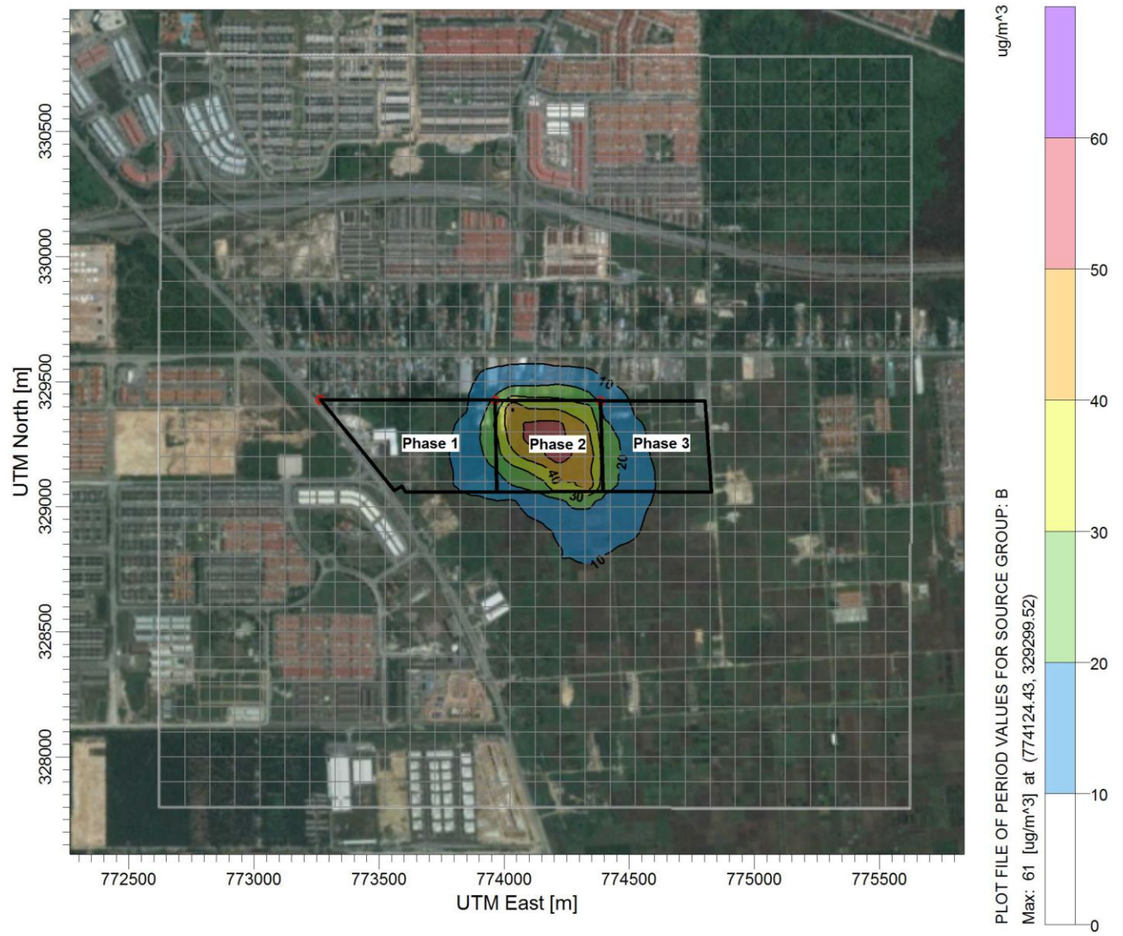
Worst Case Scenario



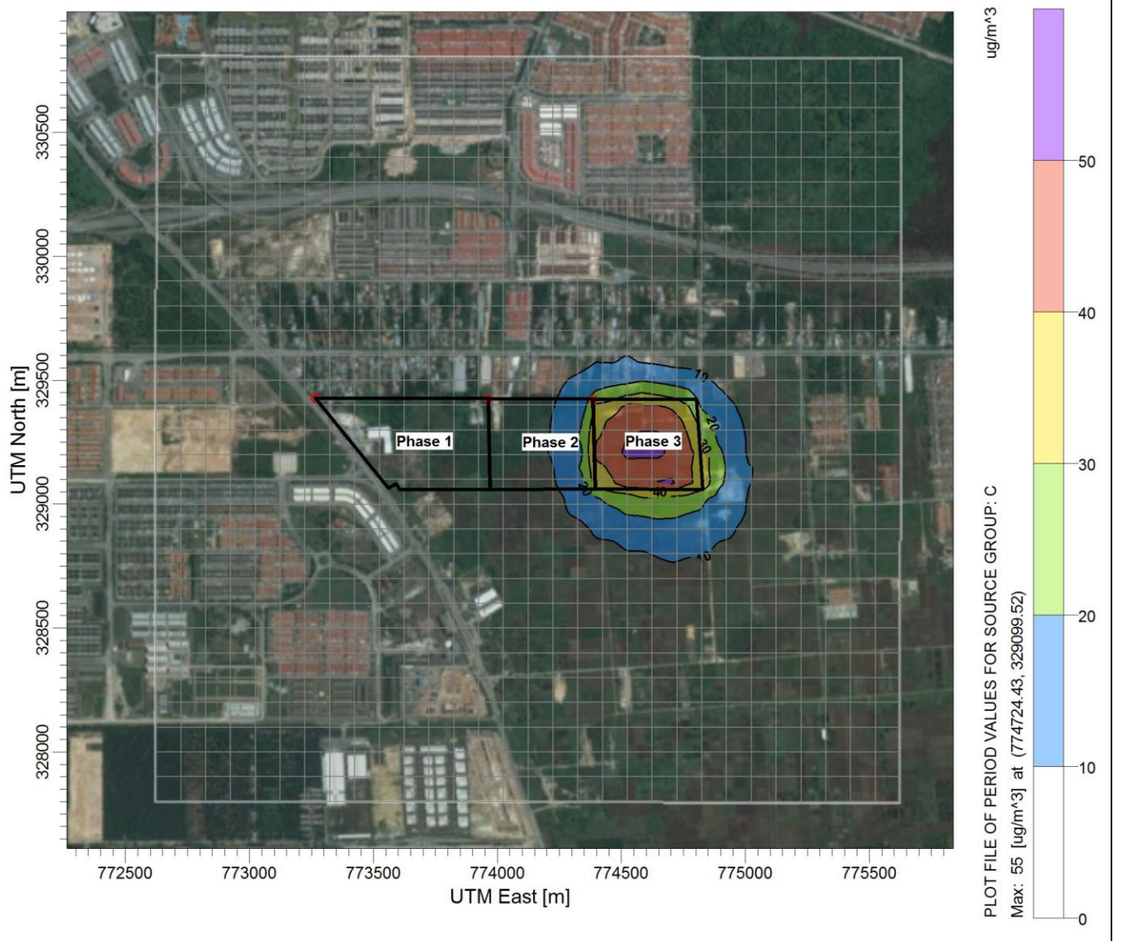
Sub Phasing Scenario - Phase 1

SECTION 6 : POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES DURING THE CONSTRUCTION STAGE

Chart 6-7 Predicted Annual Maximum Average Incremental Concentration of TSP for Depot Area (90% Reduction) (Cont'd)



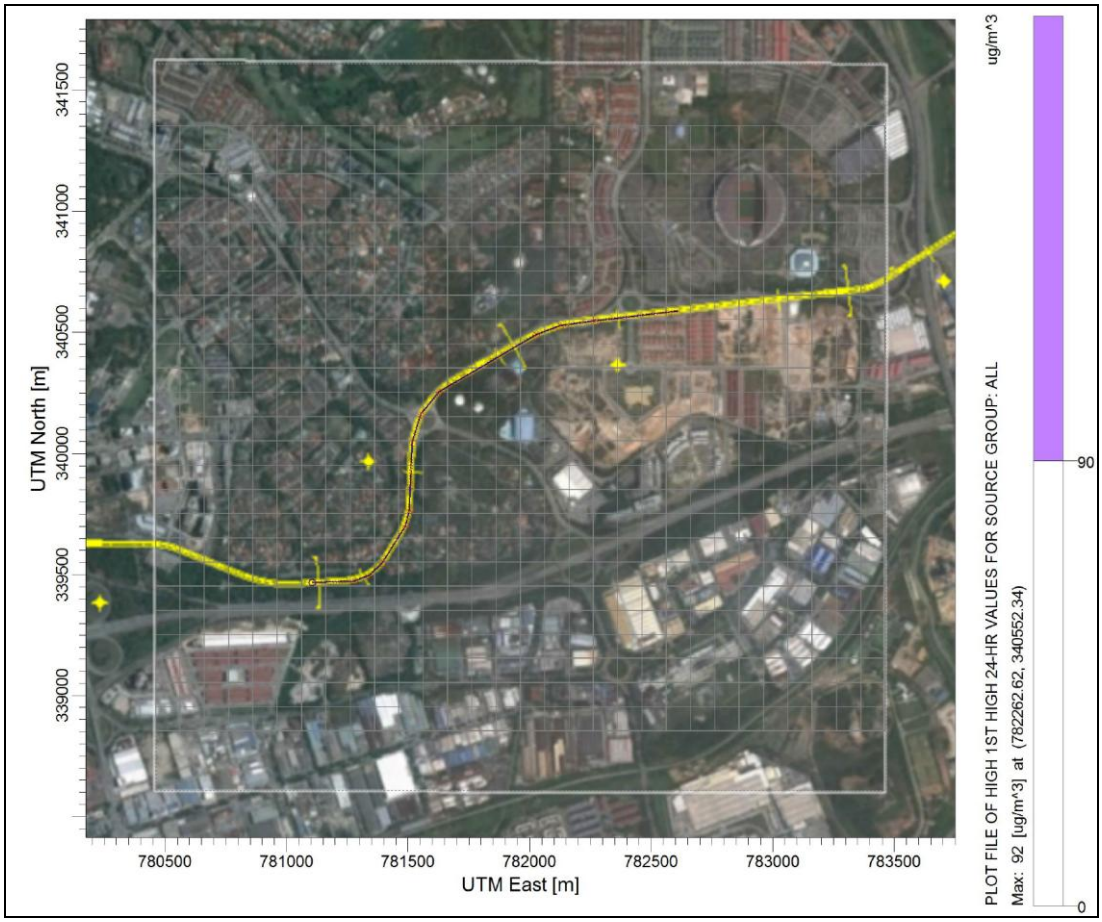
Sub Phasing Scenario - Phase 2



Sub Phasing Scenario - Phase 3

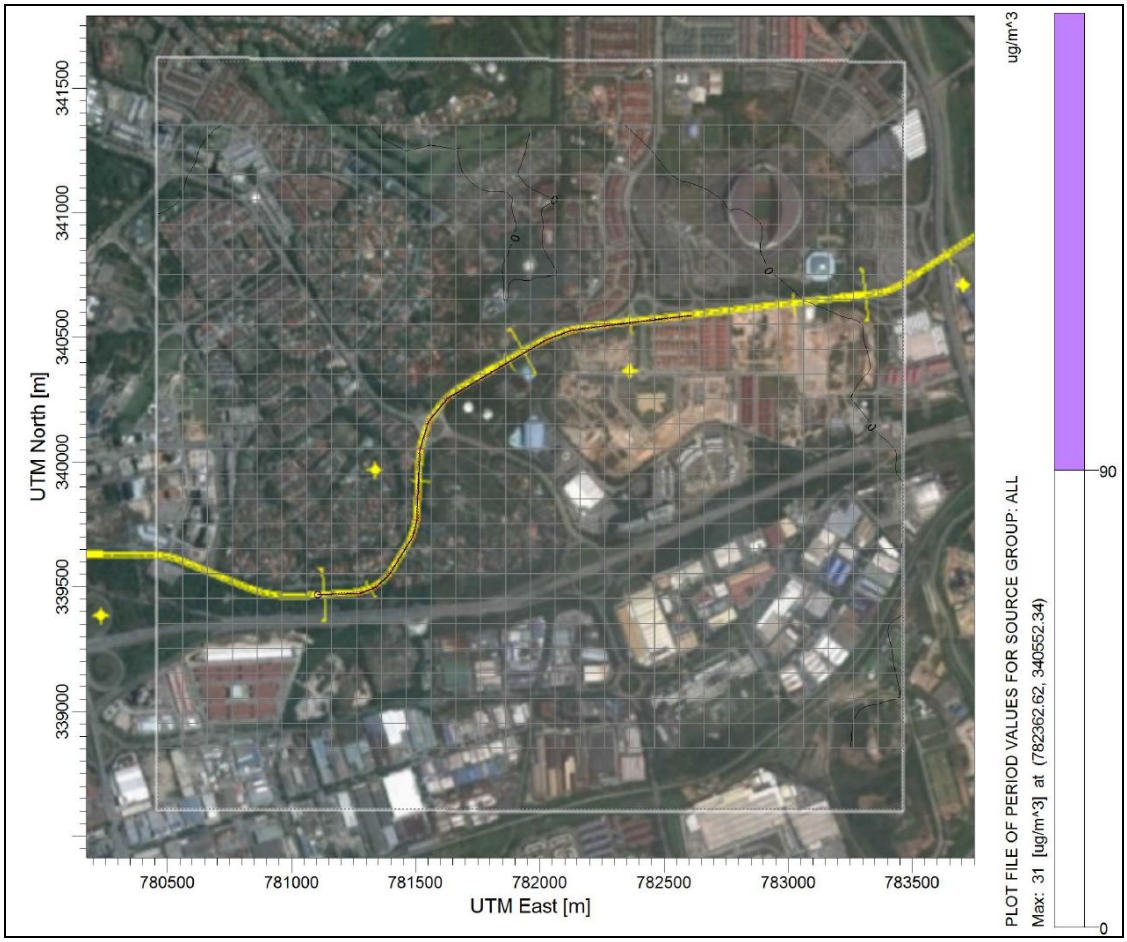
SECTION 6 : POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES DURING THE CONSTRUCTION STAGE

Chart 6-8 Predicted 24-Hours Maximum Average Incremental Concentration of TSP for Underground Works (90% Reduction)



SECTION 6 : POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES DURING THE CONSTRUCTION STAGE

Chart 6-9 Predicted Annual Maximum Average Incremental Concentration of TSP for Underground Work (90% Reduction)



SECTION 6 : POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES DURING THE CONSTRUCTION STAGE

Management measures to minimise fugitive dusts

a. Site Clearing and Earthwork Activities

- Site clearing and the earthworks shall be conducted in stages or phases within the depot area instead of total clearing.
- Provide hoarding or equivalent barriers around the construction area.
- Areas cleared for open spaces shall be turfed as soon as possible.
- Regular water spraying of construction sites, particularly along the haul road (**Plate 6-7**).
- Stockpiles shall be covered. Spraying of water proposed for uncovered stockpiles to control dust emissions, unless the stockpiled materials results in no visible emissions.

b. Movement of Construction Vehicles

- Ensure construction access or haulage route are kept damp by water browser or equivalent measures on regular basis during the whole construction period.
- All construction vehicles shall have their wheels washed at a wheel washing facility before leaving or entering the site onto a public road (**Plate 6-8**).
- Wheel washing facility shall be provided at all entry or exit points into the public road. The wheel washing facility shall be properly managed and maintained to ensure that the immediate public road is clean and free from construction dirt (earth, debris, etc.). This may include cleaning and sweeping such areas.
- Lorries or vehicles which carry earth, sand, aggregate or other similar types of material, shall be covered with tarpaulin, plastics or other equivalent material before they are allowed to enter the public road.

At other construction areas identified earlier such as the underground stretch areas where heavy vehicular movement and movement of disposal of excavated material is anticipated, additional mitigating measures outline below to control the vehicular emission and fugitive dust generation are proposed. The measures are as follows:

- Fuel-efficient and well-maintained haulage trucks will be used to minimise exhaust emissions. Smoke belching vehicles and equipment shall not be allowed and shall be removed from the project area;
- Undertake immediate repairs of any malfunctioning construction vehicles and equipment;
- Idling of engines shall be discouraged;
- Install wheel washing equipment (where necessary); and

- *Where possible and deemed practicable* by the Project Proponent, particularly at the identified hotspots area, the residential properties along the proposed underground stretch to be installed with portable fencing with shade netting (**Plate 6-9**). With proper netting material, fugitive dust reduction of 70% can be achieved.

In addition, along the alignment of the elevated structure construction area where nearby residential area is anticipated to be annoyed by the nuisance created by the controlled fugitive dust emission, the Project Proponent is recommended to provide prior notification to the affected community on schedule of construction activities and if possible to provide complaint hotline.

SECTION 6 : POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES DURING THE CONSTRUCTION STAGE

	**Plate 6-7** Water browser dampen the site
	**Plate 6-8** Wheel washing bay constructed at the exit/entrance of the site
	**Plate 6-9** Portable fencing to minimise dust dispersion

6.10 SOIL EROSION AND SEDIMENTATION

Soil erosion and sedimentation could be potential impacts from the Project and mainly contributed by the site clearing and earthworks from the construction of the depot, underground works and the elevated segments.

6.10.1 Depot Construction

Impact from the depot construction is expected to be significant due to the large area (28 ha). The depot area is located at the agricultural land and relatively flat with the existing ground level ranging from RL 5 m to RL 15 m. A soil erosion and sedimentation assessment was carried out for the depot area (**Appendix F**) and shown in **Figure 6-4**. Summary of the different stages is shown in **Table 6-18**.

Table 6-18 Soil Erosion and Sedimentation Contribution

	Pre-Construction	Construction (Worst Case Scenario)	Construction (With Mitigation Measures)
Total soil loss (ton/ha/yr).	9,013	23,719	11,859
Average soil loss (ton/ha/yr)	4.09	10.78	5.38
Total erosion (ton/yr)	22.53	59.30	29.65
Sediment contribution (ton/yr)	6.40	16.85	8.43

The results of the assessment show that during worst case scenario (without mitigation), the average value of the soil loss is about 1.13 ton/ha/yr. The total soil loss for the entire area during construction, assuming worst case with no mitigation measures, was 23,719 ton/ha/yr. However, this could be reduced by about 50% with the adoption of effective soil erosion and sediment control measures to 11,859 ton/ha/yr.

The rates of soil loss for all four scenarios were compared with soil loss tolerance rates from erosion risk map of Malaysia (DOE, 2003) (**Table 6-19**). From **Table 6-19**, it can be seen that generally the Project site falls under the low category where the potential soil loss is between 10 – 50 ton/ha/year.

Table 6-19 Soil Loss Tolerance Rates from Erosion Risk Map of Malaysia

Soil Erosion Class	Potential Soil Loss (ton/ha/year)
Very Low	<10
Low	10 – 50
Moderate High	50 – 100
High	100 – 150
Very High	> 150

Surface runoff flowing from the exposed areas during site clearing and earthworks will carry sediment into the nearest watercourses, Parit Johan Setia and eventually into Sg Langat located about 3 km away. Suspended sediment will affect water quality of the streams while bottom sediment (as bed load) will effect to cause waterways to become narrow and shallow and result in clogging of the waterway.

The sediment may be expected that sediment will settle out at the sourthern part of the depot (other development area) where the agricultural land will acts as a natural trap for sediment. This will reduce the amount of sediment into the river. Furthermore, there is no water intake downstream of depot.

Therefore, soil erosion and sedimentation is not expected to significantly impact the Parit Johan Setia and Sg Langat and it is predicted that soil erosion and sedimentation can be effectively controlled with the implementation of mitigation measures.

Mitigation measures to reduce erosion and sedimentation

The following measures will be undertaken to minimise the effects of soil erosion and sedimentation:

- Silt Traps
- Temporary drainage and check dams
- Silt Fence
- Turfing
- Compaction

Silt Traps

- A total of five silt traps will be constructed to retain the sediment from the eroded soil particles by allowing it to settle and allowing the sediment-free water to discharge outside the Project site (**Figure 6-5** and **Plate 6-10**).

- The depot site will be divided into two large catchments with two silt traps provided in series for each catchment (**Figure 6-5**), which will eventually flow into the main silt trap and the northwest of the depot site before discharging into an existing drain along Jalan Langat.

- The silt traps shall be inspected and desilted on a regular basis to ensure that they function optimally. The sediments collected must be removed once it is about 50% full, as the effectiveness of the sediment control will be reduced at this stage.

- Dewatering work for structure foundations or earthwork operations adjacent to, or encroaching on, stream or watercourses shall be conducted in a manner to prevent muddy water and eroded materials from entering the drainage system by first discharging into the silt trap.

Temporary Drains and Check Dam

- A network of temporary drainage will be constructed to ensure that all runoff from the Project site is captured and diverted into the silt traps (**Figure 6-5**).

- These drains will be constructed around the perimeter of the site and other areas where necessary and the earthworks will be graded towards the drains to allow runoff to flow into them.

- Check dams will be provided along the temporary drains to slow down the flow of the runoff. The check dams shall be constructed using rocks in gabion mesh and wrapped in geotextile, and placed at every 100m intervals along the drain.

Silt Fence

- Silt fences will be erected and along the boundary of the depot or at the edge of the slope to filter and slow down the runoff from flowing out to the public road and drain (**Figure 6-5** and **Plate 6-11**).

- Silt fences shall be constructed from geotextile and well-anchored to ensure that they do not collapse during heavy storms.

Compaction

- All completed platforms that are not turfed will be well compacted to ensure that the soil particles is not readily eroded by runoff while awaiting the construction of buildings at a later period.

Turfing

- Turfing shall be carried out at areas where earthworks have been completed.

- The turf will be watered regularly, especially during the dry weather periods to ensure its rapid growth and continuous health.

6.10.1 Underground Works

For the underground works, impact from the soil erosion and sedimentation is expected during excavation work. Excavation work will be carried out in stages and for an average maximum depth of 15 m over a duration of 24 months.

A temporary retaining wall shall be erected at the sides of the trench, and hence protecting the side from soil erosion. Therefore the impact from sedimentation is mainly from the dewatering of the trench and from the stockpile of excavated earth.

The excavation will be for a 2 km stretch between Persiaran Kerjaya and Persiaran Hishamuddin, where the water table was recorded at an average of 4m below the surface.

Sedimentation resulted from the underground works will affect the water quality of the surrounding drainage system and eventually will shallow and result in clogging of the waterway.

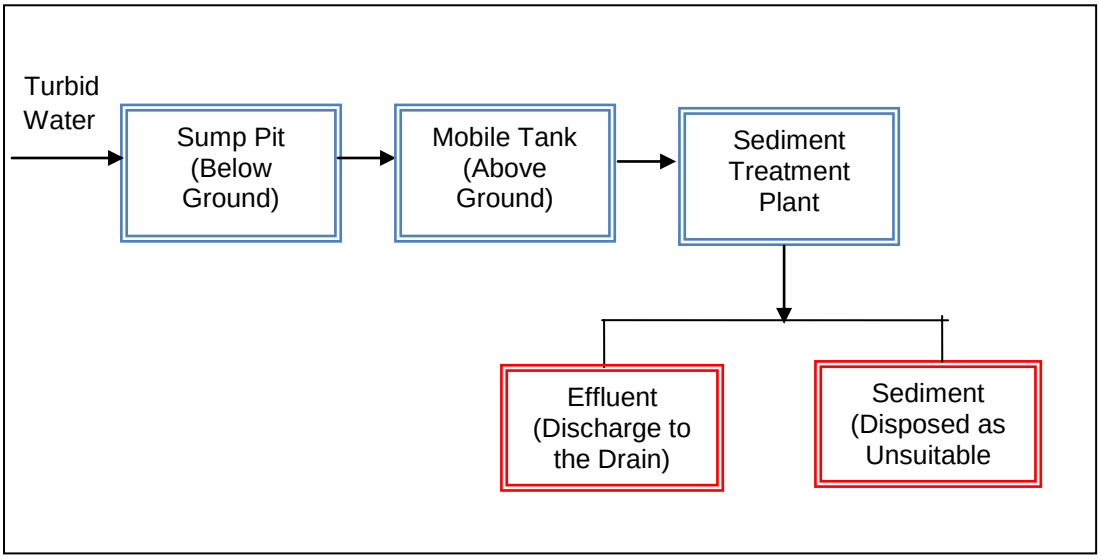
Mitigation measures to reduce erosion and sedimentation

- The excavated material shall be stockpiled above ground before being removed by lorries for disposal. Silt fences shall be erected around the stockpile area to prevent eroded material from flowing out.

- In the excavated area, due to the space constraint, sump pits will be excavated to collect underground water which will be turbid due to the excavation, and the turbid water will be pumped out into mobile tank above ground (**Figure 6-6**).

- The water in the tank will be transferred to the sediment treatment plant where the sediment will be separated from the runoff via a chemical process. The sediment will then be disposed as unsuitable material (**Chart 6-6**).

Chart 6-10 Sediment Treatment Process



6.10.2 Elevated Works

For the elevated works, impact from soil erosion and sedimentation is expected to be minimal since cleared areas for each station and each pier are relatively small. The impact from sedimentation is mainly from the dewatering of the substructure working area.

The major issue from soil erosion and sedimentation during the construction of the elevated structure is likely to be at the section along Sg Kayu Ara. The elevated structure will be constructed along the river reserve.

Excavation for the construction of the column foundations may result in some soil erosion and sedimentation of the river due it's close proximity to the water.

Sedimentation will affect water quality of the streams while bottom sediment (as bed load) will effect to cause waterways to become narrow and shallow and result in clogging of the waterway.

Mitigation measures to reduce erosion and sedimentation

- Mobile silt traps will be provided to capture the runoff from the dewatering work for structure foundations. The runoff will be pumped into the mobile storage tank and allow for settlement before discharging into the nearby drain or watercourse. The trapped sediment will removed and disposed off as unsuitable material (**Figure 6-7**).

- Silt fence will be erected along the boundary of the overall working area to filter and slow down the runoff from flowing out to the existing road (**Figure 6-7**and **Plate 6-12**)

- Sand bags or Coirlog will be placed around the column excavation work area to stop the sediment outflow. The trapped sediment will be cleaned up and taken away as unsuitable material (**Figure 6-7** and **Plate 6-13**)

- Mitigation measures to be implanted along the Sg Kayu Ara river reserve (CH0+000 – CH1+500) such as:

    - Sheet pile to be installed at the river bank to prevent river bank erosion and also prevent the silt from flowing into the Sg Kayu Ara.

    - Temporary slope protection namely installation of plastic sheet at the river bank to prevent soil erosion.

    - Turfing shall be carried out at areas where construction work has been completed.

Erosion and Sedimentation Control Plan

A typical conceptual Erosion and Sedimentation Control Plan (ESCP) has been prepared for the depot and elevated works (**Figure 6-5, 6-6 and 6-7**). The conceptual ESCP incorporates the measures includes silt traps, temporary earth drains, check dams and silt fence.

However, the types of mitigation measures to be implemented will vary depending on the site conditions and the space available on site.

6.11 FLOODING AND HYDROLOGY CHANGES

Flooding may occur due to the conversation of land use and decreasing permeability, especially at the depot area. This may result in the localised floods such as flash flood especially during heavy downpour and also affect areas downstream.

6.11.1 Depot Construction

Depot construction involves 28 ha of conversation of agricultural land. The depot is located at Kg Johan Setia, where this area is presently affected by floods based on the DID records as indicated in **Section 4.6.3** of the report. DID records showed that Kg Johan Setia suffered from the floods in 2003, 2004, 2006, 2008 and 2012. Therefore, this area may be subject to flooding during the construction stage.

Parit Johan Setia is the nearest watercourses to the depot which is located about 300 m away and eventually flows westerly into Sg Langat which is about 4 km downstream from the depot. The depot construction and operation will increase the runoff and lead to more runoff into the existing drainage and eventually into the nearby rivers. The existing drainage may not be designed to cater for the additional runoff, resulting in flash floods during heavy downpour.

The depot is located at Johan Setia, which is located within a peat zone and the surrounding area is susceptible to peat fires, especially during the prolonged dry weather periods. In March 2014 peat fire has been recorded at Kg Johan Setia and Jalan Kebun. Kg Johan Setia is located along the northern boundary of the depot (**Figure 4-5**).

Based on the study conducted by University Malaya (R. Hashim and S. Islam), the groundwater table at Johan Setia was 0.3 m below the surface, and the depth of the peat is 1.5 m from the surface.

The existing peat soil at the depot area will be excavated and backfilled with suitable material as part of the ground improvement works. Temporary dewatering for the preparation of the filling work will induce a groundwater drawdown. This could extend beyond the depot area and affect the groundwater levels in the surrounding areas

The lowering of groundwater table is due to the faster drainage of water that reduces the capacity of the peat to retain water and cause the peat to dry and subside. Dry peat soil is highly combustible because it contains a high proportion of organic material. During dry seasons, dry peat is a serious fire hazard.

Based on the preliminary soil investigation, a maximum of about 3.0 m depth of peat soil will be removed prior to the filling work. Temporary dewatering during earthwork will temporarily reduce the groundwater level in the surrounding area. However, the groundwater level will rise again during the earthworks stage when filling is being carried out.

6.11.2 Underground Works

Construction of underground viaducts and stations will involve excavation of a 2 km stretch between Persiaran Hishamuddin and Persiaran Dato' Menteri. There is no flooding recorded along this stretch.

However, flooding may also occur if the existing surrounding drainage system is closed or obstructed due to the construction activity. There is also a possibility that the surrounding drainage not able to accommodate the increase in surface run-off from the underground works.

6.11.3 Elevated Works

Construction of elevated sections and stations are not expected to cause major flooding as the work area has a small footprint. The construction works will be carried out along the road shoulder or road median.

The alignment traverses along Sg Kayu Ara from CH 0+00 – CH1+500 and One Utama and Damansara Utama station are located along the Sg Kayu Ara river reserve. Sg Kayu Ara is a flood prone area and flooding has been recorded at Kg Cempaka Sg Kayu Ara and Kelana Idaman due to the overflow of the Sg Kayu Ara and related drainage problems.

The alignment from CH 0+00 – CH1+500 is traverses along Sg Kayu Ara river reserve. Construction the elevated structure and 2 stations (One Utama and Damansara Utama) may result in soil erosion and sedimentation which will effect to cause waterways to become narrow and shallow and result in clogging of the waterway. This will eventually increase the risk of flooding to the area as Sg Kayu Ara has been identified as flood prone area.

In Shah Alam, the alignment traverses through the Stadium Shah Alam (CH13+000) and UiTM (CH19+200) where both areas have been affected by flooding which are recorded on 2006, 2011 and 2011. Taman Berkeley, Taman Sri Andalas and Taman Bayu Perdana are affected by flooding in Klang area.

<u>Management measures to minimise flooding and hydrology changes</u>

- Project Proponent shall liaise with the relevant local authorities for the provision of widening the drainage to cater the increase of the runoff to the surrounding drainage.

- Project Proponent shall liaise with the relevant local authorities to maintain the surrounding drainage to minimise obstruction of the flow.

- The temporary drainage to be regularly maintained such as desilting and disposal of the construction or solid wastes into the drain is prohibited.

- All ESCP implementation shall be regularly inspected and maintained properly to ensure its function effectively.

- Constant pumping of groundwater will not allowed. Earth filling to be carried out once excavation of the required peat has reached the required depth.

- Earth bund shall be constructed along the northern boundary of the site to minimise the groundwater drawdown particularly on the Kg Johan Setia

- Provision of a water truck to constantly keep the peat soil damp during dry weather periods

- Establish an emergency action plan to contain the fire while waiting for the fire department to arrive

6.12 WATER POLLUTION

The water pollution is expected from following construction activities:

- Operation of maintenance yard
- Operation of batching plant

The location of above facilities has yet to be determined. The facilities will not to be established near major watercourses as identified in **Section 4.6.2** (**Table 4-9**).

Water pollution in the water courses may occur due to waste oils, fuels and lubricants from machineries that are used during construction in the event of breakdowns, repairs and maintenance flowing into the drainage system. Any spillages such as spillage of diesel may also potentially reach the nearby rivers and result in water pollution.

Runoff from the batching plant containing chemicals may lead to contamination of the nearby waterways. Formation of hardened concrete in the existing waterways may occur due to runoff from washing of concrete trucks or concrete coated equipment as well as mortar mixing activities.

Management measures to minimise water pollution

- Maintenance of vehicles and plants will be carried out at the designated area. Sand contaminated with oil spillage will be removed and disposed of as scheduled waste.

- Fuel spillage seeping into the ground will be prevented by the construction of a containment wall either made out of concrete or bricks around the skid tank (**Plate 6-15**).

- All runoff from the batching plant shall be directed into a grout settling pond before being discharged into drainage system. Slurry residue and sedimentation from the settling pond shall be cleared periodically and allowed to dry before being disposed.

6.13 WASTE GENERATION

Wastes will be generated from the construction activities and these include:

- Biomass
- Excavated or unsuitable material
- Solid and construction wastes
- Scheduled wastes

The main vegetation at depot area consists of shurbs, vegetation and agricultural respectively. All the trees need to be felled and removed as biomass. The total volume of biomass generated from the site clearing is estimated to be around 330 tonnes (based on the 28 ha).

The excavated or unsuitable material will be mainly generated from the removal of peat soil at the depot as well as underground construction. Based on the estimation, about 4million m^3 will be generated from depot and 30,000 m^3 from underground excavation. The excavated and unsuitable material will be stockpiled temporarily on site prior to disposal at the Bukit Tagar Sanitary Landfill.

Solid waste will be generated by workers on site and workers camp. The composition of the waste is expected to be mostly food waste, paper, cans and bottles and plastics. Construction waste generated would be largely made up of material packaging, disused formwork, concrete debris and used containers.

Scheduled waste will be generated from the maintenance of the construction vehicles such as used oil, used batteries and used oil filter. The contaminated sand resulted from cleaning the oil spillage will be disposed off as scheduled waste.

SECTION 6 : POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES DURING THE CONSTRUCTION STAGE

Management measures to minimise waste

Biomass

- Minimise biomass generation by implementing the Project in phases.
- Biomass can be used as temporary slope protection to reduce soil erosion as it will assist in filtering the silt from the runoff and remaining biomass will be stockpiled temporarily at the designated area.
- Location for disposal will be identified prior to commencement of construction works for each phase and shall be away from watercourses.
- Open burning of biomass is prohibited.

Excavated/Unsuitable Material

- The excavated material from the depot, elevated and underground work will be stockpiled temporarily at the designated area at the depot and working area for elevated and underground. Location for disposal will be identified prior to commencement of construction works
- The stockpiled area shall be located away from the watercourses. Temporary drainage to be constructed surrounding the stockpiled area to divert any runoff away from the watercourses.

Solid and Construction Waste

- All construction waste shall be stockpiled at designated area before sending out for disposal.
- Construction and solid waste generated from the Project will be disposed at a municipal approved landfill or dumping site.
- Sufficient waste bins shall be provided at the site office. Burning of solid waste is strictly prohibited at the site.
- Designated personnel shall be assigned to collect waste from all the bins and tie them up in proper garbage bags before dumping them into the large communal garbage bin located within the site.
- Burning of waste is prohibited.

Scheduled Waste

- Scheduled wastes shall be stored in proper drums and kept in a shed or store designated for the storage of such waste. Signs indicating “DANGER” and “HAZARD” shall be clearly visible outside the shed. The storage area shall be roofed to prevent entry of rainwater and must be ventilated adequately.

- All scheduled and toxic wastes shall be labeled according to their contents as required by the Third Schedule of the Environmental Quality (Schedule Wastes) Regulations 2005.

- Used oil shall be sold and/or transported out of the Project site by a licensed contractor. The respective contractors shall maintain an up-to-date inventory of the types of quantities of the scheduled waste stored, or sent out.

6.14 SOCIAL IMPACTS DURING CONSTRUCTION STAGE

6.14.1 Social Impacts

Since the alignment largely traverses built-up areas and running along major roads, some of the major concerns that have been identified and raised include:

- **Traffic congestion** was the main issue raised. Their main concerns are the existing roads and highways where the alignment is proposed is already congested and will get worse during the construction period. The problem will be further compounded at locations where stations are proposed.

  The affected highways include SPRINT Highway (near Damansara Utama) and NKVE along Segment 1 (Petaling Jaya). Currently, these highways are already very congested during peak hours and any construction works along these highways will further exacerbate the traffic condition.

  In Klang, the affected roads include Jalan Meru and Jalan Pekan Baru. For Jalan Pekan Baru the concern is that the road is a narrow (residential road), already congested and being used by heavy vehicles to avoid toll. Construction along this road will further aggravate the existing traffic congestion. Similarly, traffic congestion is expected to worsen along Jalan Meru which is one of the main road in Klang.

Although the traffic along Persiaran Hishamuddin and Persiaran Dato' Menteri are not as heavy as in Klang, they voiced their concern of potential traffic congestion along these roads, particularly at the Kayangan roundabout.

(Please refer to **Section 6.5 : Traffic Assessment** for details of traffic assessment)

- **Noise and vibration impacts** are the major concerns for those located close to the proposed alignment such as Hospital Tengku Ampuan Rahimah, residents of Idaman Villa and Damansara Lagenda. During engagement with Hospital Tengku Ampuan Rahimah, they raised concern pertaining to vibration impacts as this could affect their operations which are vibration sensitive such as the operation theatres and laboratory.

  Increased noise level and vibration impacts (potential cracks to their houses) were also raised by the Idaman Villa residents during the engagement. This is particularly worrying for those residents whose houses are located closest to the NKVE.

  Other noise sensitive receptors have been identified and evaluated in **Section 6.6**.

- **Safety and security issues** were raised by Hospital Tengku Ampuan Rahimah and some of the schools located close to the major roads. For example, Tamil School at Section 7 Shah Alam, SM Kwang Hua at Kawasan 17, SMK Tinggi and SK Meru 1 & 2. In view of the nature of construction works that will be carried out, safety of the school students and public are of paramount importance. Measures must be in place to take into account conditions during the normal school hours but also during special events that may be held at the schools.

- In the case of business owners located within the vicinity of the alignment, their businesses could be severely be interrupted and disrupted taking into consideration that construction period could be stretch over a period of four to five years. Shah Alam Stadium has expressed concern that their activities could be affected during construction as they do hold events or activities on daily and weekly basis. In short, they want as little disruption as possible to their operation. For other businesses, they fear that such interruptions to their business could be long term. This is particularly of concern for the businesses along Jalan Meru and SPRINT Highway since accessibility to their businesses are crucial for their businesses. Stadium Shah Alam is another stakeholder.

Management measures to minimise social impacts

Based on the discussion conducted with the various stakeholders, the most important mitigation measure is more consultations with them. In a nutshell, they want to be consulted, informed and updated about the Project on a regular basis.

They would like further engagement before construction and during construction so that they will be consulted, involved and informed of the proposed measures that will be implemented during construction. For example, all the schools consulted along Jalan Meru has requested for such consultations to discuss and find the best ways especially to resolve some of traffic and other problems (noise and vibration impacts and public safety) together with the Project Proponent. It is important to note that the mitigating measures need to be localised to address the specific needs of the community at that particular location.

6.14.2 Economic Benefits

Increase in economic activities and employment are the major positive impacts construction stage. On the larger scale, the construction sector is expected to benefit from the Project due to its size and magnitude. The main beneficiaries in this sector include:

- construction companies (various work packages will be tendered out for the Project)
- construction material supplier (demand for construction material such as cement and steel is expected to increase)
- engineering and support services companies that provide civil and structural works, survey works, transport planning and other related services.

Significant number of employment will be generated to fulfill the demand for the construction needs of the Project. Other spin-offs and business opportunities can also be expected at local level in terms of job creation and demand for property or housing, food and other services.

SECTION 6 : POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES DURING THE CONSTRUCTION STAGE

	**Plate 6-10** Silt trap constructed to trap the sediment
	**Plate 6-11** Silt fence erected at the edge of the slopes
	**Plate 6-12** Silt fence erected along the boundary of the elevated working area

SECTION 6 : POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES DURING THE CONSTRUCTION STAGE

	**Plate 6-13** Sand bag or Coirlog placed at the elevated working area to divert the runoff from flowing out to the public road
	**Plate 6-14** Turfing at the completed slopes
	**Plate 6-15** Containment bund constructed around fuel storage tank

SECTION 6 : POTENTIALLY SIGNIFICANT IMPACTS AND MITIGATION MEASURES DURING THE CONSTRUCTION STAGE

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P1	LOW	
P2	MEDIUM	BENEFICIAL IMPACTS
P3	HIGH	
N1	LOW	
N2	MEDIUM	ADVERSE IMPACTS
N3	HIGH	

				PROJECT ACTIVITIES											
				PRE-CONSTRUCTION STAGE											
				Soil Investigation Works	Environmental Sampling	Land & Property Acquistion	Utilities Relocation								
ENVIRONMENTAL COMPONENTS	PHYSICO-CHEMICAL	LAND	Soil profile	N1											
			Soil stability	N1											
			Subsidence and Compaction												
			Land use				N1								
			Buffer zones				N1								
		SURFACE WATER	Drainage pattern												
			Water quality												
			Existing use												
		GROUND WATER	Water table												
			Flow regime												
			Water quality												
			Existing use												
		AIR	Air quality												
			Visibility												
		NOISE	Intensity												
			Duration												
			Frequency												
	BIOLOGICAL	SPECIES & POPULATAION	Terrestrial vegetation												
			Terrestrical wildlife												
			Aquatic flora												
			Aquatic fauna												
		HABITATS & COMMUNITIES	Terrestrial habitat			N1									
			Terrestrical communities			N1									
			Aquatic habitat												
			Aquatic communities												
	HUMAN	HEALTH & SAFETY	Physical safety/health			N1									
			Physical well-being												
			Communicable disease												
		SOCIAL & ECONOMIC	Employment	P1	P1										
			Utilities/Amenities				N1								
			Transportation/Traffic flow				N2								
			Commerce												
		AESTHETIC & CULTURAL	Landform												
			Atmospheric quality												
			Tranquility			N2									
			Sense of community			N3									
			Landscape				N1								
			Odour												

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Figure 6-1

EIA Matrix for the Pre-Construction Stage

P1	LOW	
P2	MEDIUM	BENEFICIAL IMPACTS
P3	HIGH	
N1	LOW	
N2	MEDIUM	ADVERSE IMPACTS
N3	HIGH	

				PROJECT ACTIVITIES												
				CONSTRUCTION STAGE												
				UNDERGORUND WORKS	Tunneling	Construction of Shaft	Construction of Sation Box	CONSTRUCTION OF VIADUCT ELEVATED STATION	CONSTRUCTION OF DEPOT							
ENVIRONMENTAL COMPONENTS	PHYSICO-CHEMICAL	LAND	Soil profile		N3	N3	N3	N3	N3							
			Soil stability													
			Subsidence and Compaction													
			Land use						N1							
			Buffer zones													
		SURFACE WATER	Drainage pattern													
			Water quality		N1		N1	N1	N2							
			Existing use													
		GROUND WATER	Water table		N2		N2									
			Flow regime		N2		N2									
			Water quality													
			Existing use													
		AIR	Air quality		N1	N1	N1	N1	N2							
			Visibility													
		NOISE	Intensity		N1	N1	N1	N2	N2							
			Duration					N2	N2							
			Frequency					N2	N2							
	BIOLOGICAL	SPECIES & POPULATAION	Terrestrial vegetation		N1	N1	N1									
			Terrestrial wildlife		N1	N1	N1									
			Aquatic flora		N1	N1	N1									
			Aquatic fauna													
			Mangroves													
		HABITATS & COMMUNITIES	Terrestrial habitat													
			Terrestrial communities													
			Aquatic habitat													
			Aquatic communities													
	HUMAN	HEALTH & SAFETY	Physical safety/health		N2	N2	N2	N2	N2							
			Physical well-being					N1								
			Communicable disease						N1							
		SOCIAL & ECONOMIC	Employment		P1	P1	P1	P1	P1							
			Utilities/Amenities													
			Transportation/Traffic flow		N1	N1	N1	N3	N3							
			Commerce		P3	P3	P3	P3	P3							
		AESTHETIC & CULTURAL	Landform		N1	N1	N1	N1								
			Atmospheric quality						N2							
			Tranquility					N2								
			Sense of community													
			Landscape													
			Odour													

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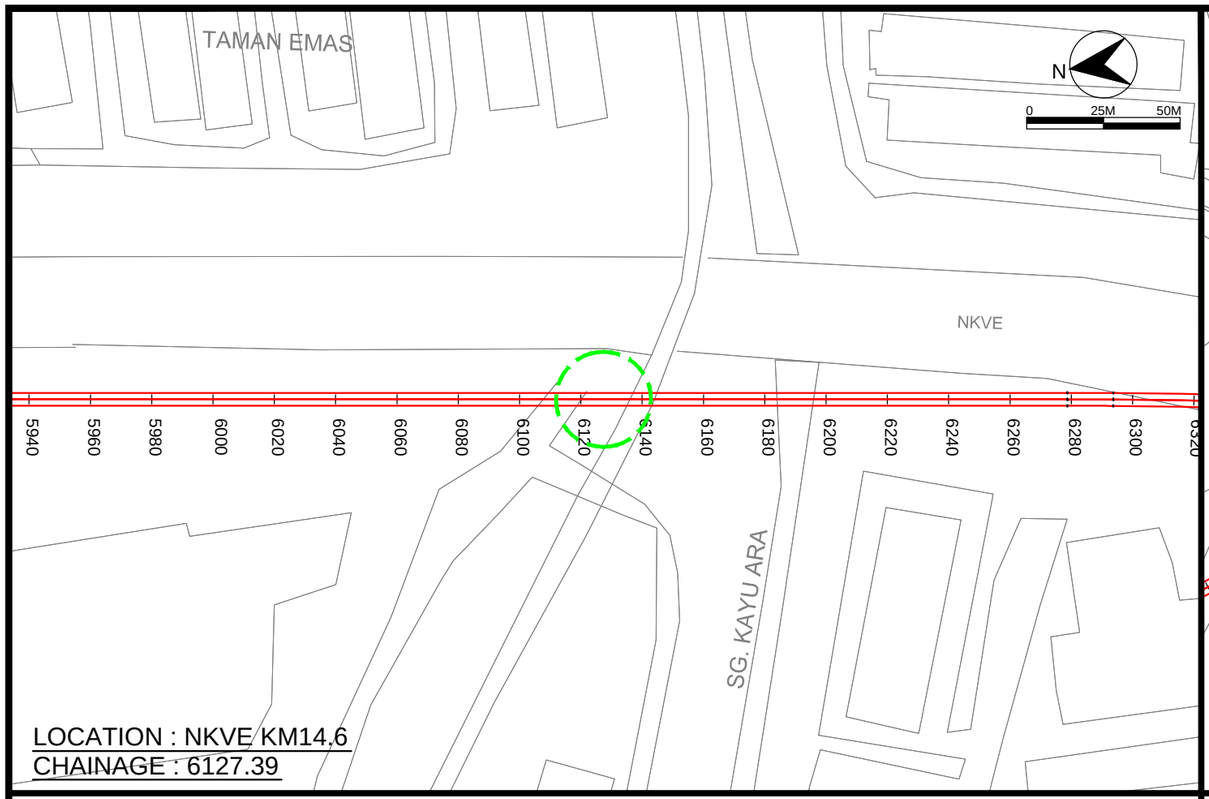
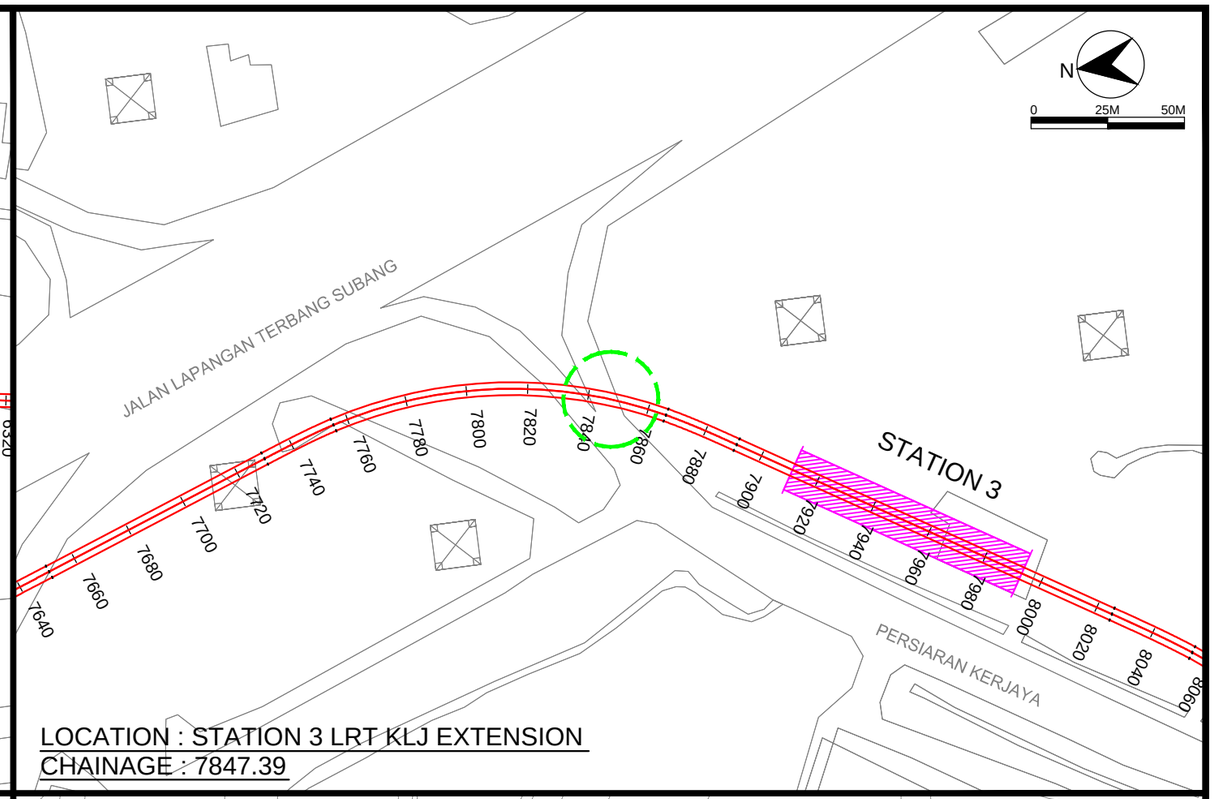
Figure 6-2

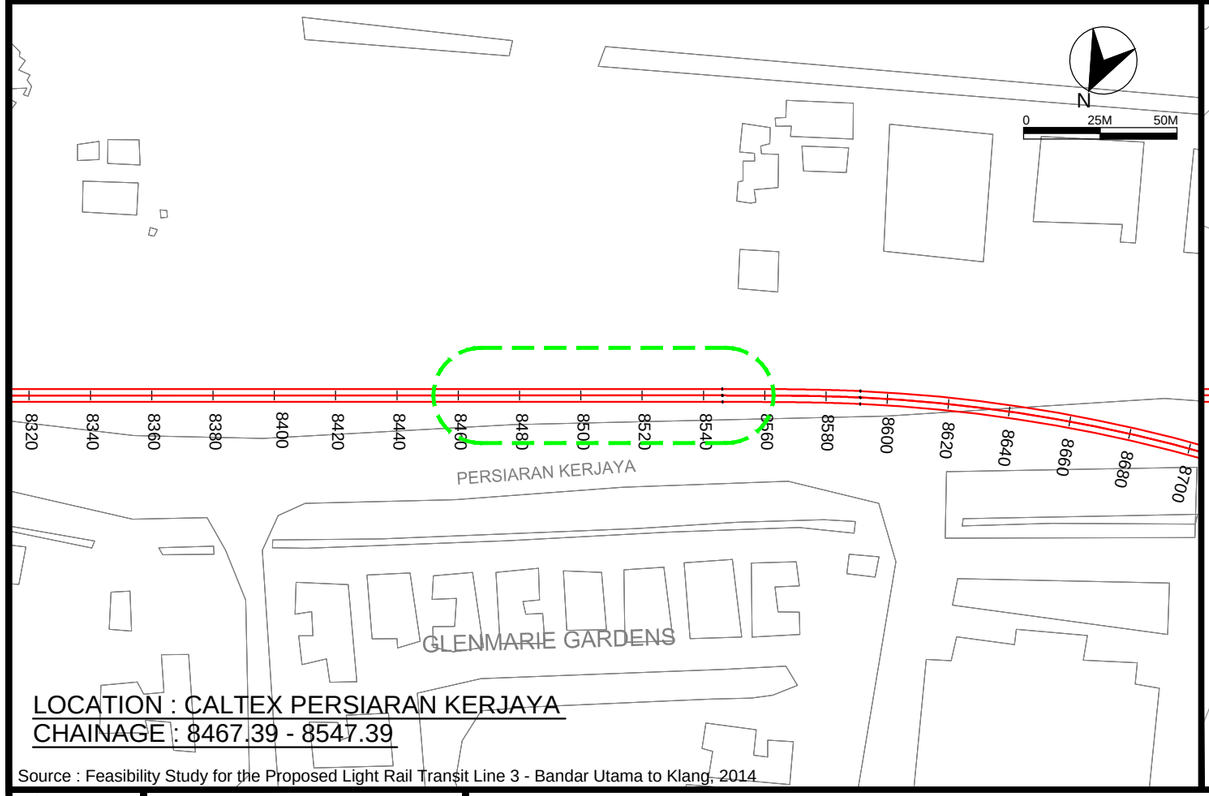
EIA Matrix for the Construction Stage



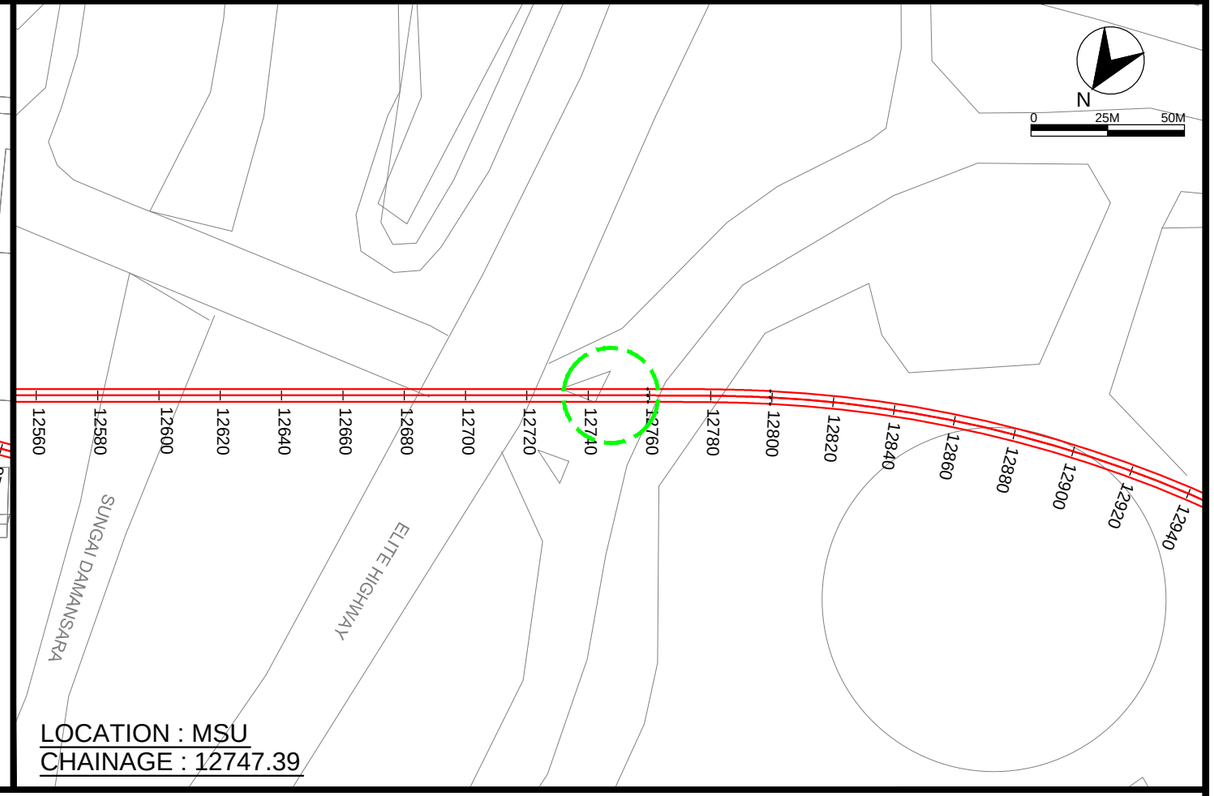
LOCATION : NKVE KM14.6
CHAINAGE : 6127.39



LOCATION : STATION 3 LRT KLJ EXTENSION
CHAINAGE : 7847.39



LOCATION : CALTEX PERSIARAN KERJAYA
CHAINAGE : 8467.39 - 8547.39



LOCATION : MSU
CHAINAGE : 12747.39

Source : Feasibility Study for the Proposed Light Rail Transit Line 3 - Bandar Utama to Klang, 2014

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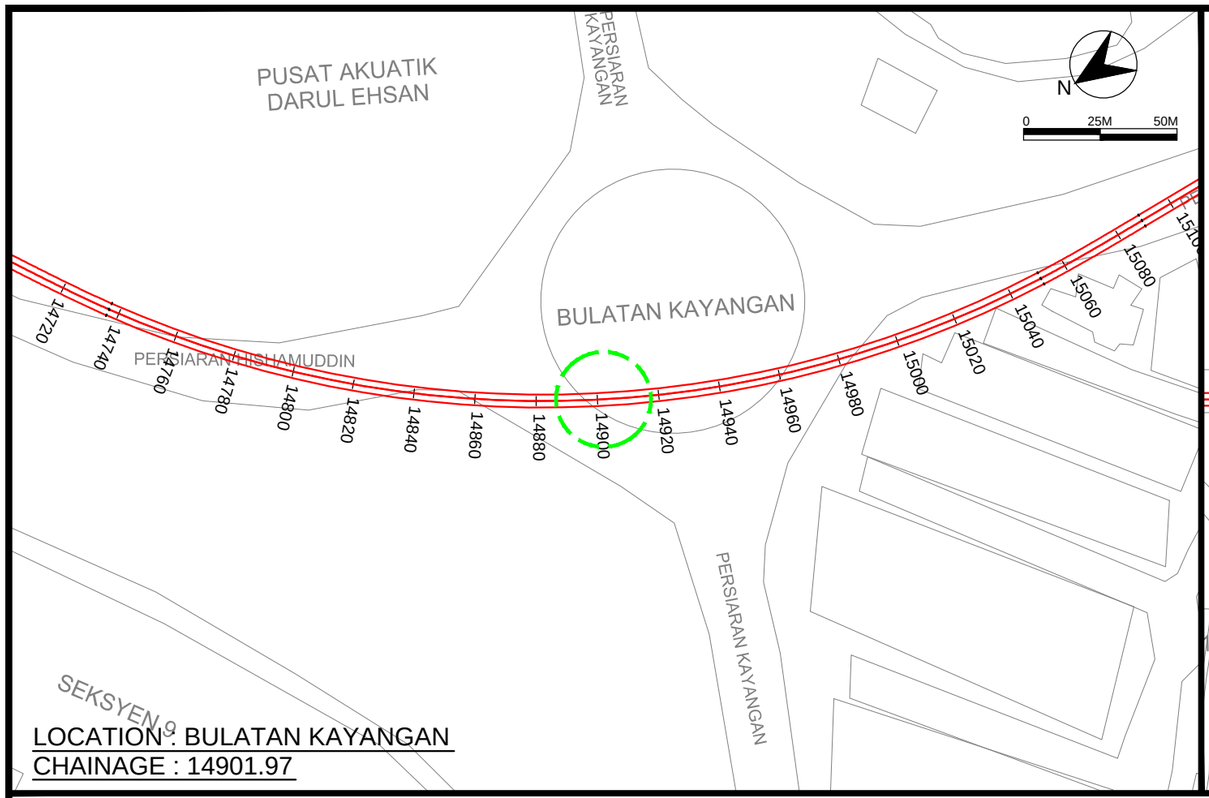
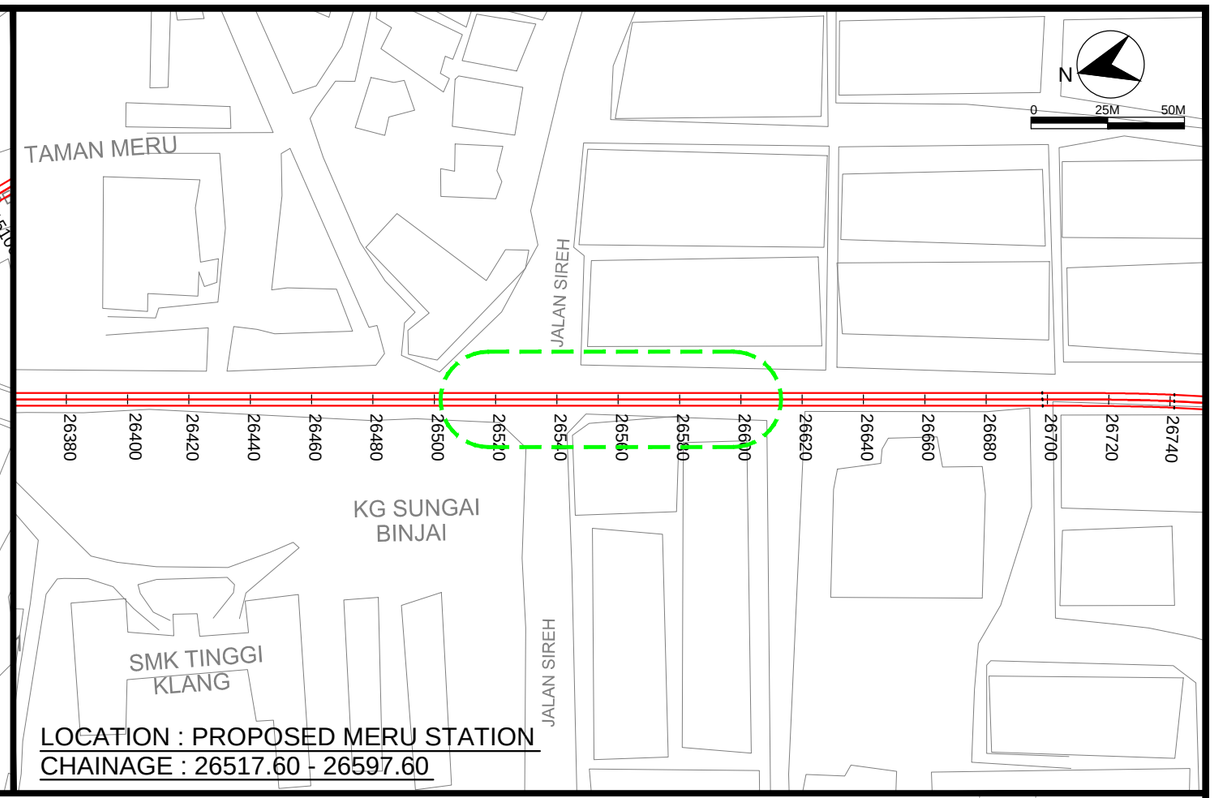
Figure 6-3a

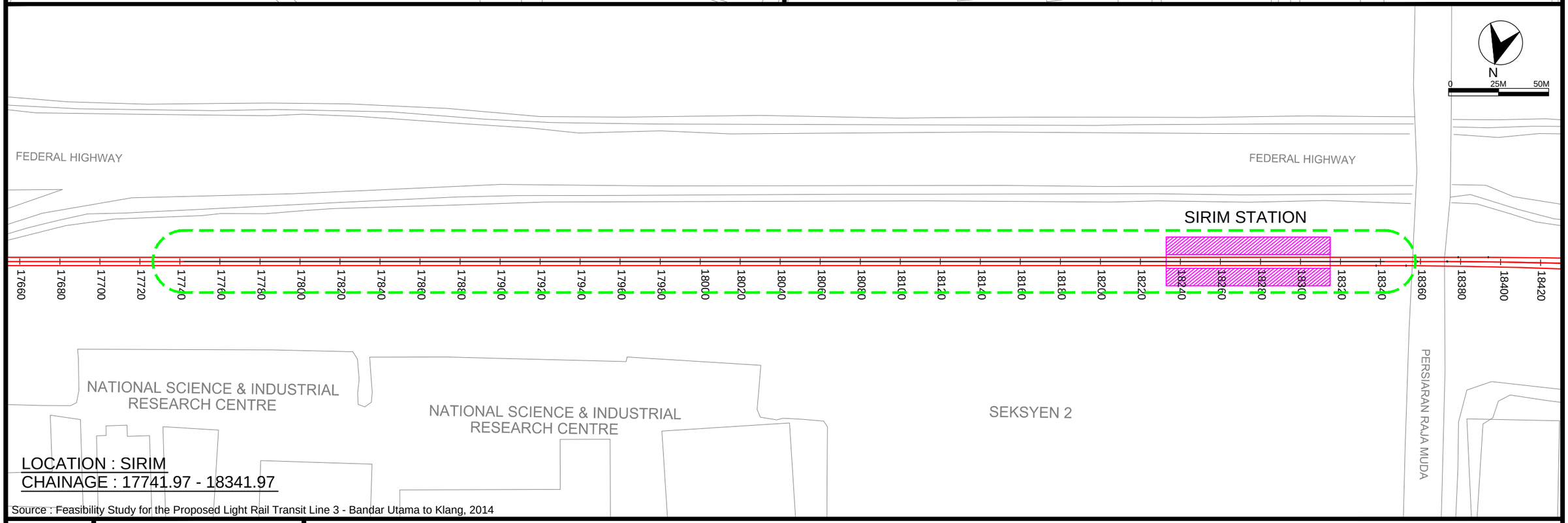
Location of Water Pipe Relocation (Sheet 1)



LOCATION : BULATAN KAYANGAN
CHAINAGE : 14901.97



LOCATION : PROPOSED MERU STATION
CHAINAGE : 26517.60 - 26597.60



LOCATION : SIRIM
CHAINAGE : 17741.97 - 18341.97

Source : Feasibility Study for the Proposed Light Rail Transit Line 3 - Bandar Utama to Klang, 2014

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Figure 6-3b

Location of Water Pipe Relocation (Sheet 2)

X:\EJ 548 DEIA Of LRT3\Drawings\DEIA NEW\Fig 6-3.dwg

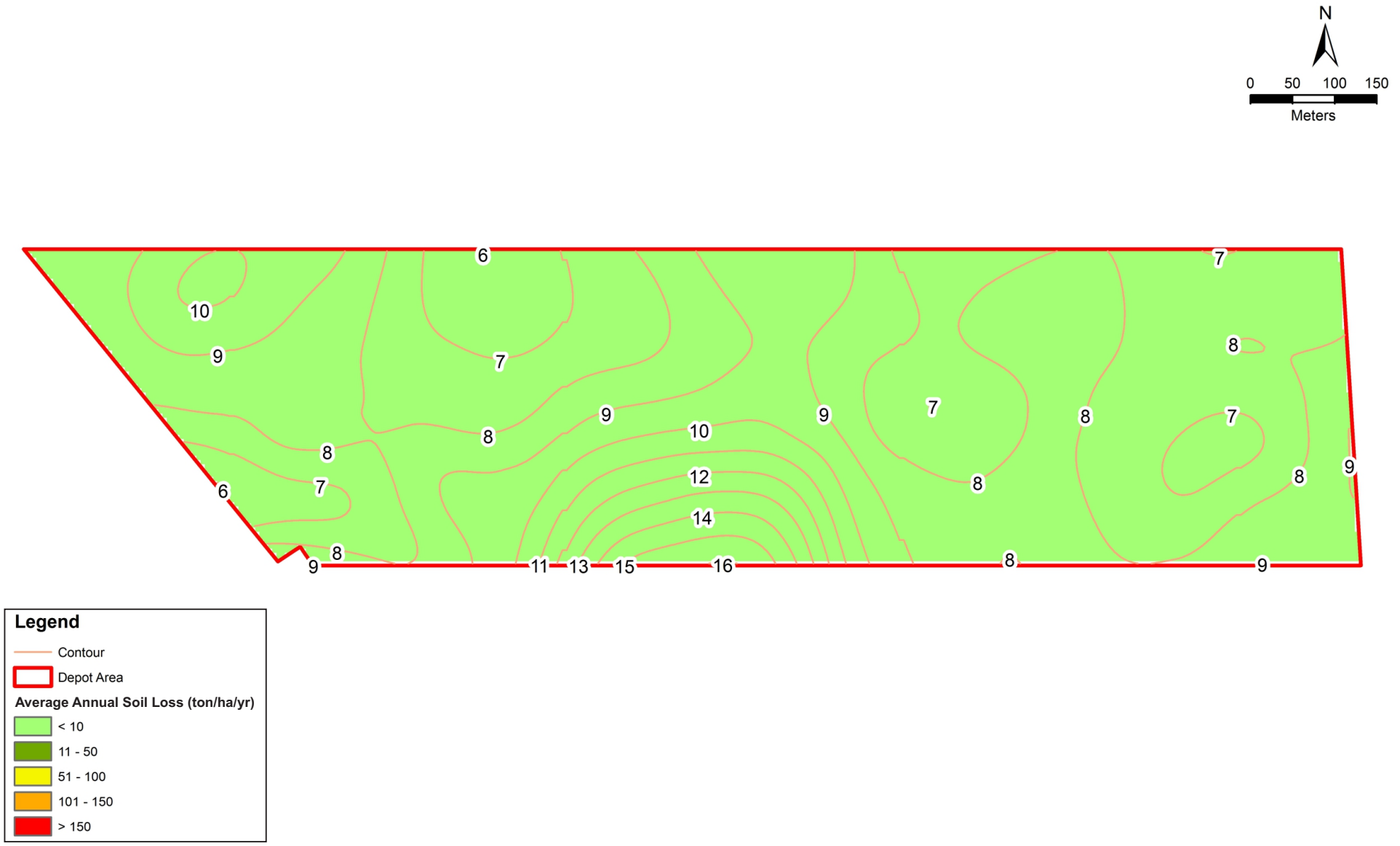

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Figure 6-4

Soil Loss Map at Depot area (Worst Case)

EJ 548 DEIA Of LRT3\Drawings\DEIA NEW\Fig 6-4.cdr

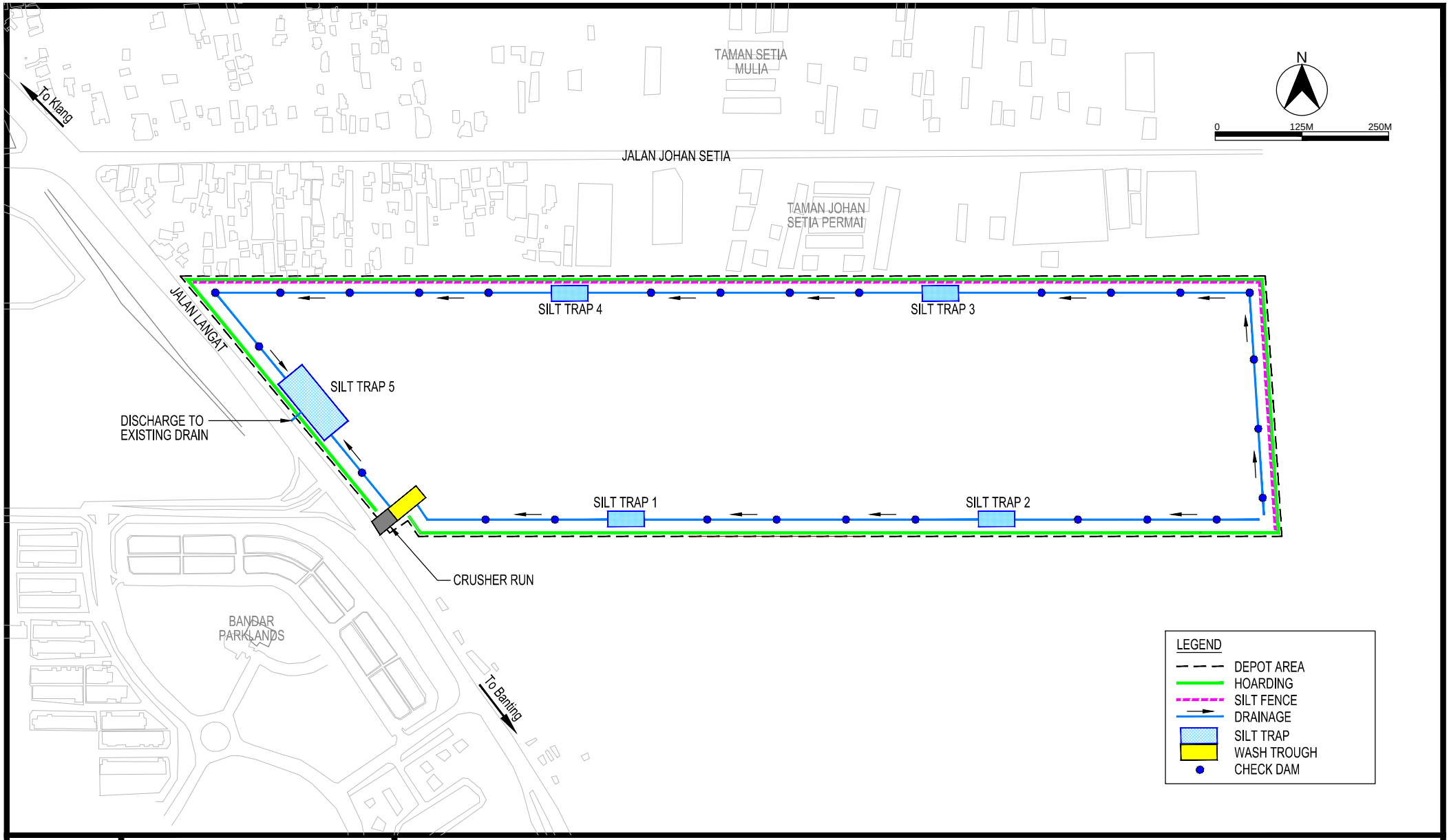

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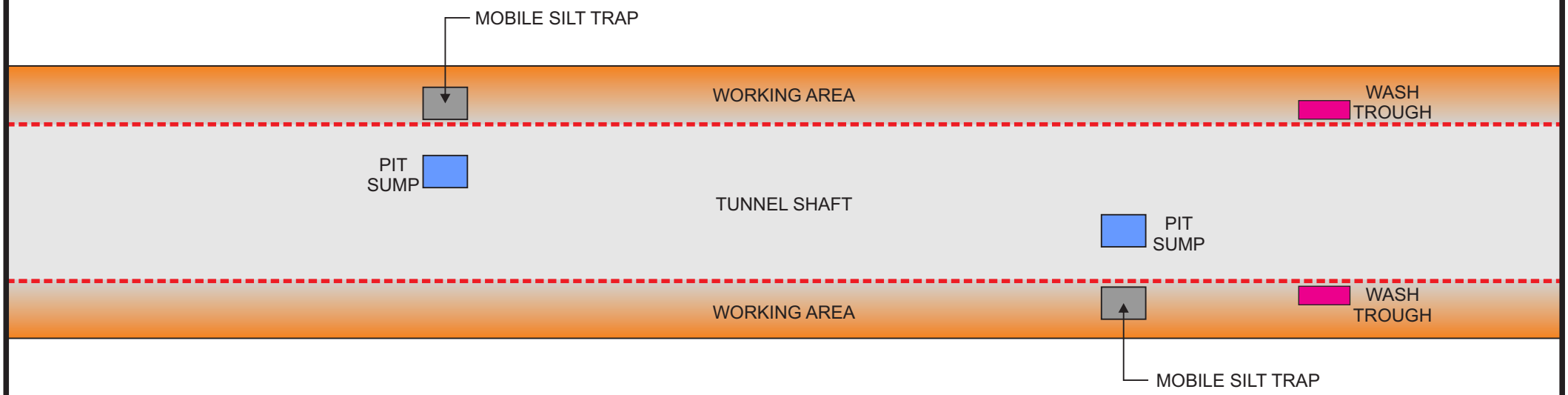
Figure 6-5

Conceptual Erosion and Sediment Control Plan for Depot Area

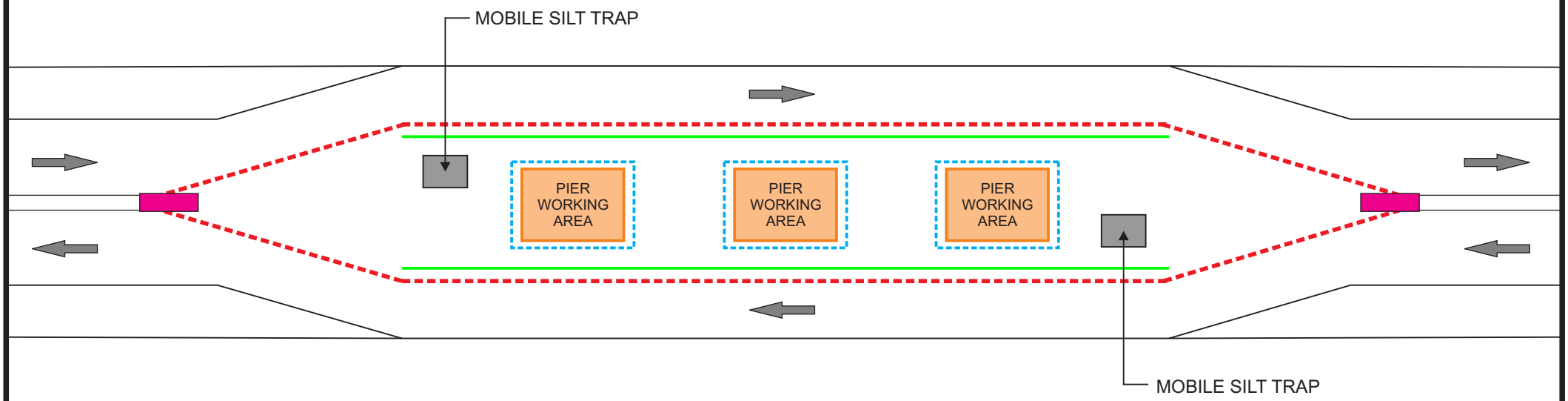
X:\EJ 548 DEIA Of LRT3\Drawings\DEIA NEW\Fig 6-5.dwg



Conceptual Erosion and Sediment Control Plan for Underground Works

Scale : Not To Scale

ere consulting group sensible environmental solutions	Figure 6-6	Conceptual Erosion and Sediment Control Plan for Underground Works



Conceptual Erosion and Sediment Control Plan for Elevated Works

Scale : Not To Scale

LEGEND

- Wash Trough
- Pier Working Area
- Sand Bag/Coirlog
- Barrier
- Silt Fence
- Traffic Flow

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sensible environmental solutions

Figure 6-7

Conceptual Erosion and Sediment Control Plan for Elevated Works