7.0 EVALUATION OF IMPACTS

7.1 Introduction

The principal biophysical and socio-economic environmental effects expected to results from the proposed project are discussed in this Chapter. The significance of the project impacts on the environment is evaluated in terms of the potential changes to the baseline status, magnitude and duration. Specific project activities, which would require management to mitigate any potential environmental impacts are then identified.

The major activities expected during the site preparation phase are site survey and hydrological survey. These activities are not expected to generate any significant impacts to the existing environment and therefore, impacts evaluations are only focusing on the construction phase. The overall evaluation of the environmental impacts will be presented in a matrix format as outlined by the Department of Environment (DOE) at the end of this chapter. Subsequently, the significance of these impacts will be evaluated in terms of its magnitude, duration as well as the effects caused onto the surrounding environment.

Mitigating measures are then proposed for the significant impacts in order to ensure that the proposed project incurs the minimal pressure on the receiving ambient environment (refer Chapter 8).

7.2 Impact Analysis Methodology

Potential environmental impacts resulting from this proposed project are identified from Project Description (Chapter 5), baseline information on Existing Environment (Chapter 6) and the application of best professional judgment by environment consultants.

For the analysis, project activities are divided into planned (routine) and unplanned (non-routine) categories. A routine activity is a project activity or aspect that will likely to occur (planned) during or is integral to the proposed program, whereas a non-routine activity or accident is not expected or is unplanned, but has the potential to cause a recognized hazard/impact.

In order to systematically evaluate the potential impacts, an environmental effect matrix is used. The matrix is developed by analyzing the project description and the description of the existing environment to identify potential impacts. The purpose of the matrix is to summarize what are considered to be the potential impacts of the proposed project activities on the environmental components for each phase.

The components of the affected environment considered in this study are as follows:

- Air Quality
- Noise Level
- Water Quality
- Coastal Hydraulic
- Ecology
- Traffic
- Socio-economics
- Waste Management
- Occupational health and safety

The project activities or aspects considered in the impact matrix include the following:

- Site Preparation Phase
- Construction Phase :
    - Sand mining and transportation
    - Reclamation
- Abandonment Phase

The Impact Matrix is summarized and presented in **Table 7-1**.

Table 7-1 Environmental Assessment Matrix

Key	
	Insignificant and excluded from Matrix
√	Environmental impact that is potentially but on a temporary basis and will assue equilibrium after certain period of time
x	Environmental impact that is potentially significant but about which there is insurtificient data to make a reliable prediction. Close monitoring and control is recommended.
√	Potentially significant adverse environmental impact for which a design solution has been identified.
√	Residual and significant adverse environmental impact
x	Significant environmental enhancement

			Project Activities												
			Site Preparation Stage				Reclamation and Revertment								
			Mobilization of machinery	Establishment of temporary facilities	Study and Survey activities	Clearance of debris and rubbish	Sand Mining	Transportation of sand	Construction of perimeter bund	Filling Activities	Canal dredging works	Spills and Leaks	Waste Disposal and Recovery	Traffic	Abandonment
Physico-Chemical	Land	Land forms													
		Soil Profile					√								
		Slope Stability													
		Soil Composition													
		Subsidence and Compaction													
		Seismicity													
		Flood Plains/Swamps													
		Landuse													
		Engineering and Mineral Resources					√								
		Buffer Zone													
	Surface Water	Shoreline								√	√				
		Bottom Interface								√	√				
		Flow Variation								√	√				
		Water Quality								√	√				
		Drainage Pattern					√	√	√	√	√	√	√		
		Water Balance								√	√				
		Flooding								√	√				
		Existing Use								√	√				
	Groundwater	Water Table													
		Flow Regime													
		Water Quality													
		Recharge													
		Aquifer Characteristic													
		Existing Use													
	Atmosphere	Air Quality	√	√	√	√		√	√	√	√			√	
		Air Flow													
		Climate Change													
		Visibility													
	Noise	Intensity	√	√	√	√		√	√	√	√			√	
		Duration													
		Frequency													
Biological	Species Population	Terrestrial Vegetation													
		Terrestrial Wildlife													
		Other Fauna													
		Aquatic/Marine Flora					√		√	√	√		√		
		Fish					√		√	√	√		√		
		Other Marine Fauna					√		√	√	√		√		
	Habitats and Communities	Terrestrial Habitats													
		Terrestrial Communities													
		Aquatic Habitats													
		Aquatic Communities													
		Estuarine Habitats					√		√	√	√		√		
		Estuarine Communities					√		√	√	√		√		
		Marine Habitats					√		√	√	√		√		
		Marine Communities					√		√	√	√		√		
Human	Health and Safety	Physical Safety						√						√	
		Psychological Well-being											√		
		Parasitic Disease											√		
		Communication Disease											√		
		Psychological Disease											√		
	Social and Economic	Employment													
		Housing													
		Education													
		Utilities													
		Amenities													
	Aesthetic and Cultural	Landforms													
		Biota													
		Wilderness													
		Water Quality													
		Atmospheric Quality													
		Climate													
		Tranquility								√			√		
		Sense of Community													
		Community Structures													
		Man-made Objects													
		Historic Places or Structures													
		Religious Places of Structures													
		Landscape													
		Composition													

7.3 Potential Impacts during Site Preparation Phase

Site preparation phase mainly involves project kick-off, hydrographic survey, mobilization of machinery and equipment, establishment of temporary facilities on site as well as clearance and removal of debris and rubbish. These activities will be carried out in small scale and in a short period, thereby, it is not predicted to create any major environmental impacts.

7.3.1 Impacts on Air Quality

Dust generated during the carrying out of site preparation and emission from the exhausts of moving vehicles constituting SO_2 and CO are expected to be a problem over the duration of these activities. However, the issue will ease at the end of the site preparation and impacts are anticipated to be short term and localised.

7.3.2 Impacts on Noise Level

Noise emission from the vehicles and machinery is expected to be short term during the preparation of works. The impacts are also expected to be minor.

7.3.3 Impacts on Waste Management

Based on the existing site condition, only very minimal amount of debris and rubbish need to be cleared for the site preparation activities. As the waste will be collected and proper disposed of to Sungai Udang Sanitary Landfill under the management of local authority or by licensed contractor, only minor impacts are anticipated.

7.4 Potential Impacts during Sand Mining and Transportation

Potential impacts during sand mining and transportation including decreasing in water quality, impacts on marine traffic, interference with local fishing activities, removal of benthos population, accidental spillage and noise impacts.

The major problem foreseen is the dispersal of sediment during the sand mining and it is expected to turbid the surrounding water bodies resulting in a deterioration of the water quality of the surrounding area. Nevertheless, the impacts of dredging or sand mining have been covered under the EIA for Sand Mining activities of Extrorish Sdn Bhd, these impacts will not be discussed in this EIA.

In relation to this, the potential environmental impacts caused by the project are mainly involved transportation of fill material from the sand source concession site to the reclamation area. These impacts are likely to be minor as discussed below:

7.4.1 Impact on Hydrodynamic

The main concern in relation to the transport vessel is anchoring activities. When anchors are lifted and positioned, scarring of the seabed will occur. Suspension and redistribution of finer sediments will lead to temporary increase in turbidity and alteration of sediment particle distribution. This will cause loss in benthic and bottom feeding organisms. Nevertheless, these effects are short-term and localised as the macrobenthos community will rapidly adjust to the changing seabed.

7.4.2 Impacts on Water Quality

Accidental spillage of fine materials or oils along the way may occur during the transportation of fill material. Sea water pollution is expected as the sand carrier used for transportation is able to transport approximately 1000 m^3 of fill material per trip. This volume of fine material may cause spread of sediment plume along the route if any accidental spillage happen. As sediment plume need time to settle, this will resulting in deterioration of the water quality along the route.

Furthermore, ship related operational discharges of oil include the discharge of bilge water from machinery spaces, fuel oil sludge and oily ballast water from fuel tanks may also cause sea water pollution especially surrounding the project site.

7.4.3 Impacts on Noise Level

Noise impacts including underwater noise due to propellers and thrusters will also be generated by vessels during the journey from the point of embarkation to the project site. However, the noise impacts are considered insignificant.

7.4.4 Impacts on Waste Management

Wastes generated from the project during this stage will be in the form of general rubbish and perishable food waste from the sand carrier and other associated vessels. These wastes will be collected and disposed on-shore by licensed contractor. As only small amount of waste is anticipated, the impacts are expected to be insignificant.

It is anticipated that waste oil, lubricants, ballast water, etc. will be generated from the operational of the sand carrier and other associated vessels. Ballast water is classified as scheduled wastes under the Environmental Quality (Scheduled Wastes) Regulations, 2005 and the discharge of ballast water from the sand carrier and other associated vessels during the transportation can impact on water quality and marine fauna. It could also cause introduction of invasive species. Therefore, all scheduled wastes inclusive of ballast water are to be stored and disposed on-shore only according to the Environmental Quality (Scheduled Wastes) Regulations, 2005. Thereby, the impacts is also anticipated to be minor.

7.4.5 Impacts on Navigation Safety

There is only a small likelihood of vessel collisions, groundings and other accidents and interference with other maritime and marine-based activities (fishing) as the marine traffic in the vicinity of the project area is low. The proposed project site is not located within the main navigation channel.

7.5 Potential Impacts during Reclamation Phase

7.5.1 Impact on Hydrodynamic

A hydraulic study is required to determine the impact due to the reclamation on coastal processes and the environment are considered as shorefront development based on Department of Irrigation and Drainage, Malaysia (DID) guideline. The hydraulic study was conducted to comply with the 'Guidelines for Preparation of Coastal engineering Hydraulic Study and Impact Evaluation' (for Hydraulic Study Using Numerical models, Fifth Edition, 2001 by DID) and 'Guideline on Erosion Control for Development Projects in the Coastal Zone' (1997)'. The main approach taken was the use of the MIKE 21 computer modelling package.

Hydrodynamic condition, wave pattern and mud transport were simulated for northeast monsoon and southwest monsoon. **Table 7-2** shows the model simulation for different scenarios. Four different options were selected during this modelling study to assess the impact of proposed reclamation work at Melaka (**Figure 7-1** to **Figure 7-4**). While **Figure 7-5** to **Figure 7-8** illustrate the detailed view of proposed reclamation project site with floating piles structure. It displays the actual structure along with reclaimed area. The present modelling study focused on proposed reclamation work which connected to main land. The approval letter from Jabatan Pengaliran dan Saliran (JPS) for this Project is appended in **Appendix 7-1**.

Table 7-2 Model Simulation for Two Scenarios with Different Options °N

Scenarios	Monsoon	Wind Speed (m/s) and Direction (º) Conditions
Scenario-A (Baseline Condition)	Northeast	5.5 m/s and 300º
	Southwest	4.5 m/s and 150º
Scenario-B (Reclamation with floating piles)	Northeast	5.5 m/s and 300º
	Southwest	4.5 m/s and 150º
Scenario-C (Reclamation with floating piles + Breakwater with 40m Mouth Distance)	Northeast	5.5 m/s and 300º
	Southwest	4.5 m/s and 150º
Scenario-D	Northeast	5.5 m/s and 300º

Scenarios	Monsoon	Wind Speed (m/s) and Direction (º) Conditions
(Reclamation with floating piles + Breakwater with 50m Mouth Distance)	Southwest	4.5 m/s and 150º

Figure 7-1 Scenario A with Bathymetry

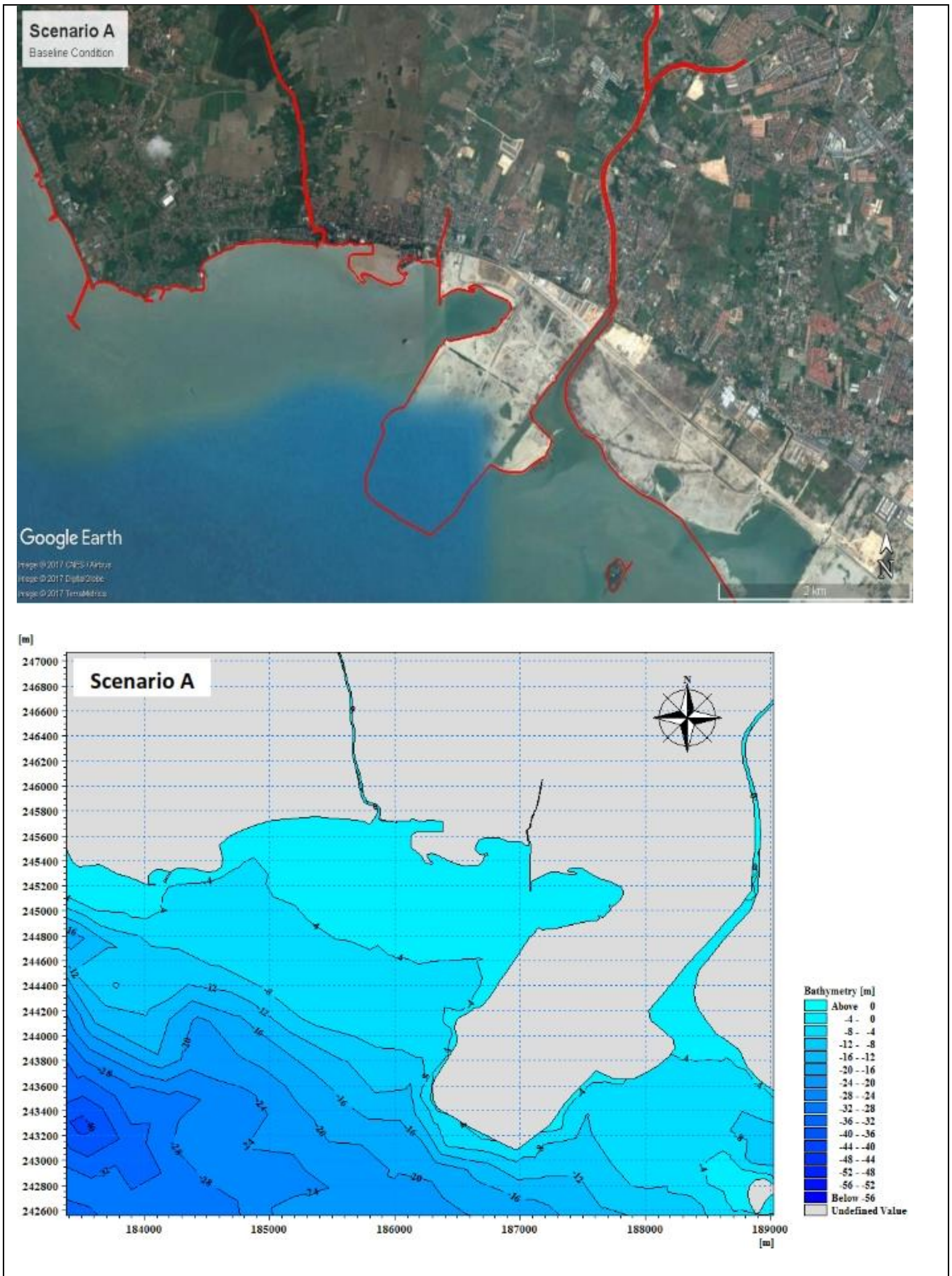


Figure 7-2 Scenario B with Bathymetry

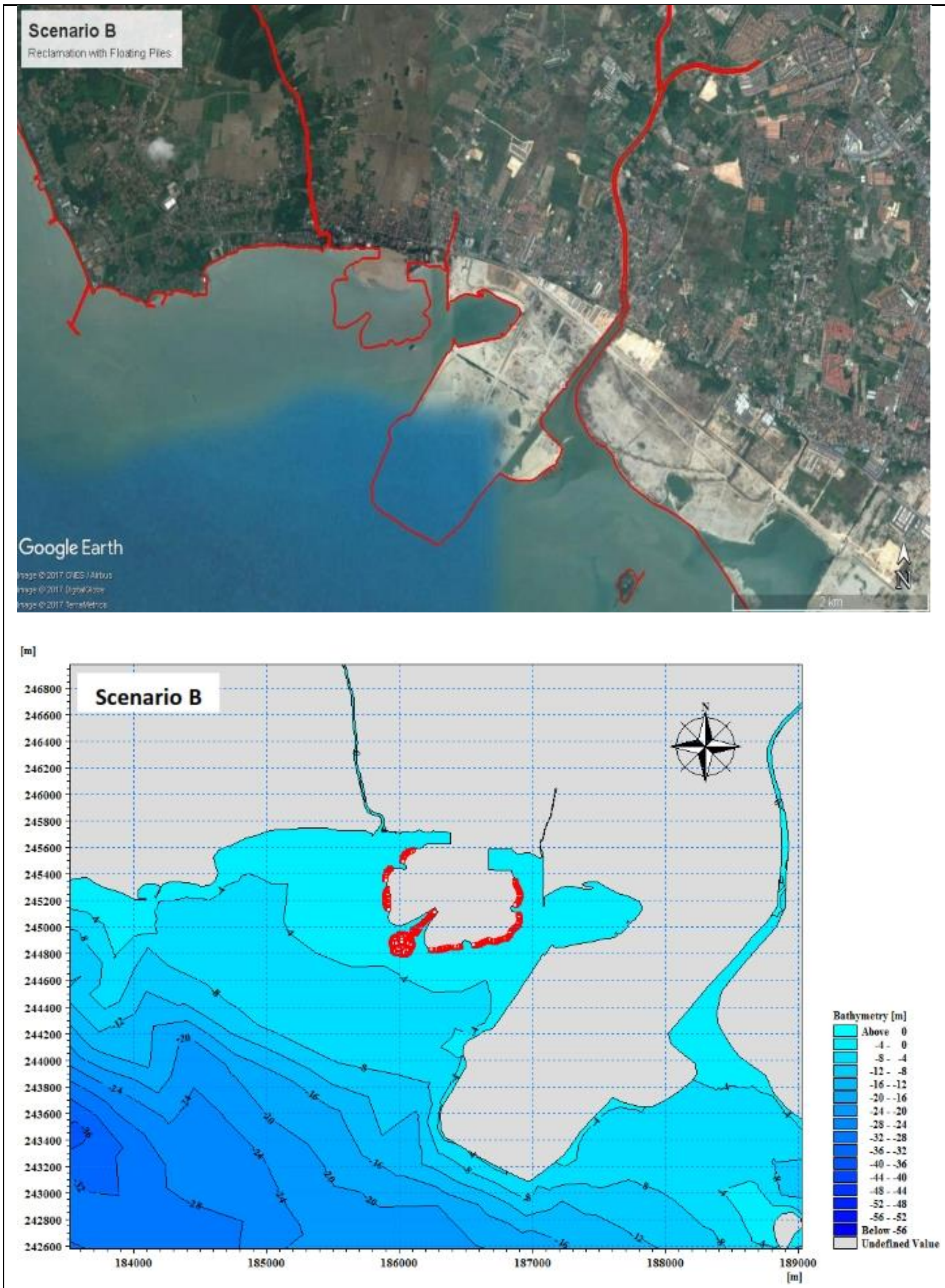


Figure 7-3 Scenario C with Bathymetry

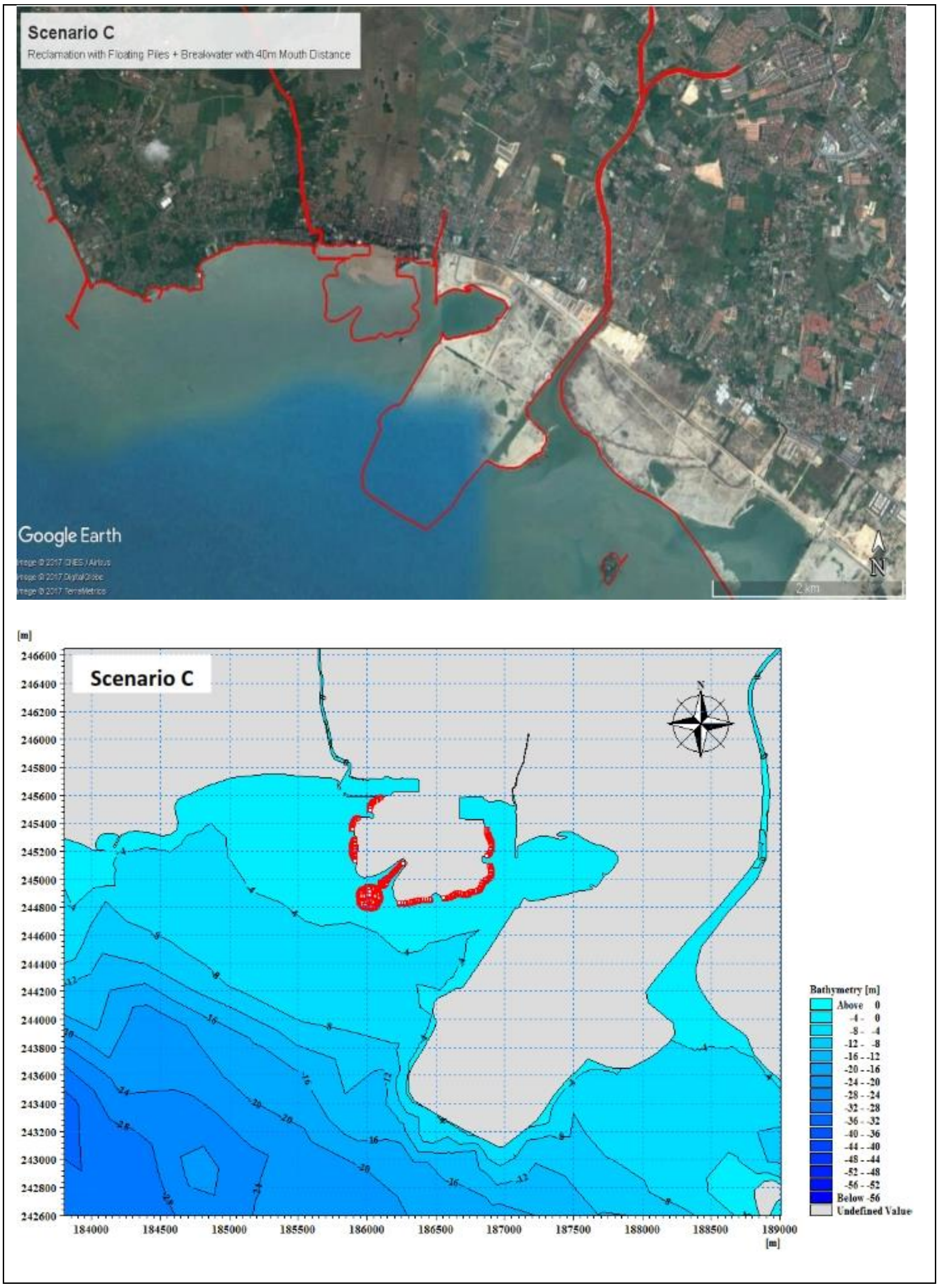


Figure 7-4 Scenario D with Bathymetry

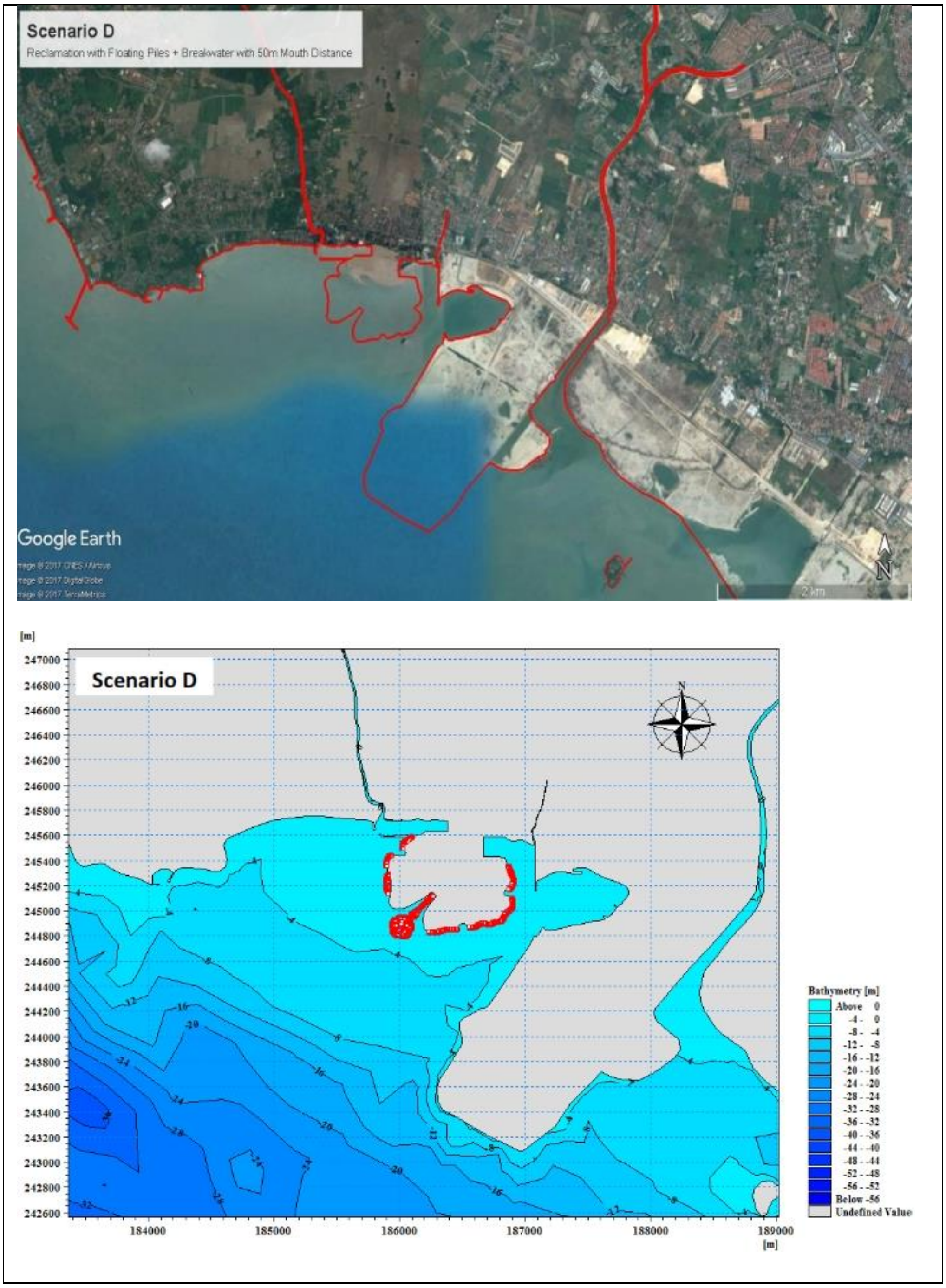


Figure 7-5 Proposed Reclamation Area with Floating Piles

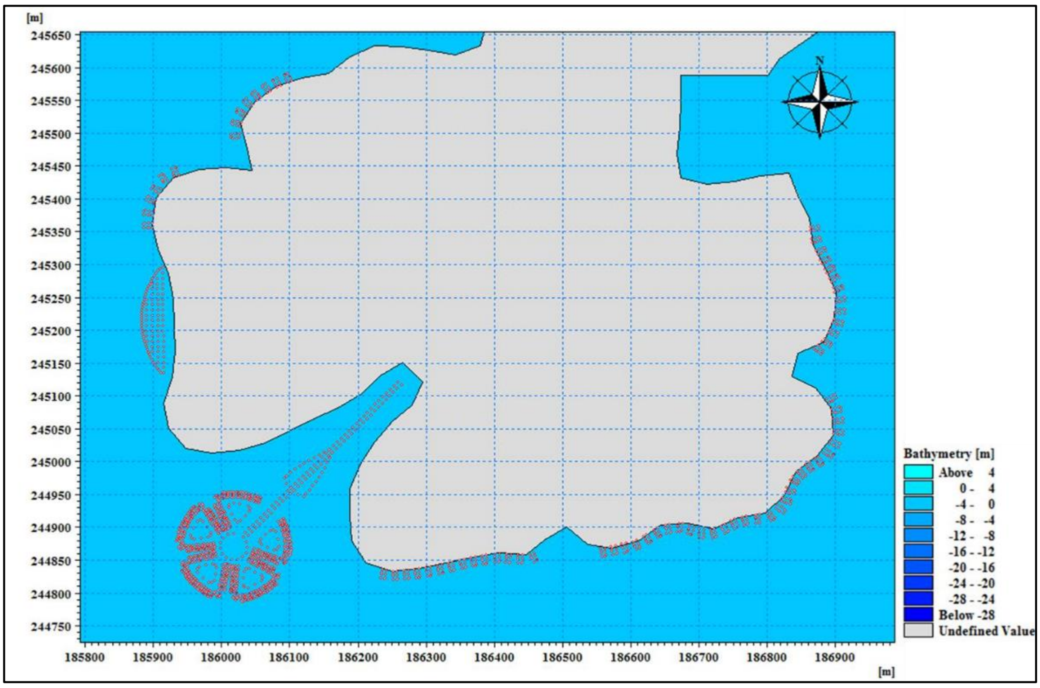


Figure 7-6 View of Floating Piles at Project Site (Left Side)

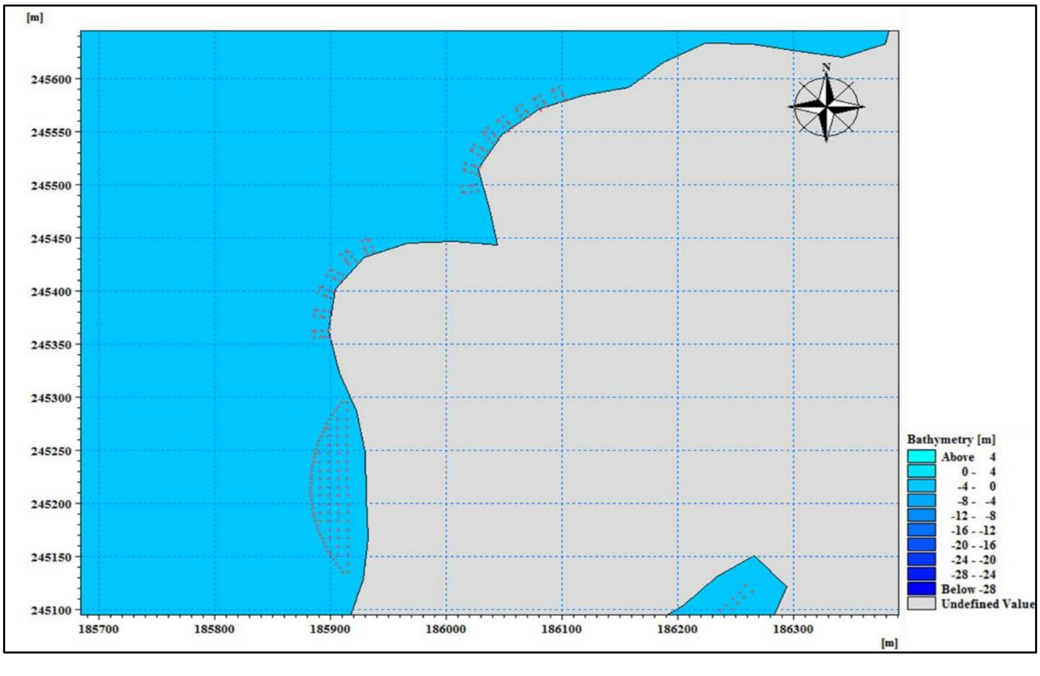


Figure 7-7 View of Floating Piles at Project Site (Centre)

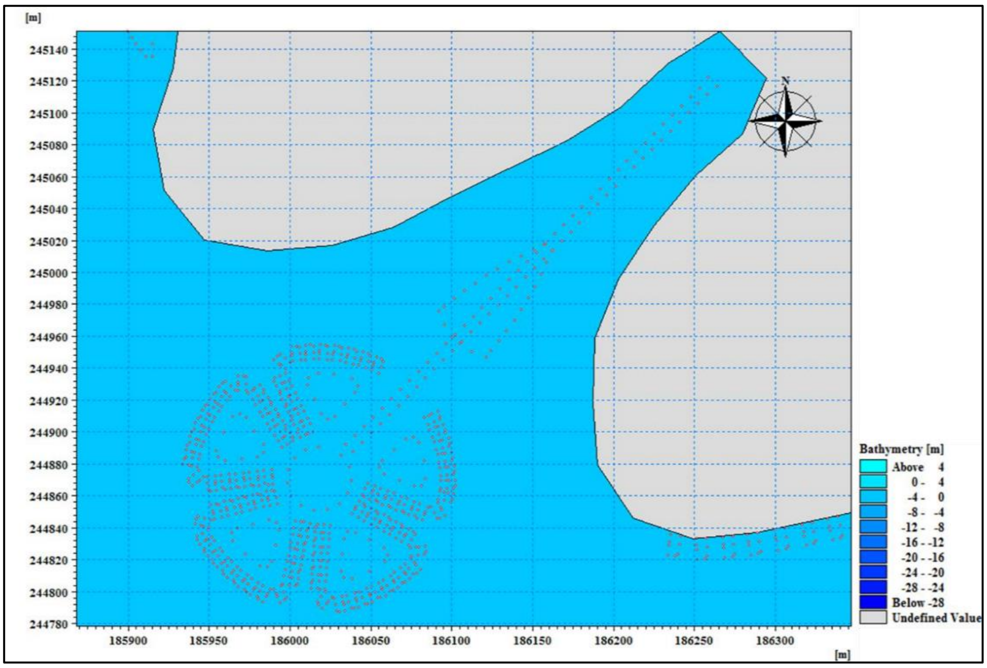
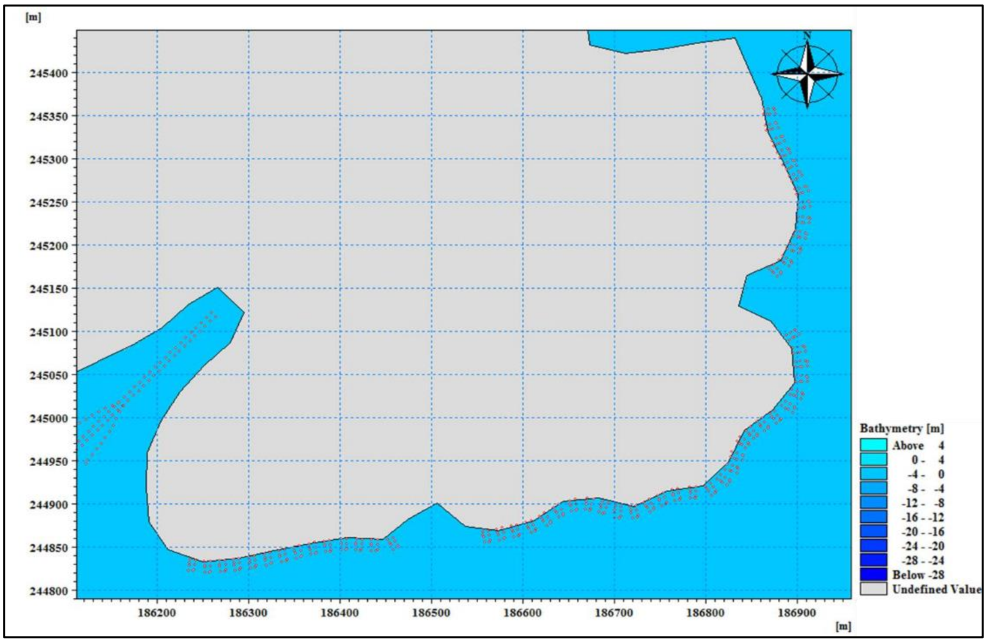


Figure 7-8 View of Floating Piles at Project Site (Right Side)



7.5.1.1 Impact on Current

Current flows have been predicted in the study area, this is based on the calibrated model MIKE 21 Flow Model. Current speeds are mainly induced by the tidal forcing and the bathymetry characteristics as well as by the wind action in the water surface. **Figure 7-9** to **Figure 7-12** show current speed for four options.

Figure 7-9 Maximum Current Speed during Northeast Monsoon

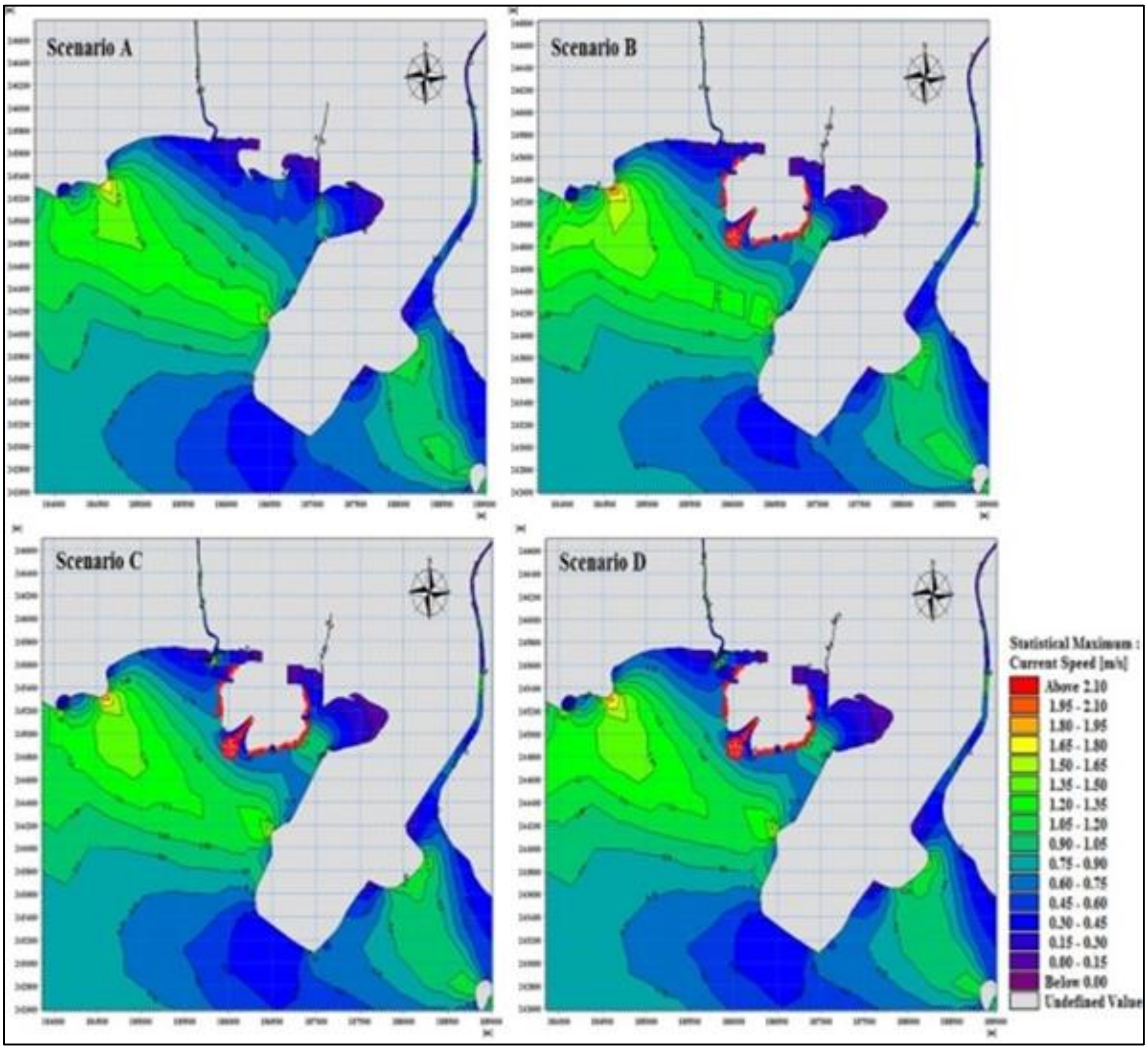


Figure 7-10 Mean Current Speed during Northeast Monsoon

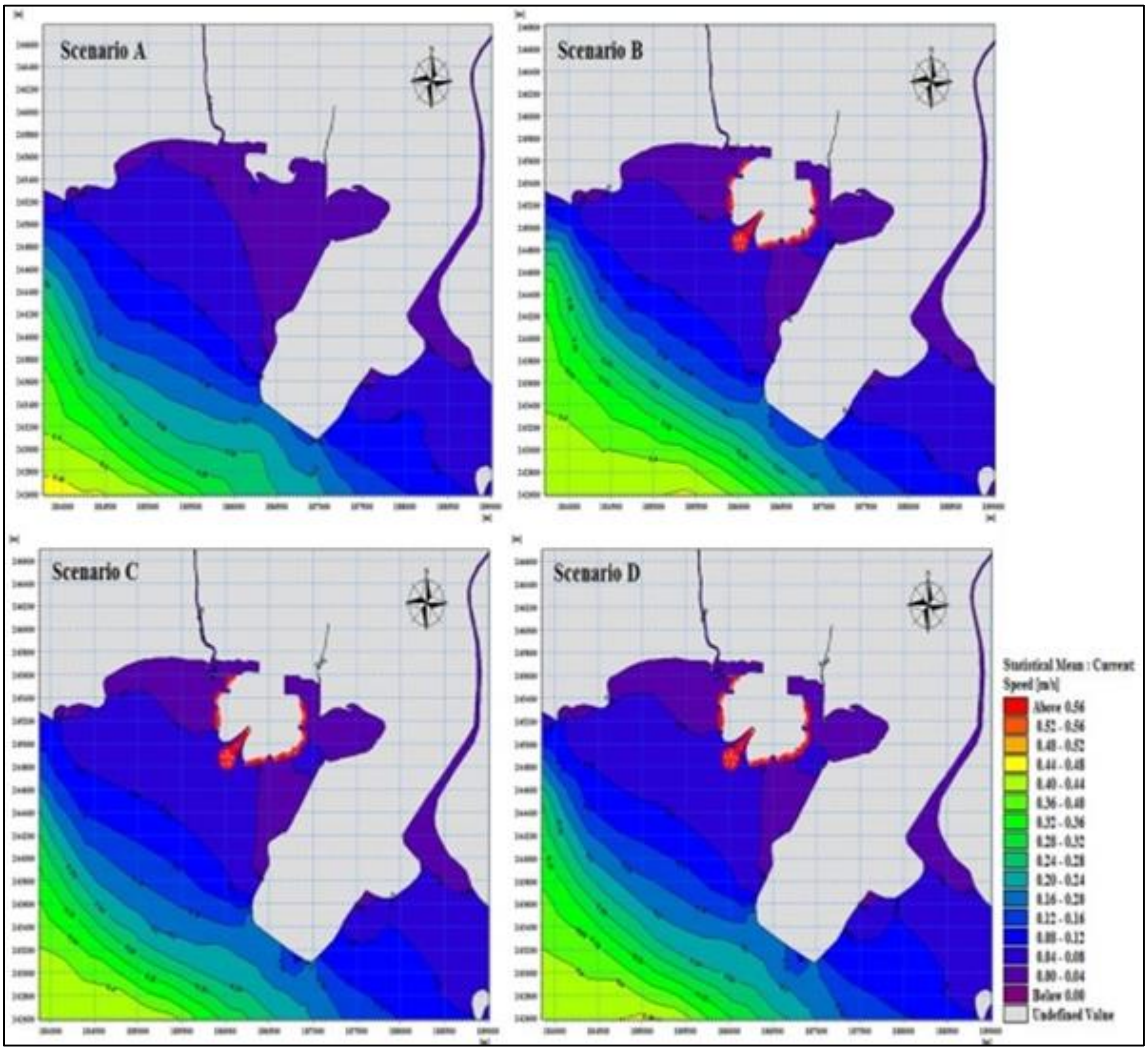


Figure 7-11 Maximum Current Speed during Southwest Monsoon

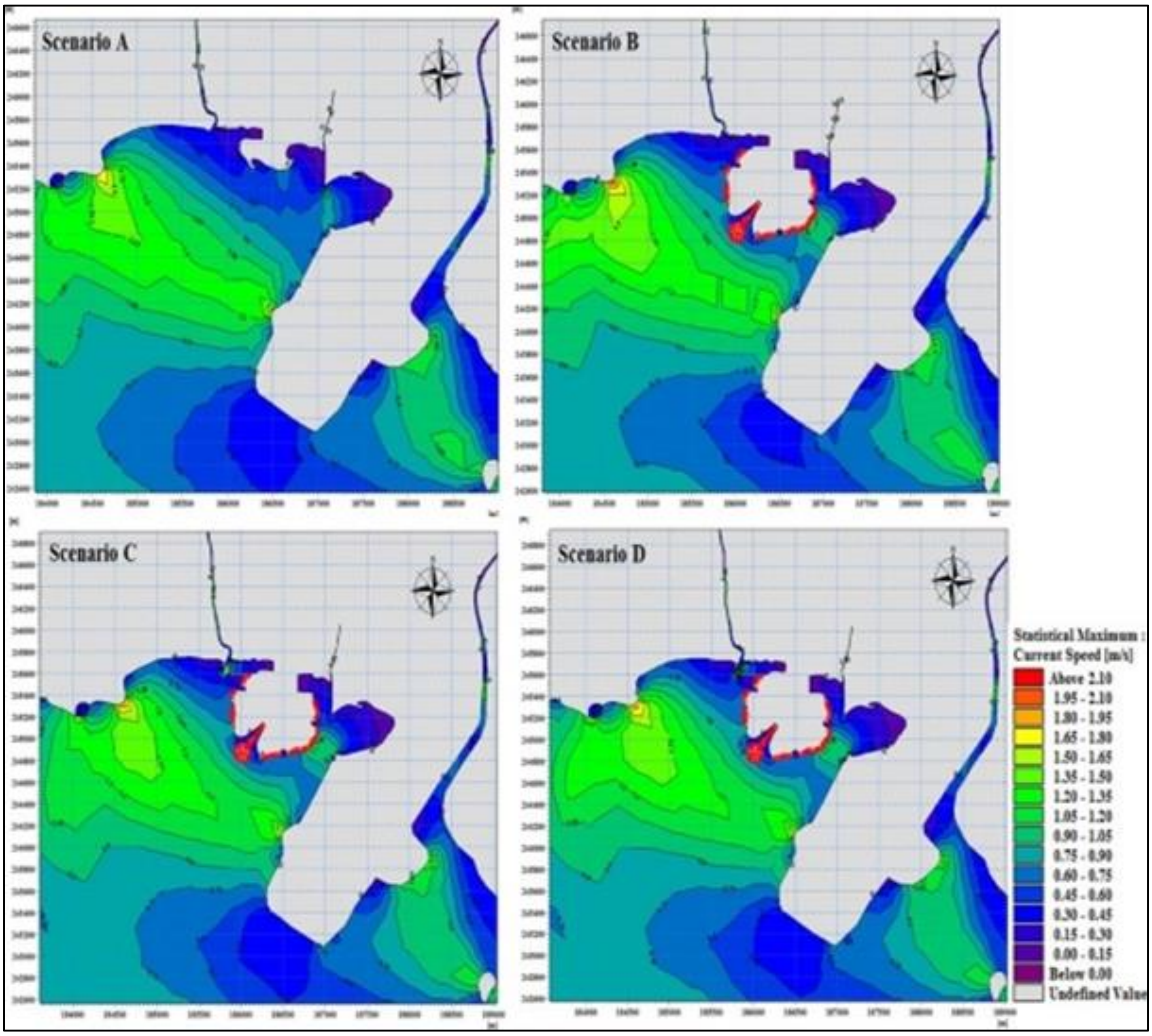
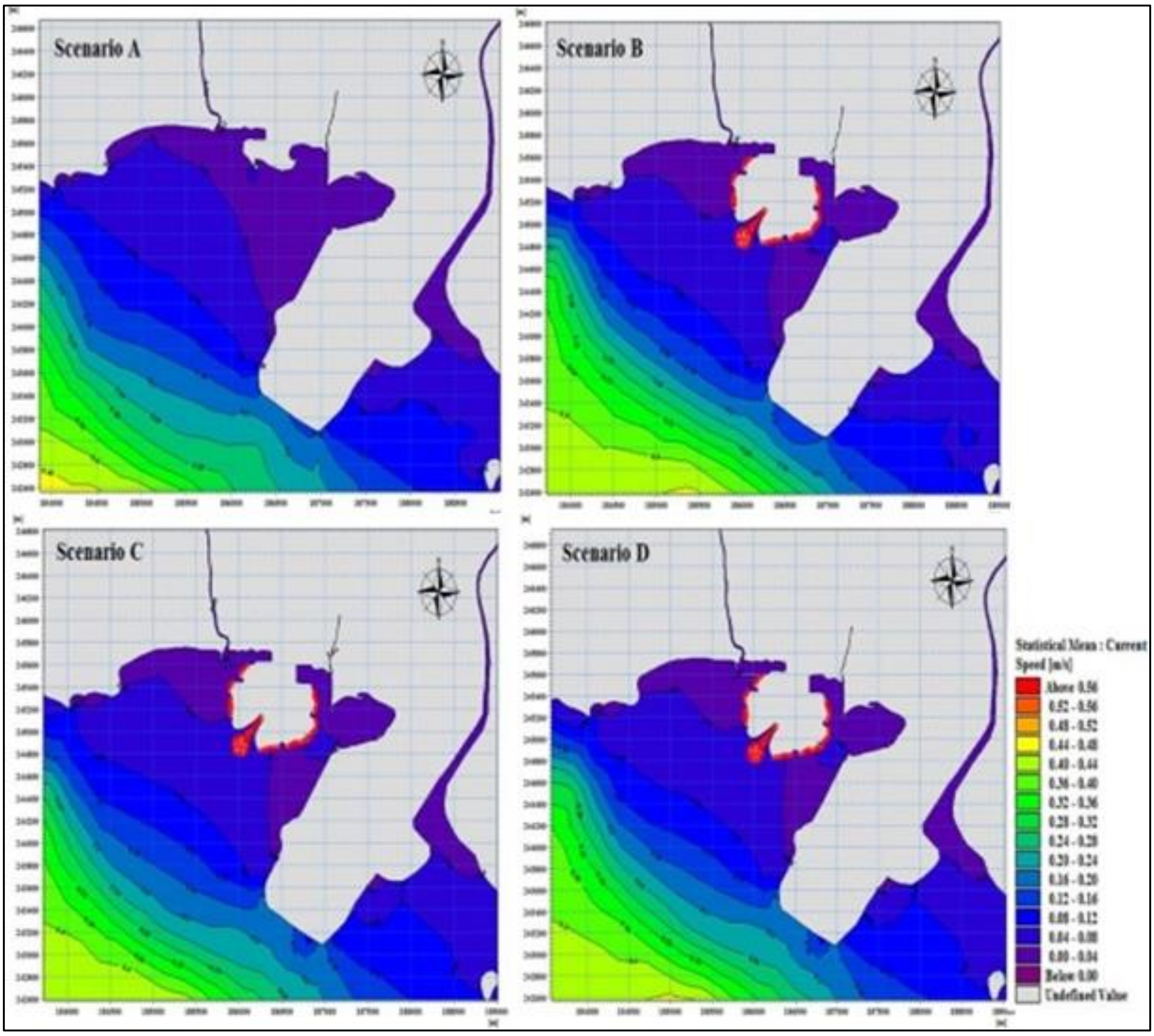


Figure 7-12 Mean Current Speed during Southwest Monsoon



7.5.1.2 Impact on Water Level

Water levels are produced by a combination of forces of which the two major components are gravitation forces and climatic effects that induce a variation of the tidal levels due the shear effect of the winds and/or regional barometric pressure fields. An assessment of water levels has been carried out to provide additional information on water levels around the project area that can be used to verify if the proposed reclamation work levels at Melaka are acceptable.

For this project the water level was simulated for two options considering the **Table 7-2** above and assessed the minimum and maximum of water levels at project site. Changes in water level are furnished in **Figure 7-13** to **Figure 7-16**. It is evident from the figures that the change in maximum water level is very small.

Figure 7-13 Minimum Water Plot during Northeast Monsoon

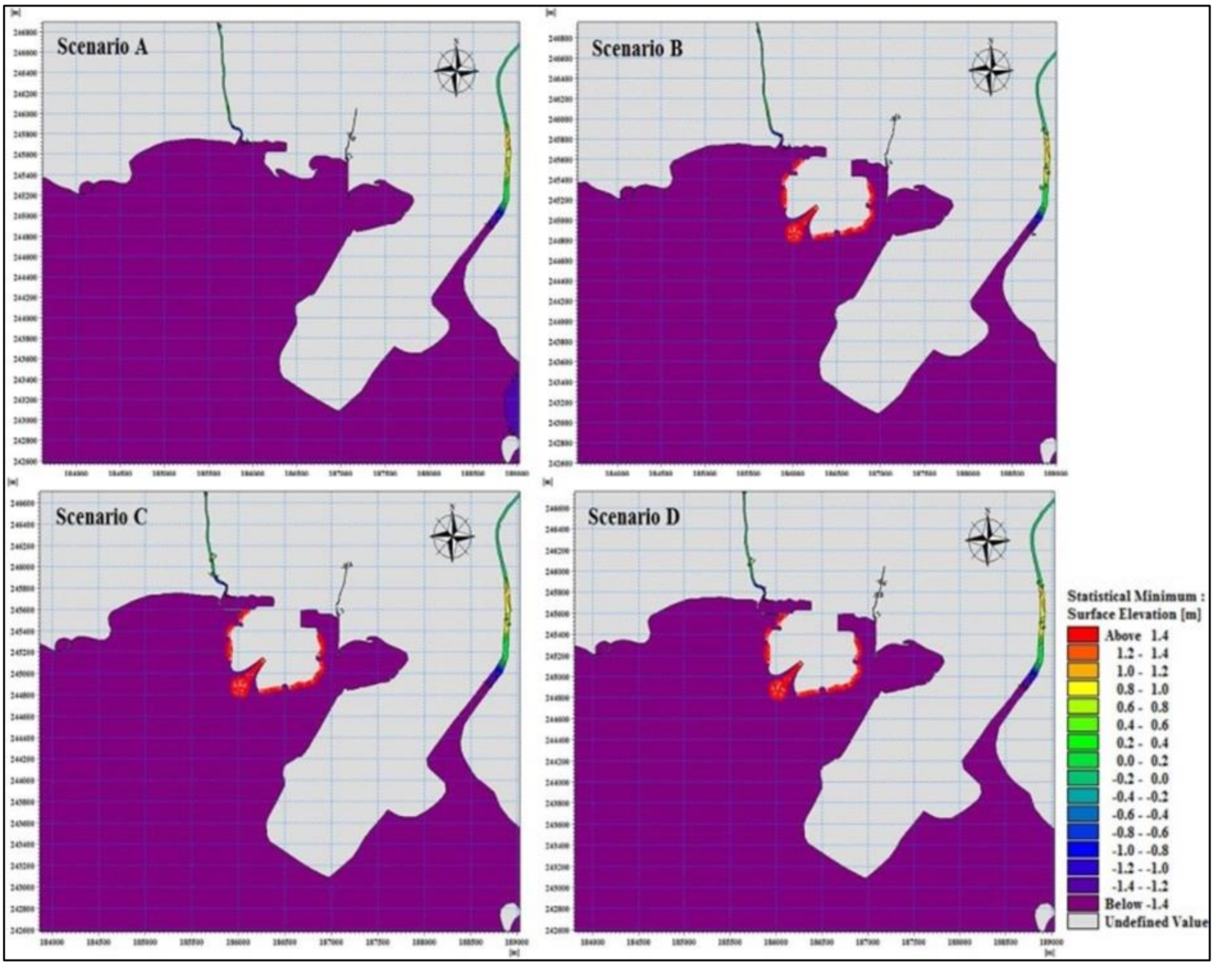


Figure 7-14 Maximum Water Plot during Northest Monsoon

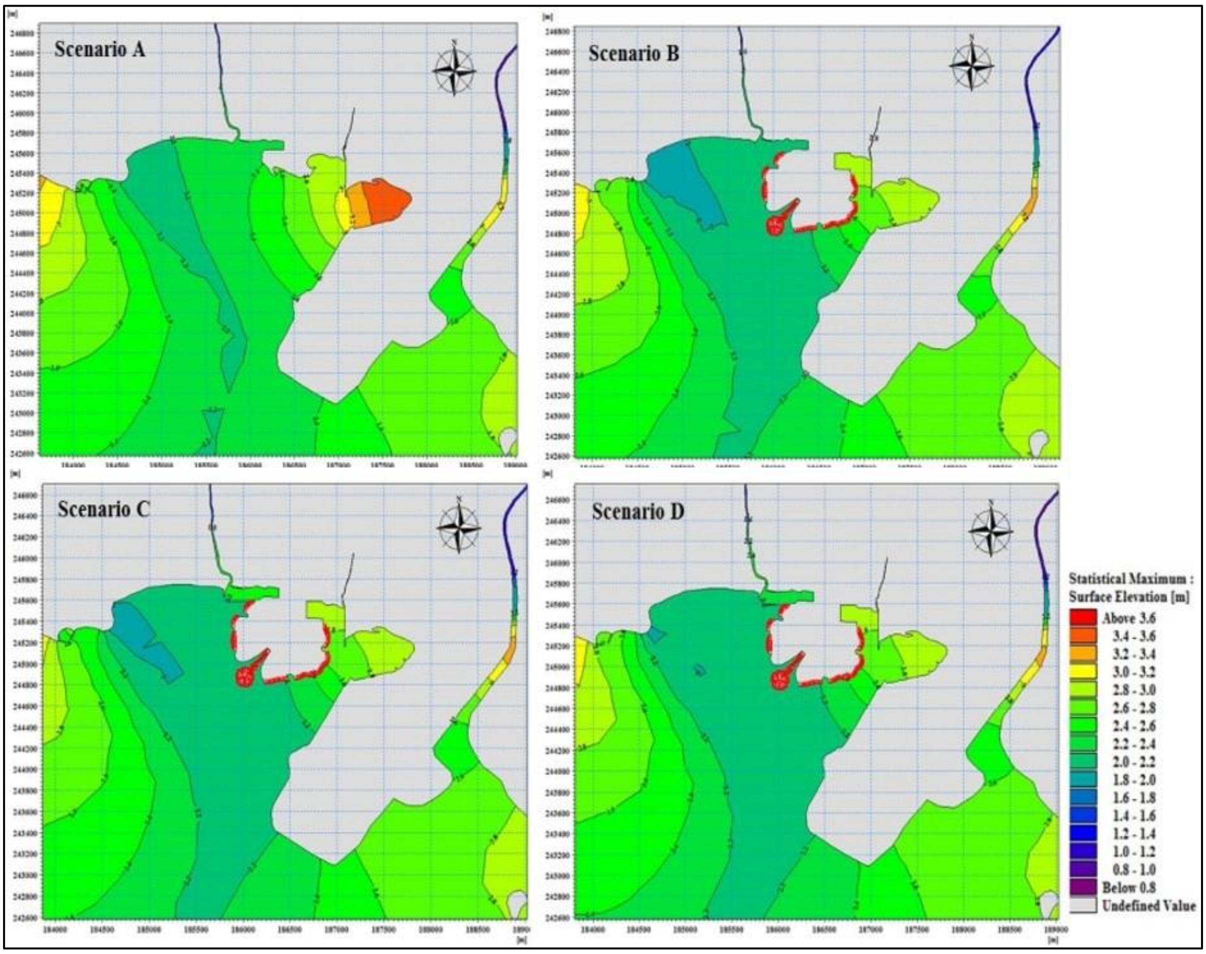


Figure 7-15 Minimum Water Plot during Southwest Monsoon

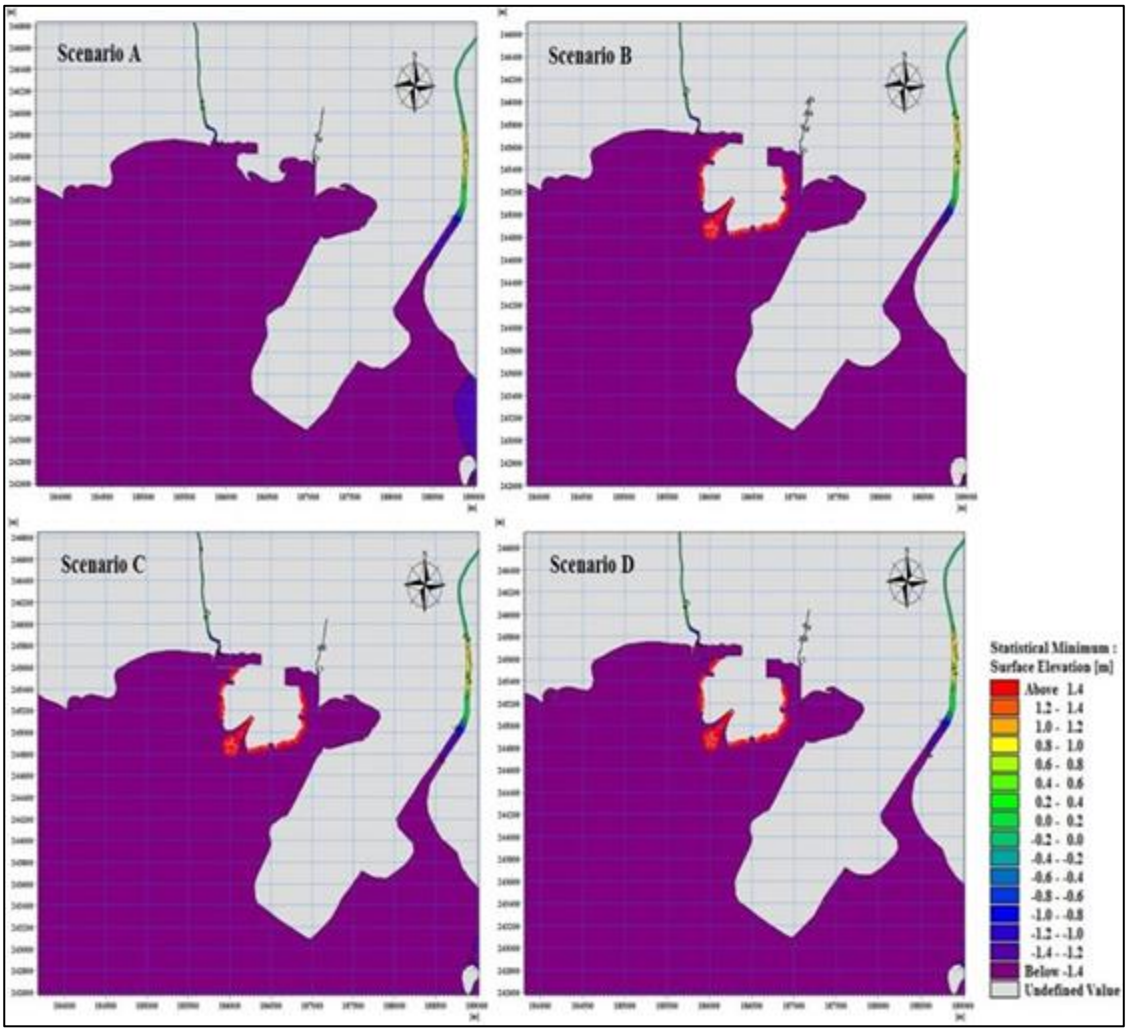
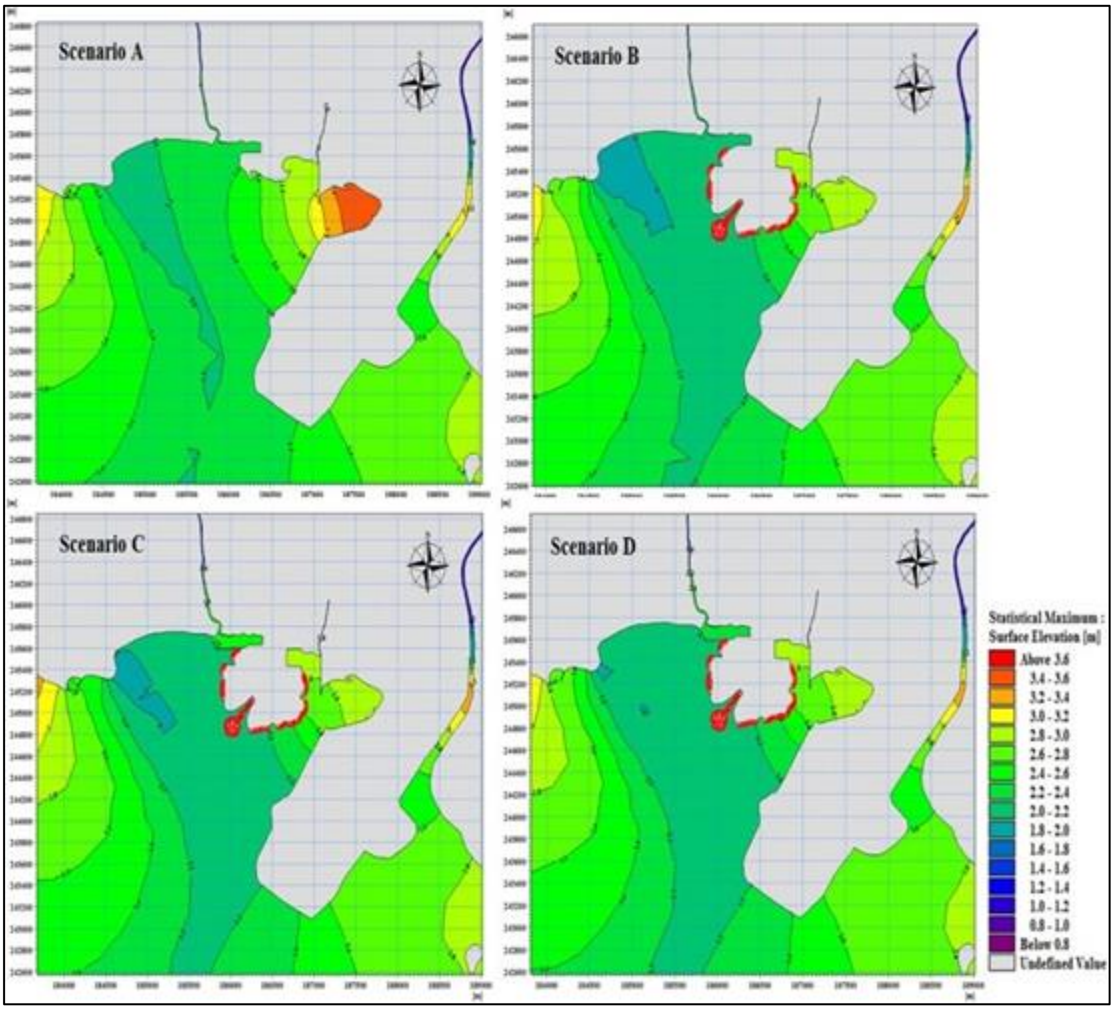


Figure 7-16 Maximum Water Plot during Southwest Monsoon



7.5.1.3 Impacts on Wave

The study of waves which would be experienced by the study area and with the proposed area is carried out using the Spectral Wave model. Wave modelling was carried out for the existing condition in this section. Two options were carried out for reclamation purposes. **Figure 7-17** to **Figure 7-18** show the wave modelling results of significant wave height and mean wave direction for before and after reclamation work. The results indicate that wave heights ranges between 0.06 m to 0.42 m depending on the wave directions. In order to provide an overview of the wave conditions at the reclaimed location, wave results have been extracted from regional wave condition. It can be observed maximum significant wave height is 0.42 m. Options were presented to provide an understanding of the basic characteristics of waves around the project site.

Figure 7-17 Significant Wave Heights Plot during Northeast Monsoon

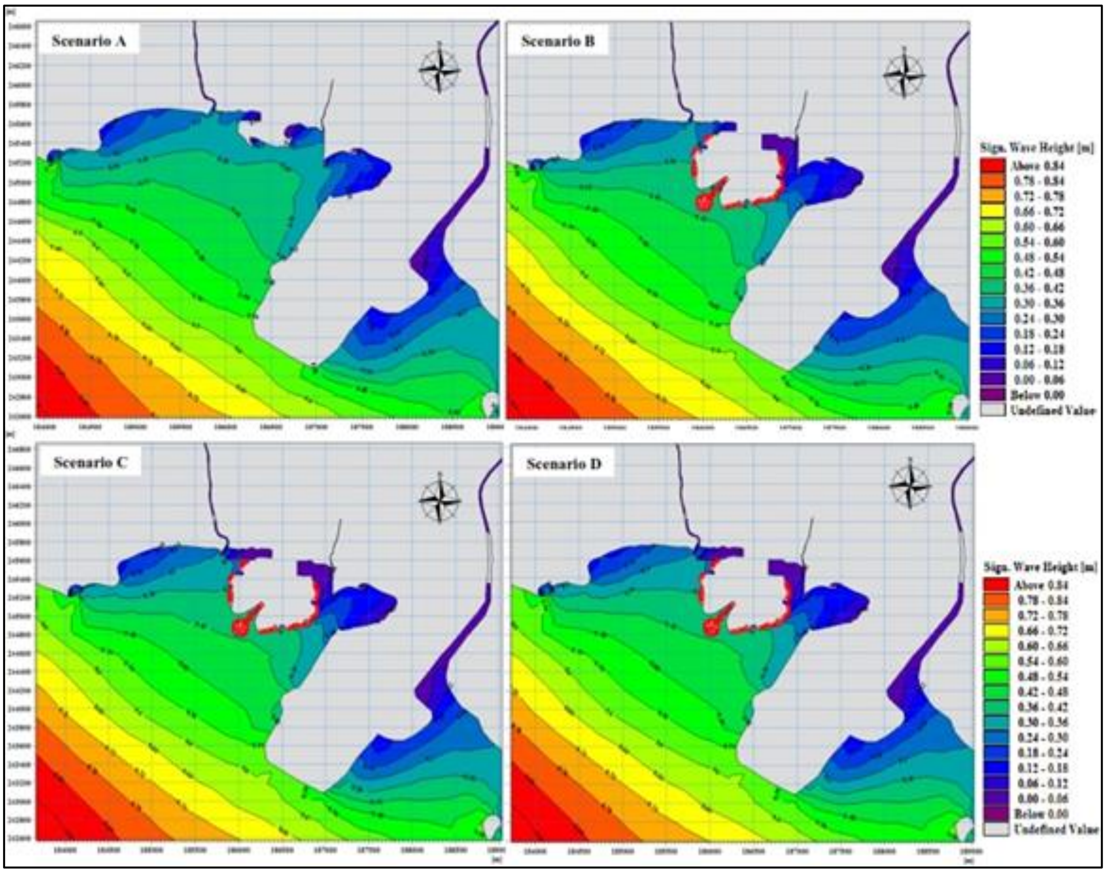
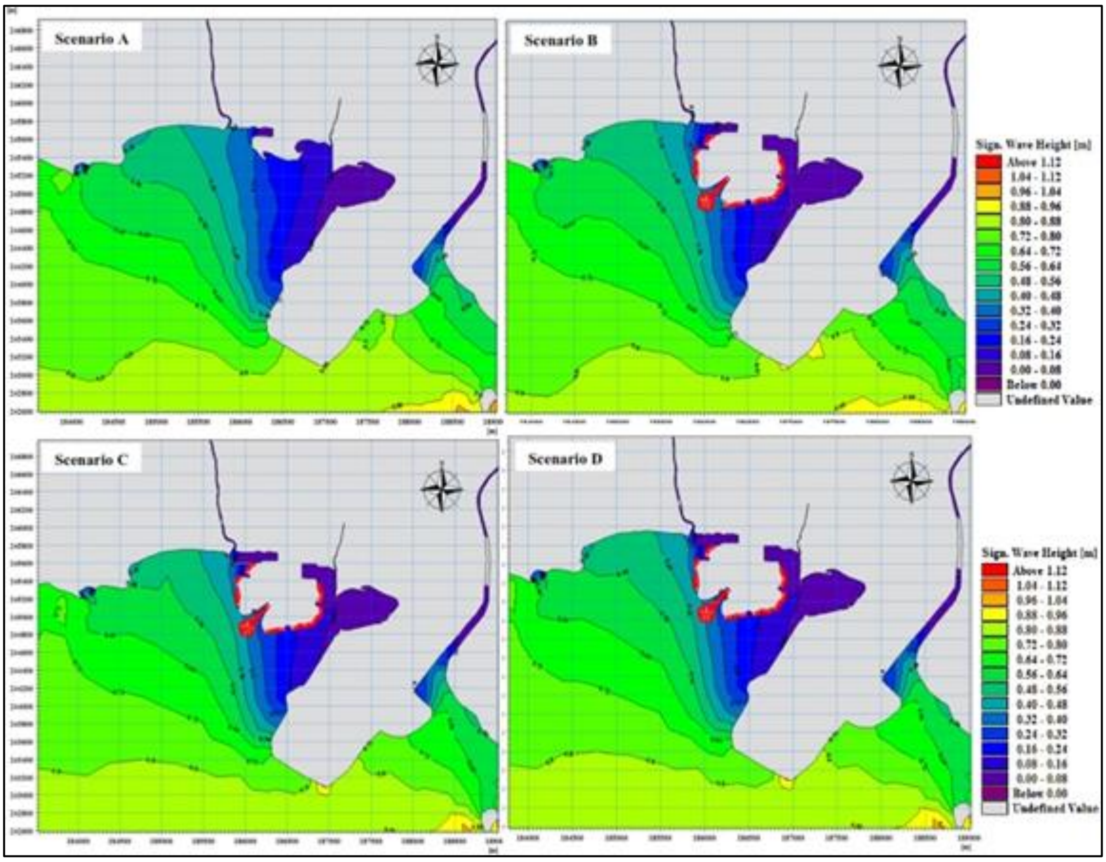


Figure 7-18 Significant Wave Heights Plot during Southwest Monsoon



7.5.1.4 Impact on Mud Transport

Impact on erosion and deposition change is also assessed for two options and provided in **Figure 7-19** to **Figure 7-20.** It is found that the project site may experience absence of erosion during existing condition and after reclamation. For each scenarios, it has been calculated the mean values of the total bed thickness change of the modelled area during the full period of simulation. The obtained map for the different scenarios exhibits very small differences. It is clear from the model result that after reclamation not much impact on morphological change during the study period.

Figure 7-19 Bed Thickness Changes Plot during Northeast Monsoon

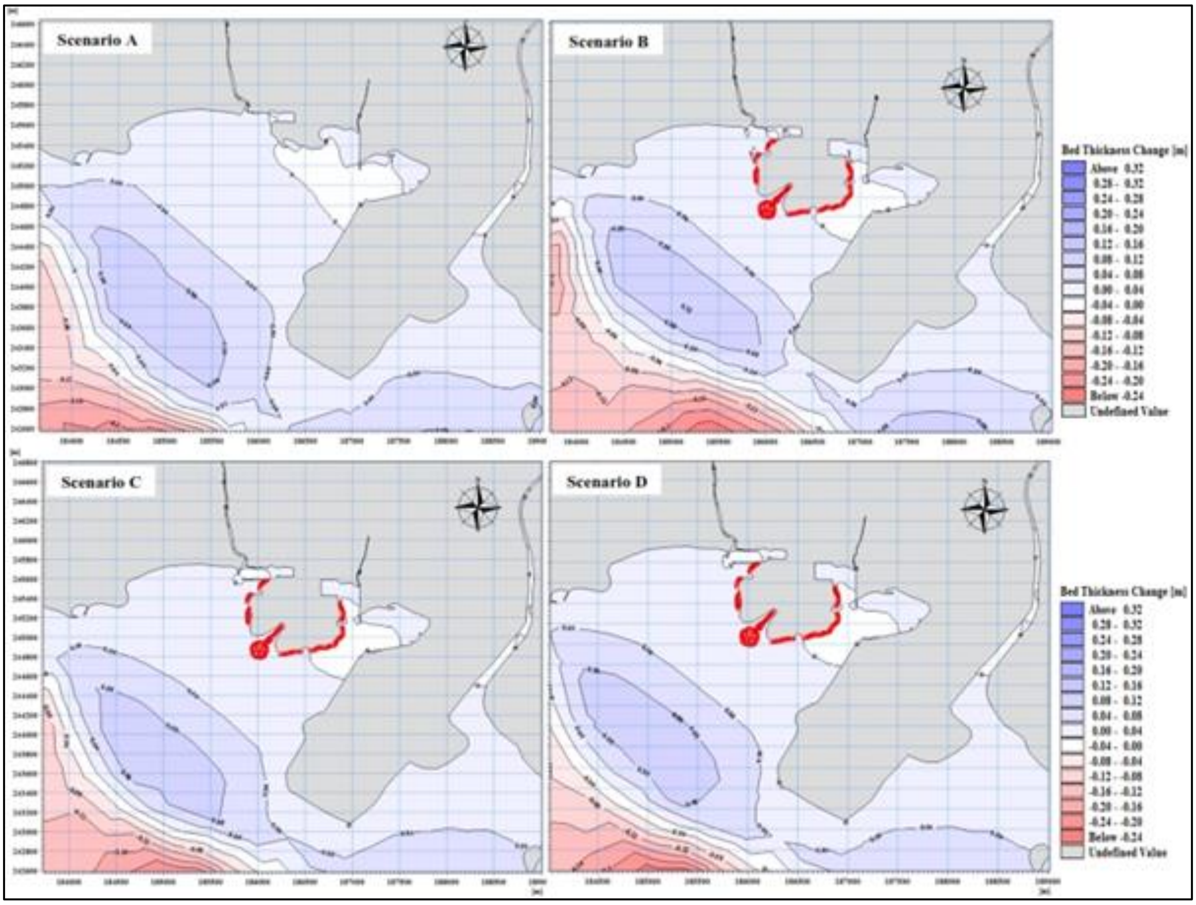
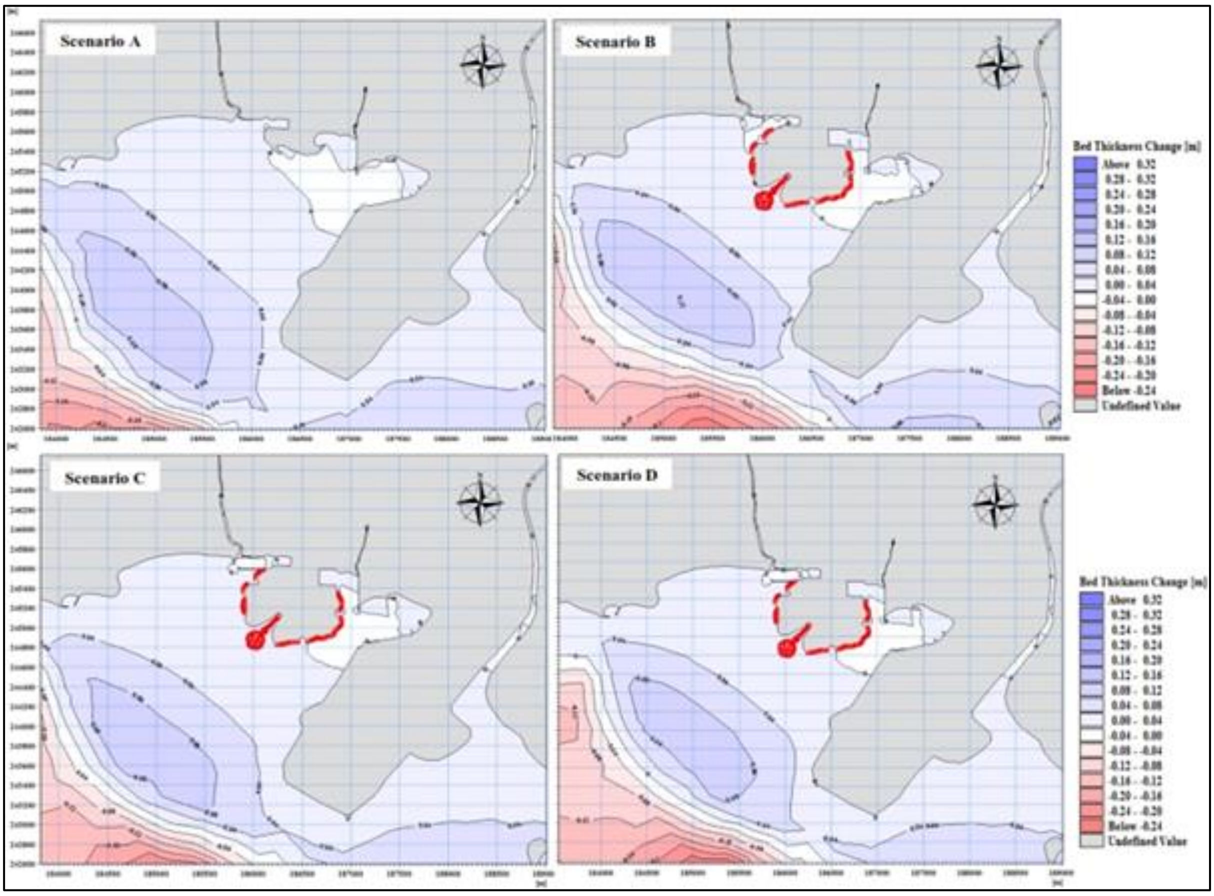


Figure 7-20 Bed Thickness Changes Plot during Southwest Monsoon



7.5.1.5 Conclusion on Hydrodynamic Study

The main objective of the project is to assess the impact of reclamation on the hydrodynamic and morphological condition at and around the project site. To accomplish the stated objective, state-of-art numerical model was developed, calibrated and validated. Hydrodynamic model was developed to assess the change in water level and current speed pattern during and after the completion of reclamation work. Whereas morphological model was developed to assess the change in erosion and deposition. Four different options were devised based on this Reclamation Project and the scenarios are

- Scenario-A - Baseline condition;
- Scenario-B - Reclamation (with floating piles);
- Scenario-C - Reclamation (with floating piles) + Breakwater (40m mouth distance); and
- Scenario-D - Reclamation (with floating piles) + Breakwater (50m mouth distance)

Considering the pattern of wind and wave characteristics in the Strait of Melaka, two different monsoon were devised. Both the hydrodynamic and morphological models and four scenarios were simulated for two monsoons to assess the impact of the reclamation work. Models were also simulated with silt curtain to assess whether it is effective or not.

In term of hydrodynamic processes, it can be concluded that the proposed reclamation at Melaka appears to have insignificant impacts for proposed area. Based on the simulation, it is clear that the reclamation works will not create any significant changes nearby the project site. The results from the study of the reclamation works may cause no significant changes in the pattern of mean and maximum current speed at and around the project site. Tables below show the summary of simulation around the project site. The morphological model results show that there will be no significant change in erosion and deposition if the reclamation work continues for a long duration for both the scenarios. Based on the simulation results, there is no significant breakwater effect due to the reclamation at the project site. By installing single layer silt curtain, the sediment dispersion plume is restricted within the reclamation area. It indicates that a continuous monitoring is needed at some specific locations nearby the project site.

Table 7-3 Summary of Simulation Results – Northeast Monsoon

Scenario	Monsoon	Current Speed		Water Level		Bed Thickness Change
		Mean (m/s)	Maximum (m/s)	Minimum (m)	Maximum (m)	(m/mth)
Scenario-A (Baseline Condition)	NE	0.00 to 0.08	0.00 to 1.20	- 1.4 to – 1.2	2.2 to 3.2	0.00 to 0.04
Scenario-B (Reclamation)	NE	0.00 to 0.08	0.00 to 1.20	- 1.4 to – 1.2	2.2 to 2.8	0.00 to 0.04
Scenario-C (Rec+Breakwater+40m)	NE	0.00 to 0.08	0.00 to 1.80	-1.4 to -1.2	2.2 to 2.8	0.00 to 0.04
Scenario-D (Rec+Breakwater+50m)	NE	0.00 to 0.08	0.00 to 1.65	-1.4 to -1.2	2.2 to 2.8	0.00 to 0.04
Scenario-A Vs Scenario-B	NE	-0.015 to 0.000	-0.4 to 0.00	-1.35 to 0.00	-0.50 to 0.00	0.00 to 0.00
Scenario-A Vs Scenario-C	NE	-0.015 to 0.000	-0.4 to 0.80	-1.20 to 0.00	-0.50 to 0.00	-0.02 to 0.00
Scenario-A Vs Scenario-D	NE	-0.015 to 0.000	-0.4 to 0.80	-1.20 to 0.00	-0.50 to 0.00	-0.02 to 0.00

Table 7-4 Summary of Simulation Results – Southwest Monsoon

Scenario	Monsoon	Current Speed		Water Level		Bed Thickness Change
		Mean (m/s)	Maximum (m/s)	Minimum (m)	Maximum (m)	(m/mth)
Scenario-A (Baseline Condition)	SW	0.00 to 0.08	0.00 to 1.20	- 1.4 to – 1.2	2.2 to 3.2	0.00 to 0.04
Scenario-B (Reclamation)	SW	0.00 to 0.08	0.00 to 1.20	- 1.4 to – 1.2	2.2 to 2.8	0.00 to 0.04
Scenario-C (Rec+Breakwater+40m)	SW	0.00 to 0.08	0.00 to 1.80	-1.4 to -1.2	2.2 to 2.8	0.00 to 0.04
Scenario-D (Rec+Breakwater+50m)	SW	0.00 to 0.08	0.00 to 1.65	-1.4 to -1.2	2.2 to 2.8	0.00 to 0.04
Scenario-A Vs Scenario-B	SW	-0.015 to 0.000	-0.4 to 0.00	-1.35 to 0.00	-0.50 to 0.00	0.00 to 0.00
Scenario-A Vs Scenario-C	SW	-0.015 to 0.000	-0.4 to 0.80	-1.20 to 0.00	-0.50 to 0.00	-0.02 to 0.00
Scenario-A Vs Scenario-D	SW	-0.015 to 0.000	-0.4 to 0.80	-1.20 to 0.00	-0.50 to 0.00	-0.02 to 0.00

7.5.2 Sediment Plume Dispersion

The plume dispersion study were carried out for southwest monsoon. The purpose of the sediment dispersion study is to investigate the movement of suspended sediments during the filling process for reclamation. This is to simulate conditions during the period of the works being carried out. The levels of suspended sediment concentration are assessed to determine potential impact to the surroundings. Sediment plumes originating from the reclamation operation were simulated. Two scenarios were investigated, with silt curtain and without silt curtain during reclamation works. Silt curtain are able to control the dispersion of turbid water by diverting the flow under the curtain, thereby minimizing turbidity in the upper layer of the water column outside the silt curtain.

The spill rate and the total spill will be highly dependent upon work procedures, scheduling and reclaimed material characteristics. Each conveyor barge with a capacity of 1,250 m^3 is assumed to operate for 12 hours (from 7 am to 6 pm) on a daily basis. Each barge has a pumping rate of 0.1 m^3/s. The spill concentration is 4.2 kg/m^3 for without silt curtain condition and 0.8 kg/m^3 for with silt curtain condition. Results from the spill are presented in maximum and minimum suspended sediment concentrations showing the extent and concentration over the simulation period for spring and neap tide. **Figure 7-21** to **Figure 7-24** show the minimum and maximum sediment dispersion extent pattern without and with silt curtain respectively during neap and spring tide. The maximum plume extent approximately up to 0.85 km during neap tide and 1.0 km during spring without installing silt curtain. Whereas with silt curtain the maximum plume reaches approximately 0.4 km during neap tide and 0.55 km during spring tide.

Figure 7-21 Minimum and Maximum Extent of Sediment Plume Dispersion Without Silt Curtain During Neap Tide

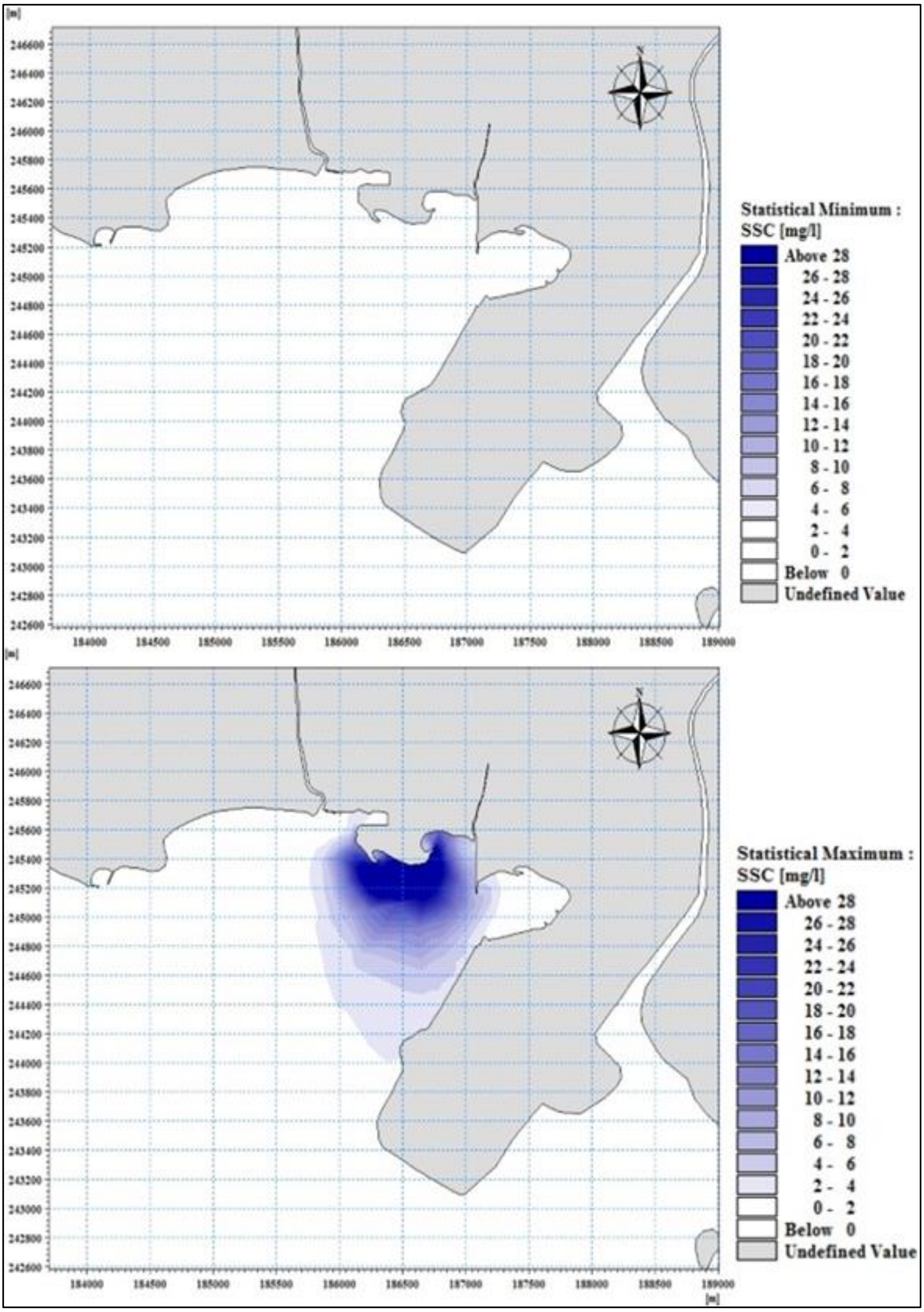


Figure 7-22 Minimum and Maximum Extent of Sediment Plume Dispersion with Silt Curtain During Neap Tide

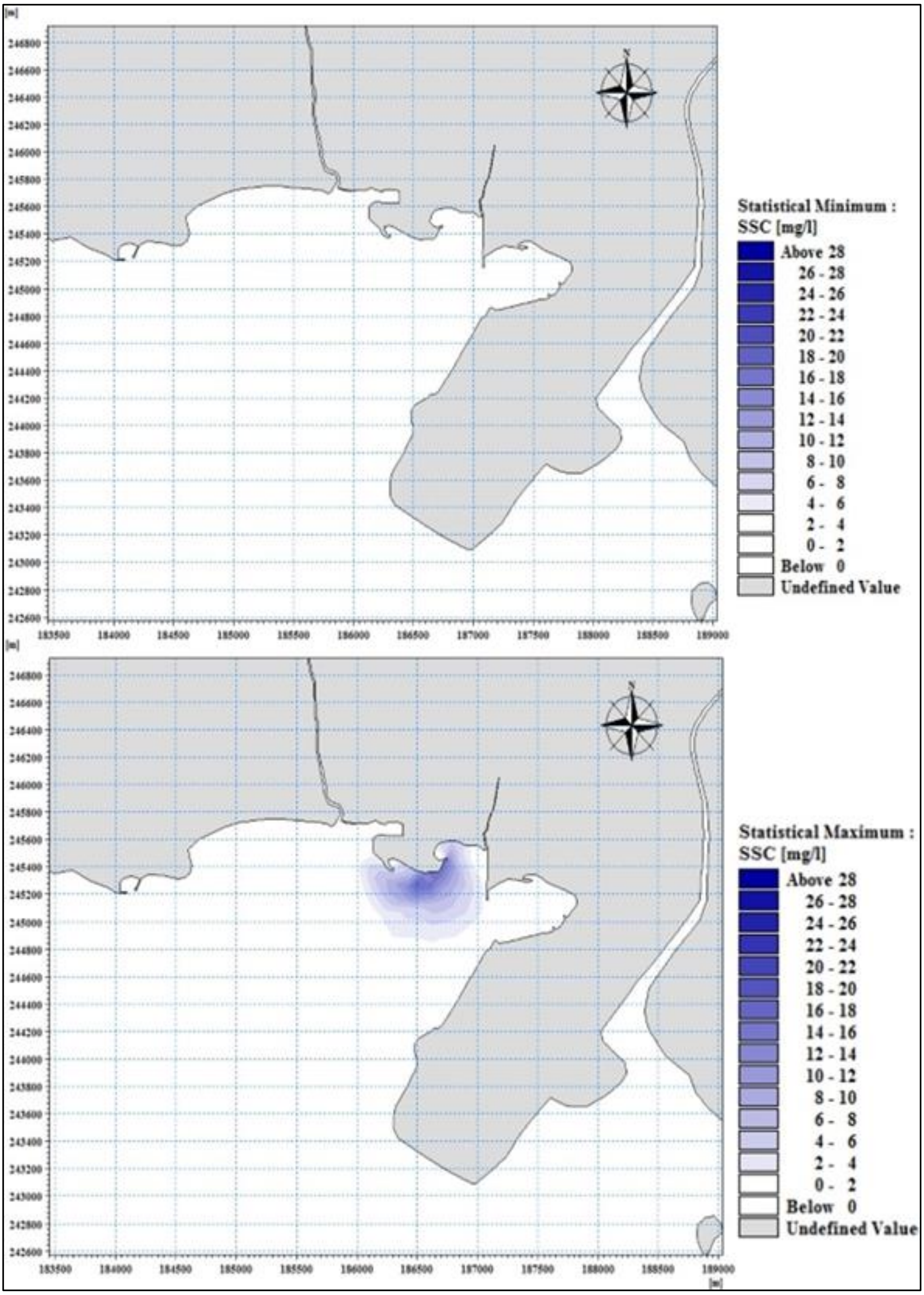


Figure 7-23 Minimum and Maximum Extent of Sediment Plume Dispersion without Silt Curtain during Spring Tide

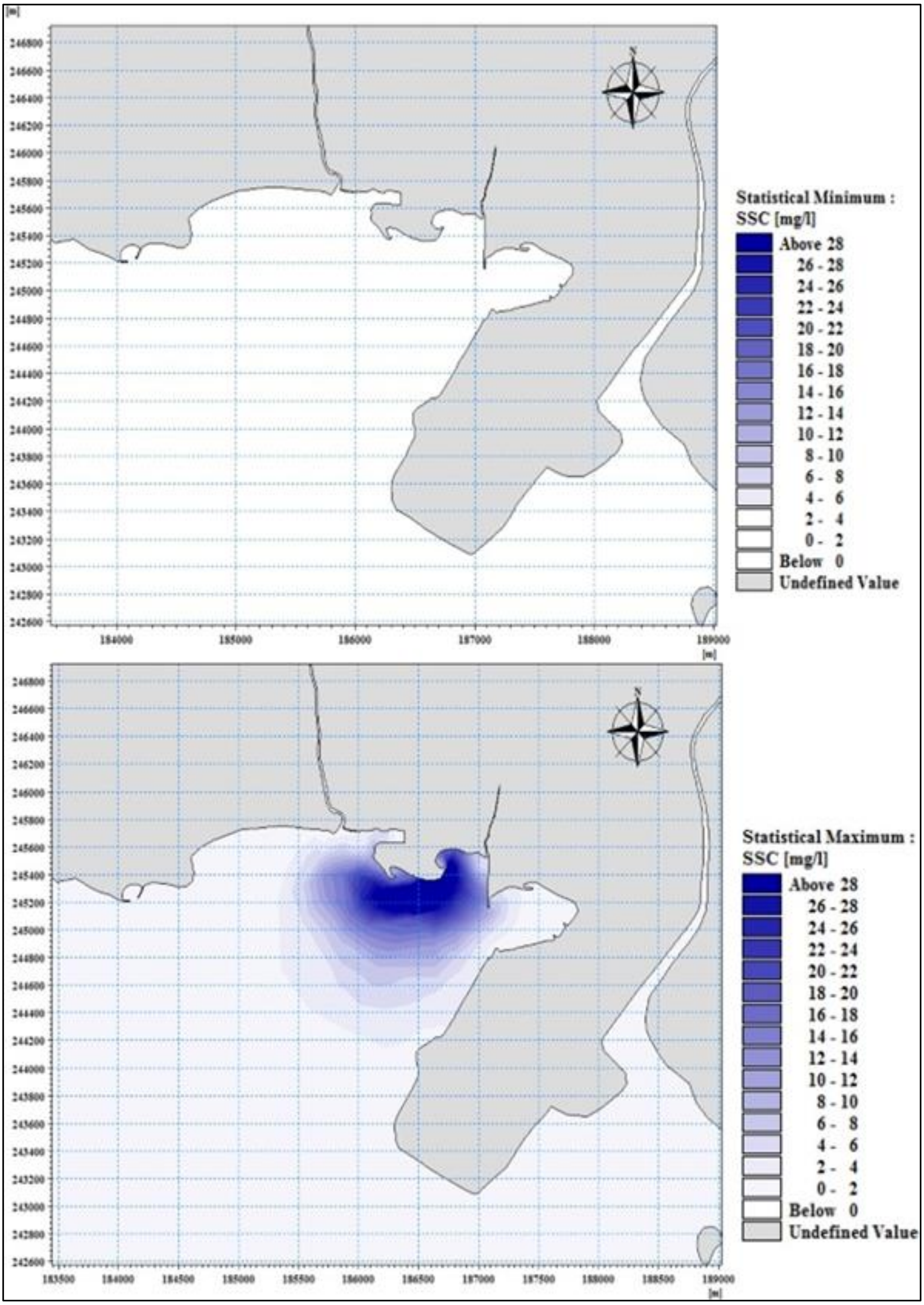
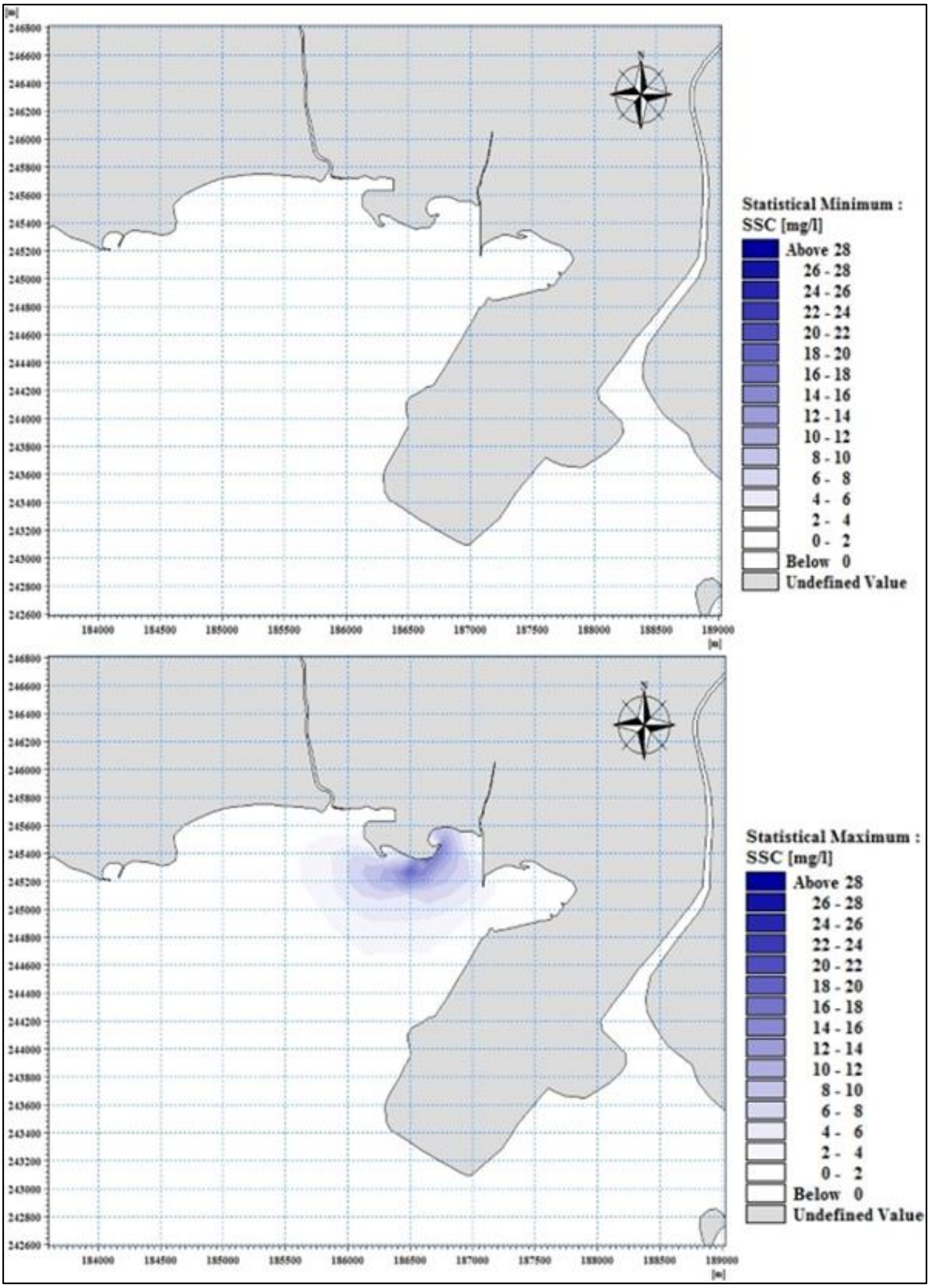


Figure 7-24 Minimum and Maximum Extent of Sediment Plume Dispersion with Silt Curtain during Spring Tide



7.5.3 Impacts on Sungai Lereh

Malacca State Economic Development Unit has requested the project proponent to build a breakwater at river mouth to protect Sungai Lereh river mouth from higher wave and strong current intrusion into Sungai Lereh. In order to ensure that there is no site effect to the river flow and backwater effect due to the construction of breakwater, JPS has requested to conduct a hydrology modelling work on Sungai Lereh, as one of the approval conditions (item vii) for the approved coastal hydralic study. The JPS's approval letter for the coastal hydraulic study is attached in **Appendix 7-1**. The objective of this study is to show that the proposed breakwater will not cause upstream flooding and hence, it's fulfilled the approval condition.

A hydrological model and a hydrodynamic model have been developed and simulated for the study using DHI's MIKE 11 NAM module. The whole Udang-Lereh catchment is depicted in **Figure 7-25** below while the proposed location for the breakwater and its cross-sections are provided in **Figure 7-26** and **Figure 7-27**, respectively.

The models were simulated for a domain around Malacca for different scenarios viz., Scenario A – Baseline condition comparing Scenario B – Reclamation (with floating piles) + Breakwater (50m mouth distance) as shown in **Table 7-5**. Two different monsoons were selected during this modelling study to assess the impact of proposed reclamation work at Malacca. These monsoons were selected based on the characteristics of wind and wave condition in the model boundaries.

Five-boundaries were defined as the boundary condition for the Sg Lereh, Malacca model area to analyze the impact of the reclamation and breakwater. Few scenarios, which are derived from the Average Recurrence Interval (ARI) from Mike 11 as stated in **Table 7-6** below were considered for the analysis and three points were chosen for data extraction to compare the backwater effect along the Sg. Lereh and Sg. Udang Down Stream, Mid-Stream and Up Stream as shown in **Figure 7-28** and **Figure 7-29**.

The results of the findings are summarised in subsections below while the full hydraulic study is appended in **Appendix 7-2**.

Table 7-5 Model Simulation for Two Scenarios with Different Monsoon

Scenarios	Monsoon	Wind Speed (m/s) and Direction (º) Conditions
Scenario-A (Baseline Condition)	Northeast	5.5 m/s and 300º
	Southwest	4.5 m/s and 150º
Scenario-B (Reclamation with Breakwater) (ARI : 5 years, 10 years, 25 years, 50 years and 100 years)	Northeast	5.5 m/s and 300º
	Southwest	4.5 m/s and 150º

Table 7-6 ARI from Mike 11 Analysis

Return Period (ARI)	Flow at Sg Lereh/ Sg Udang Upstream (m^3/s)
100 yr	38.5
50 yr	35.2
25 yr	31.85
10 yr	27.3
5 yr	23.65
2 yr	18.0

Figure 7-25 Udang-Lereh Catchment

Figure 7-26 Proposed Location of Breakwater around Sg.Lereh River Mouth

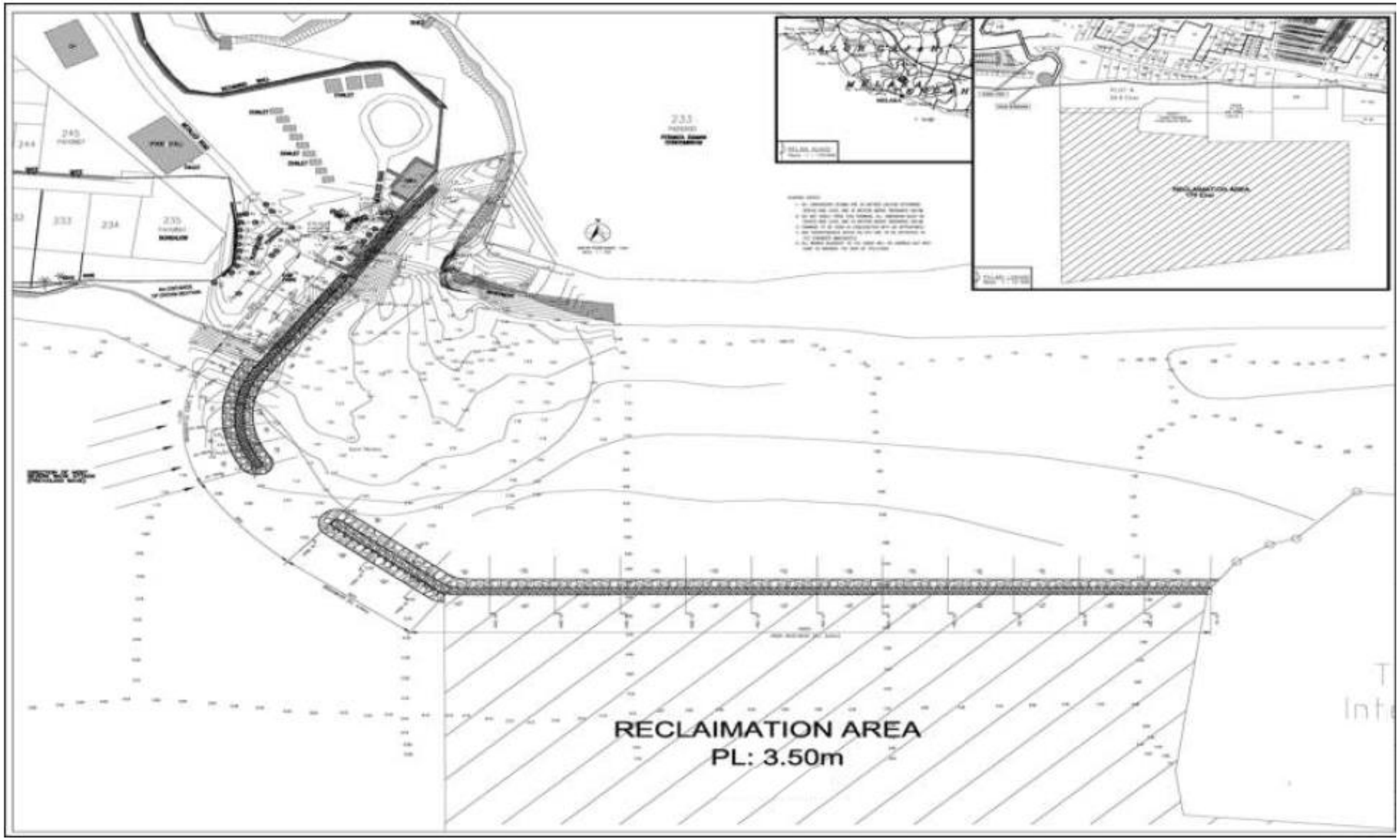


Figure 7-27 Cross-section of Breakwater

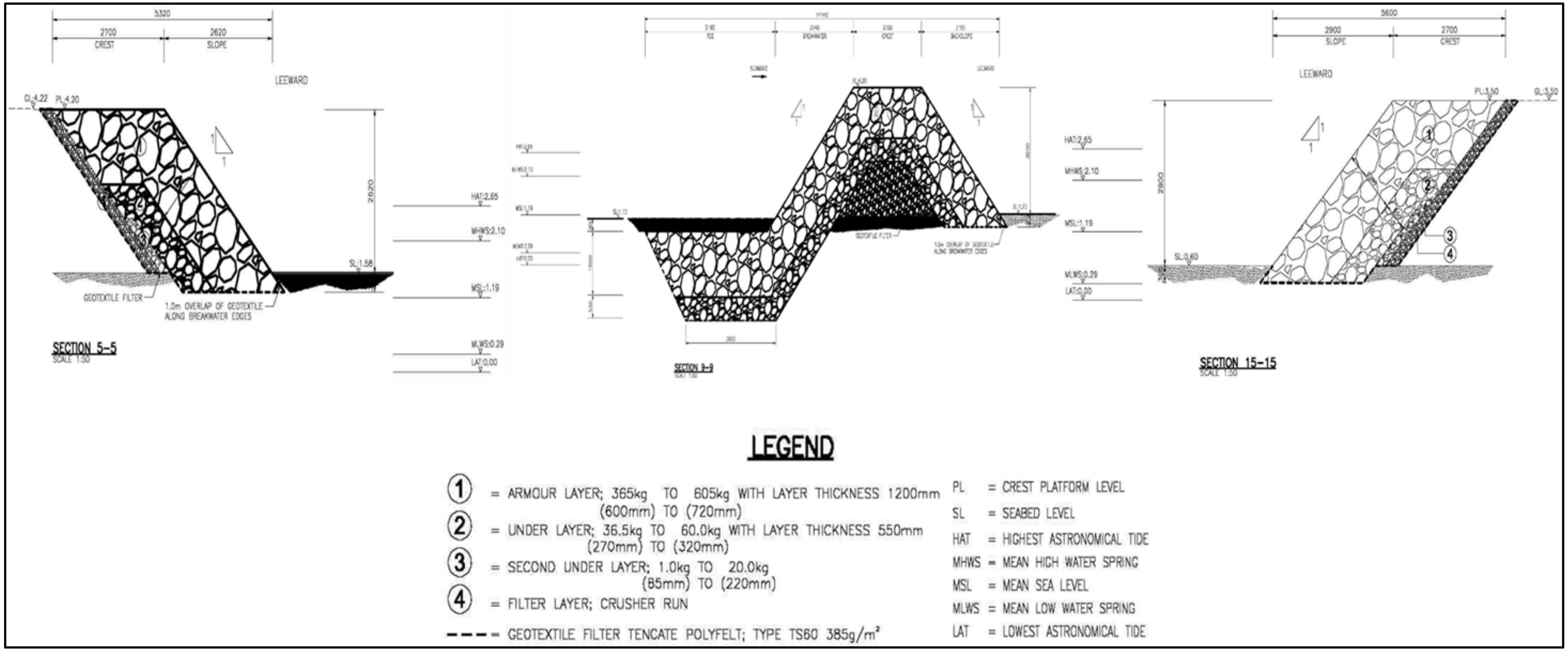


Figure 7-28 Data Extraction Boundary for Baseline Model (Scenario A)

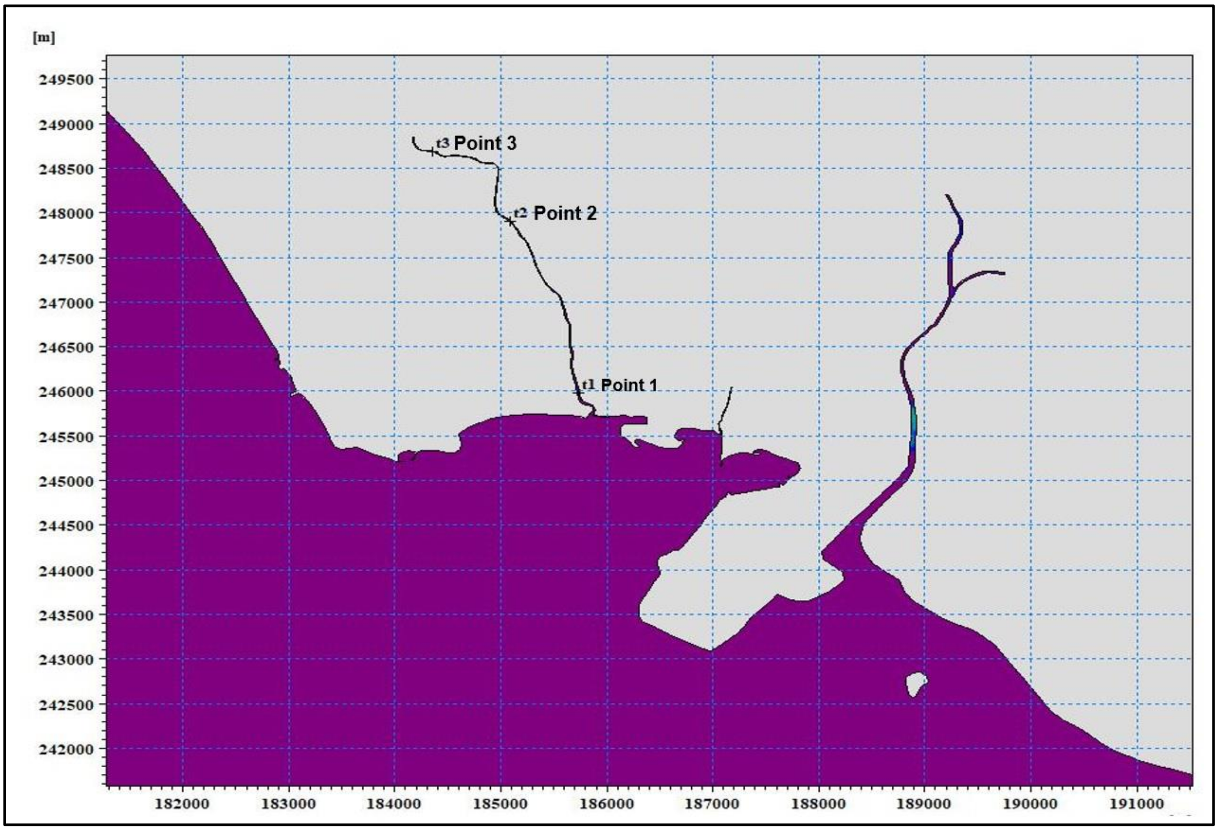
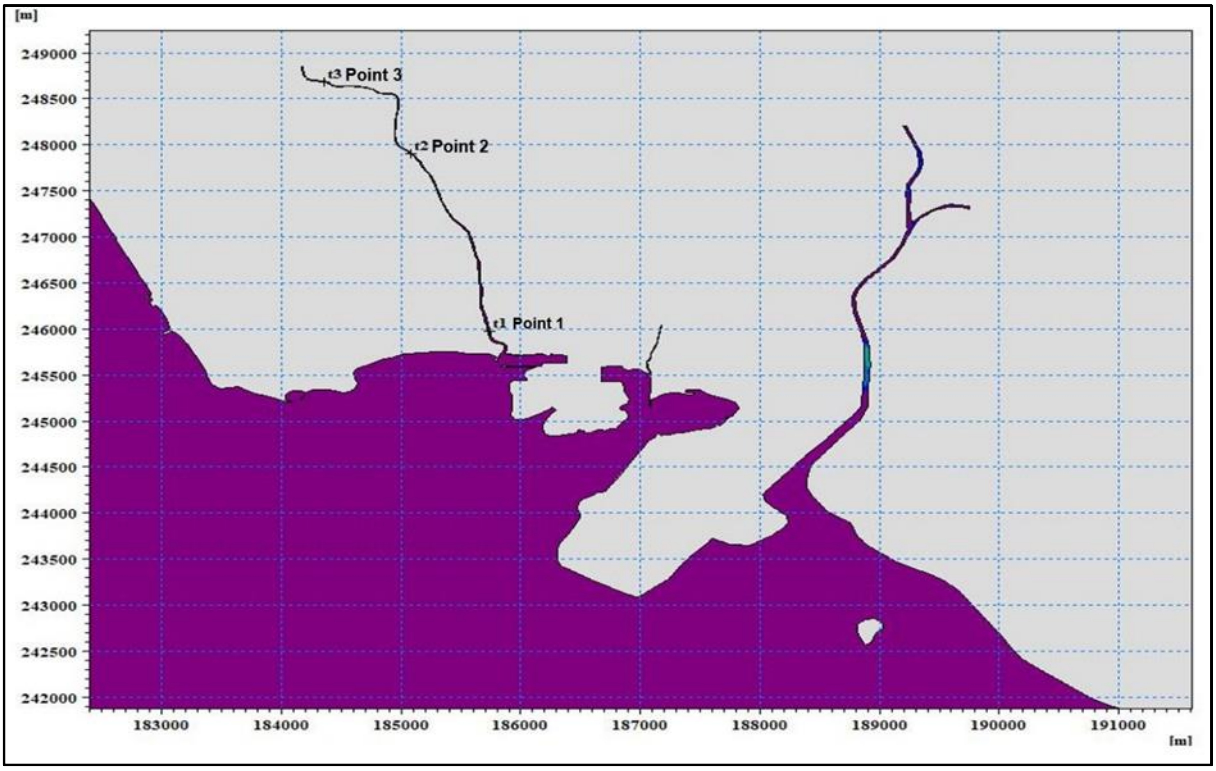


Figure 7-29 Data Extraction Boundary for Structure Model (Scenario B)



7.5.3.1 Modelling Results

a) Water Level Impacts into Sungai Lereh and Sungai Udang

Overall, the 2D modelling findings (refer to **Figure 7-30** to **Figure 7-36**) show that there are no any major fluctuations of the backwater flow into the Sg. Lereh due to the reclamation activity and construction of breakwater at the proposed location. Only very minor fluctuations happen at 1% - 2% of the upstream area and contribute about 1 mm to 3mm, very minimal changes in water levels.

Figure 7-30 Water level Extraction for Base Modelling Options (NE and SW Monsoon) at 3 Level Stream Points

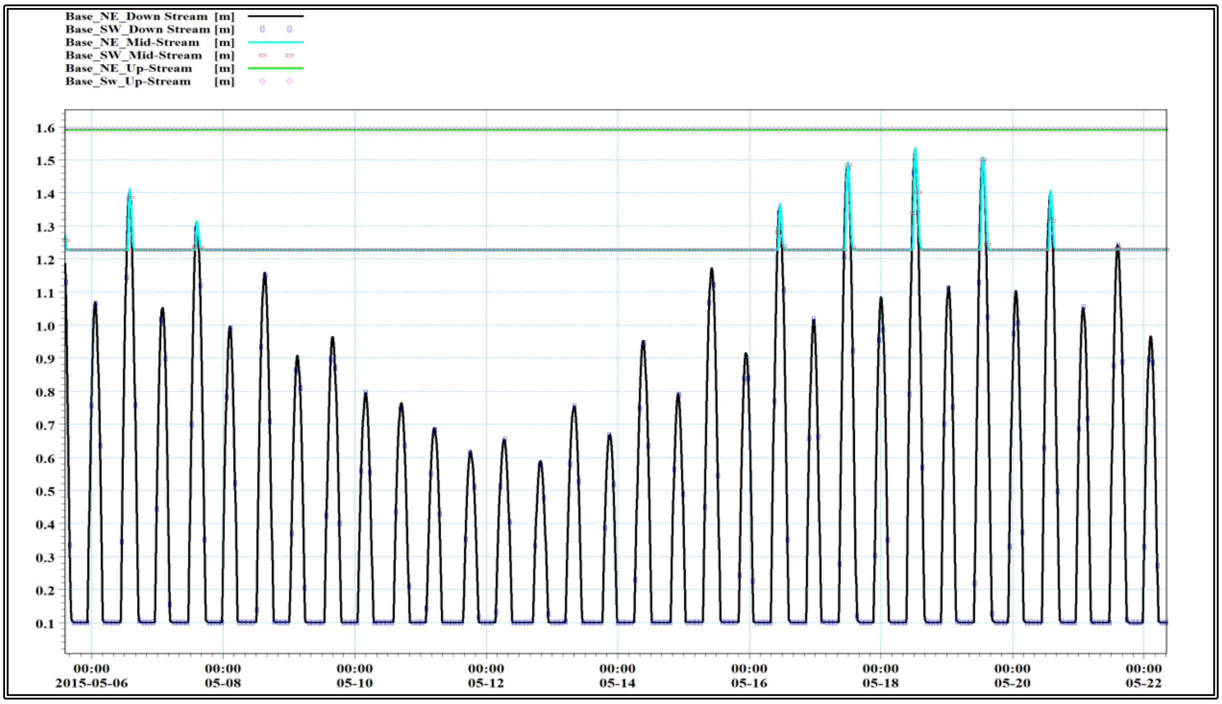


Figure 7-31 Water level Extraction for Structure Modelling Option (NE and SW Monsoon) at 3 Level Stream Points

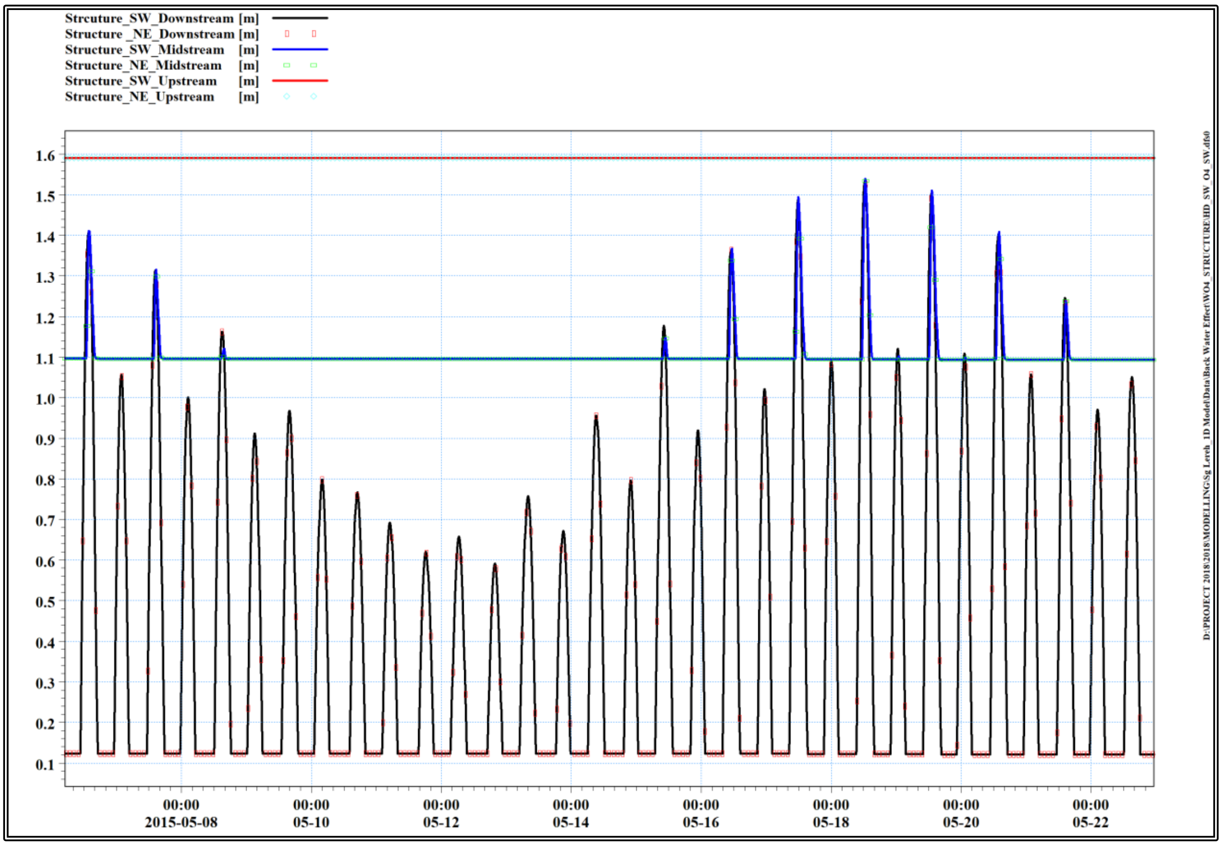


Figure 7-32 Water level Extraction Comparison for Base and Structure Modelling Options for NE Monsoon at 3 Level Stream Points

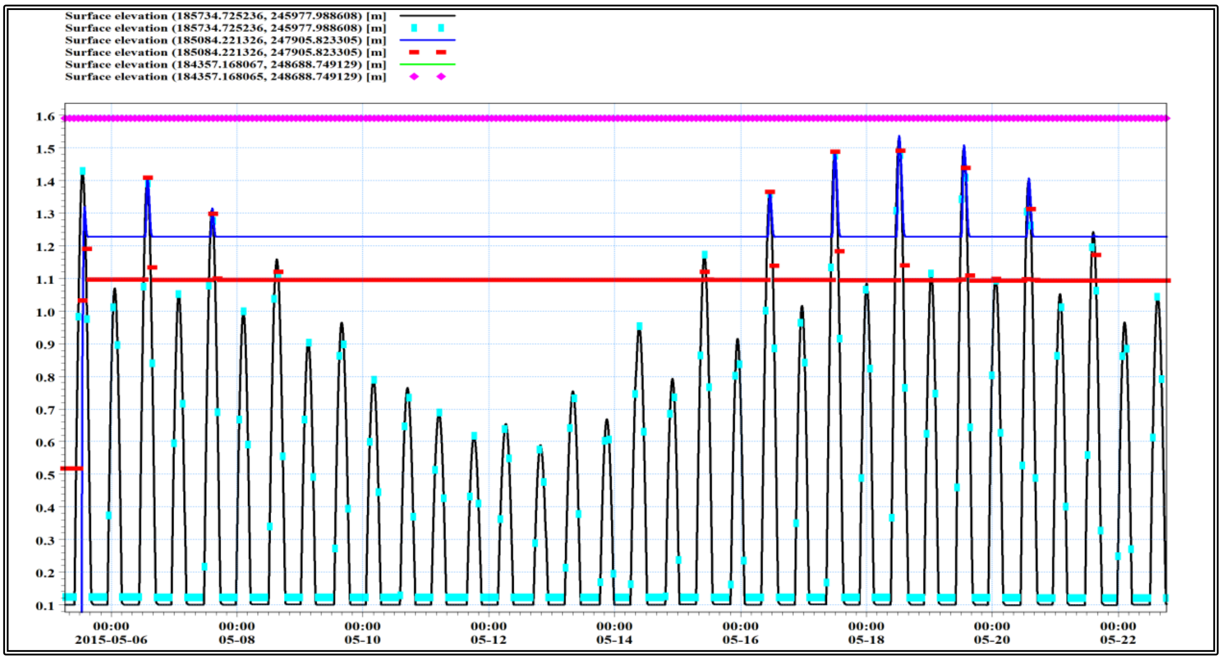


Figure 7-33 Water level Extraction comparison for Base and Structure Modelling Options for SW Monsoon at 3 Level Stream Points

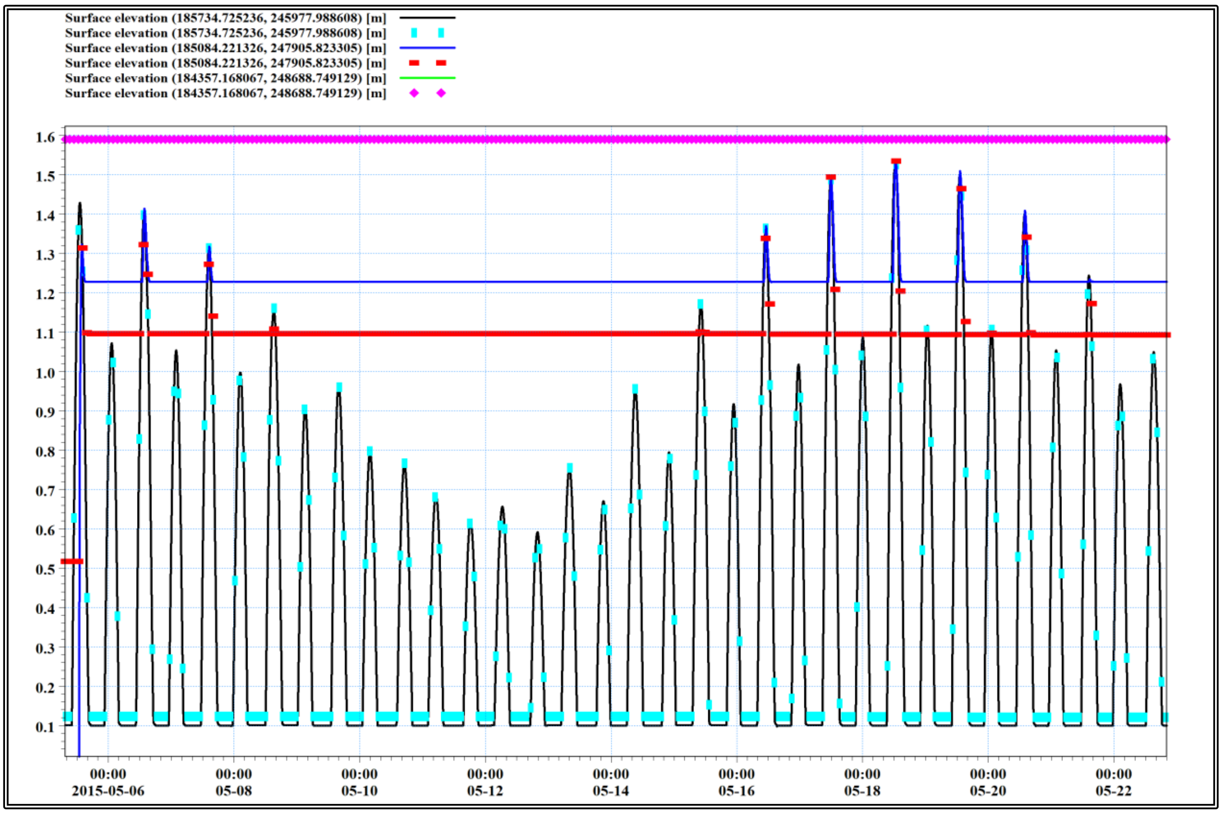


Figure 7-34 Water Level Extraction Comparison for Downstream Point ARI 2, ARI 5, ARI10, ARI 25, ARI 50 and ARI 100 Years

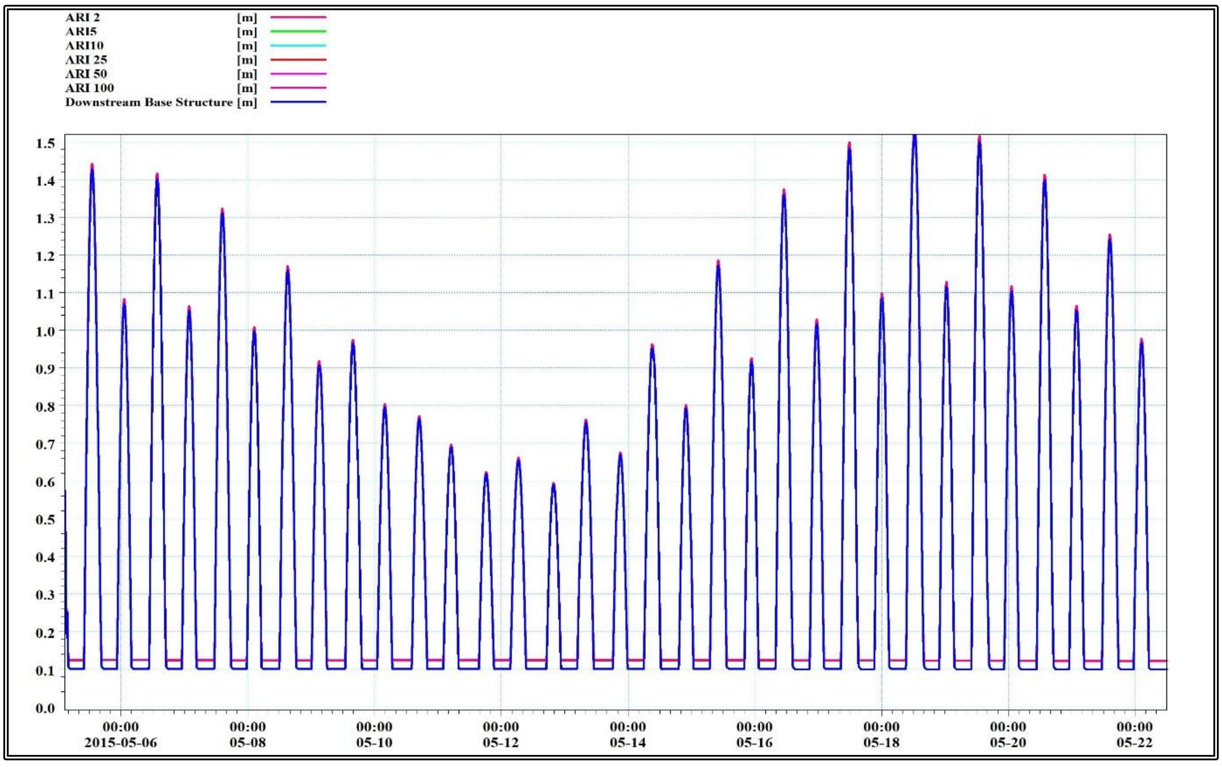


Figure 7-35 Water Level Extraction Comparison for Midstream Point ARI 2, ARI 5, ARI10, ARI 25, ARI 50 and ARI 100 Years

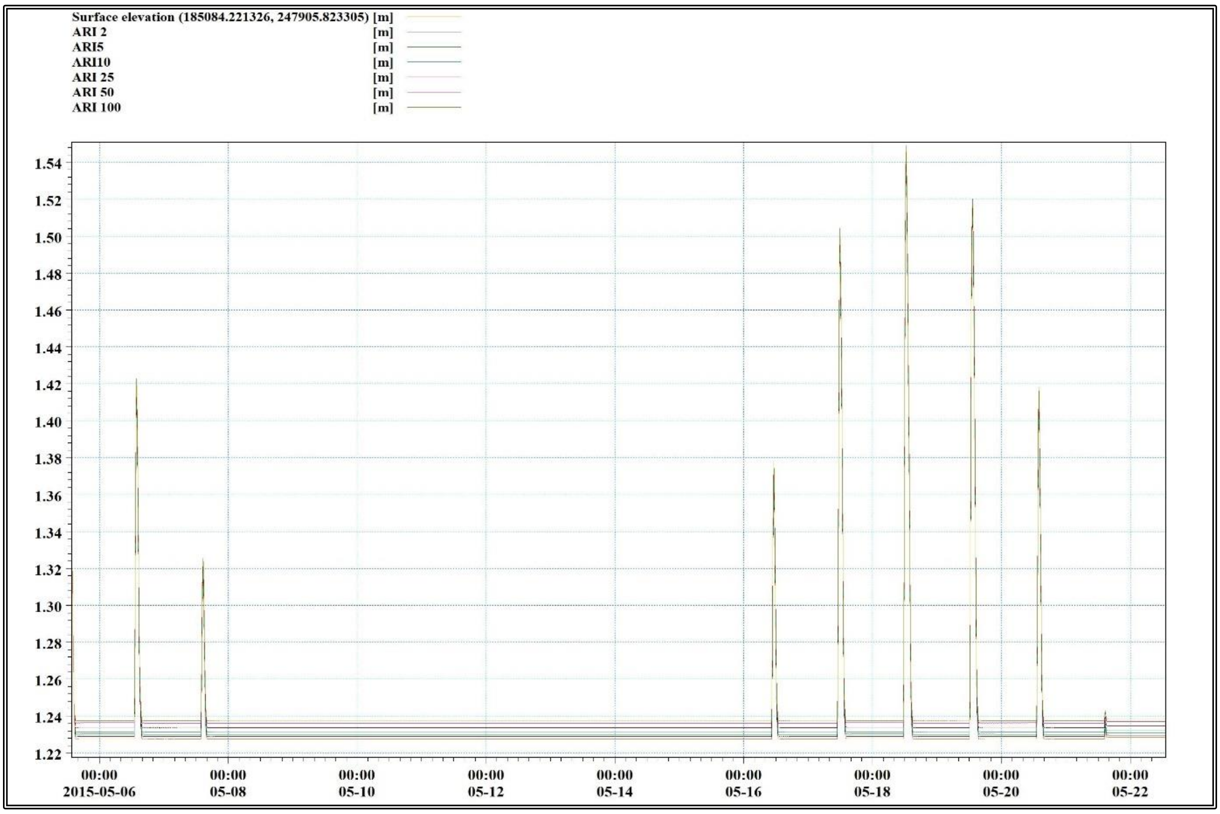
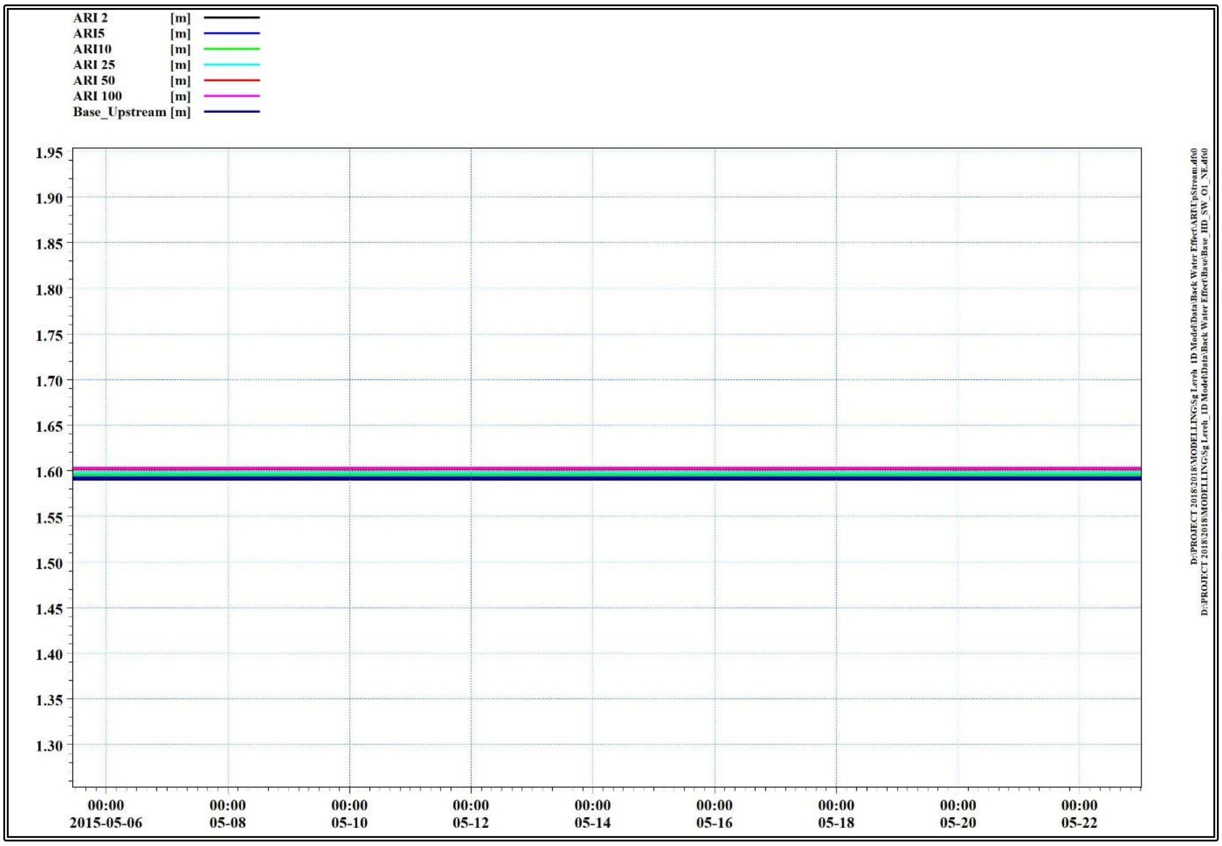


Figure 7-36 Water Level Extraction Comparison for Upstream Point ARI 2, ARI 5, ARI10, ARI 25, ARI 50 and ARI 100 Years



b) Hydrological Modelling

From the frequency analysis, flows from Sg.Udang to Sg. Lereh catchment for different ARI were calculated and furnished in the **Table 7-6** above while the tidal characteristics at the mouth of Sg Lereh are presented in **Table 7-7** below. Based on the data tabulated in these two tables, three worst case have been devised and furnished in the **Table 7-8**.

Table 7-7 Tidal Characteristics at the Outfall of Sg Lereh

Tidal level	Elevation in NGVD (m)	Elevation in LAT / CD (m)
Highest Astronomical Tide (HAT)	1.56	2.65
Mean High Water Spring (MHWS)	1.01	2.10
Mean High Water Neap (MHWN)	0.42	1.51
Mean Sea Level (MSL)	0.10	1.19
National Geodetic Vertical Datum (NGVD)	0.00	1.09
Mean Low Water Neap (MLWN)	-0.21	0.88
Mean Low Water Spring	-0.80	0.29
L.A.T / Chart Datum	-1.09	0.00

Table 7-8 Worst Scenario

Scenarios	Water Level at the outfall of Sg Lereh	Flow from the Udang-Lereh catchment
Scenario-1	HAT: 1.56 mNGVD	ARI 100: 38.5 m^3
Scenario-2	MHWS: 1.01 mNGVD	ARI 100: 38.5 m^3
Scenario-3	HAT: 1.56 mNGVD	ARI 50: 35.2 m^3

Maximum water level along Sungai Udang and Sungai Lereh based on these three scenarios are simulated and the results are presented from **Figure 7-37** to **Figure 7-39** below. The results indicate that maximum water level varies from 14 mNGVD to 6 mNGVD within the first 2km length of Sungai Udang. After that, within 3km length, it varies from 6mNGVD to 4mNGVD. After 6.5 km, it reaches to a stable water level about 2mNGVD.

Figure 7-37 Maximum Water Level along Sungai Udang and Sungai Lereh for Scenario-1

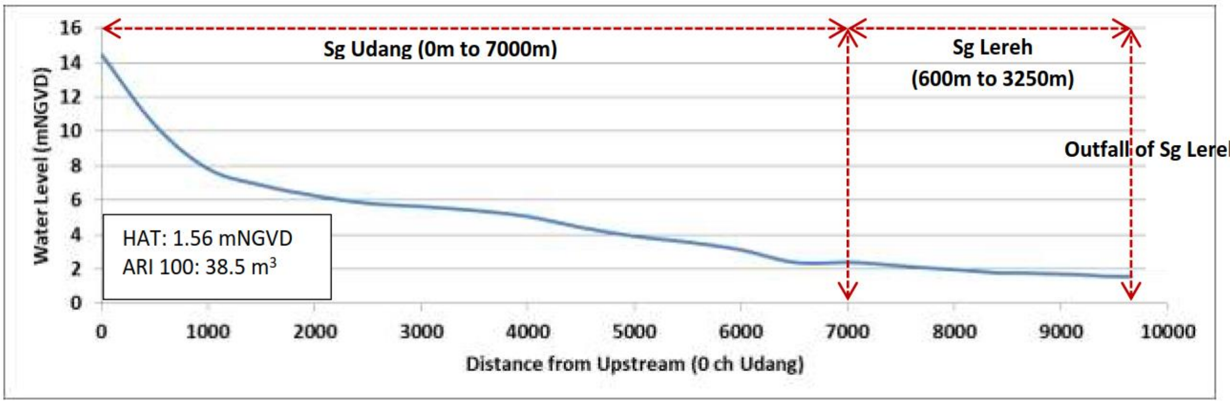


Figure 7-38 Maximum Water Level along Sungai Udang and Sungai Lereh for Scenario-2

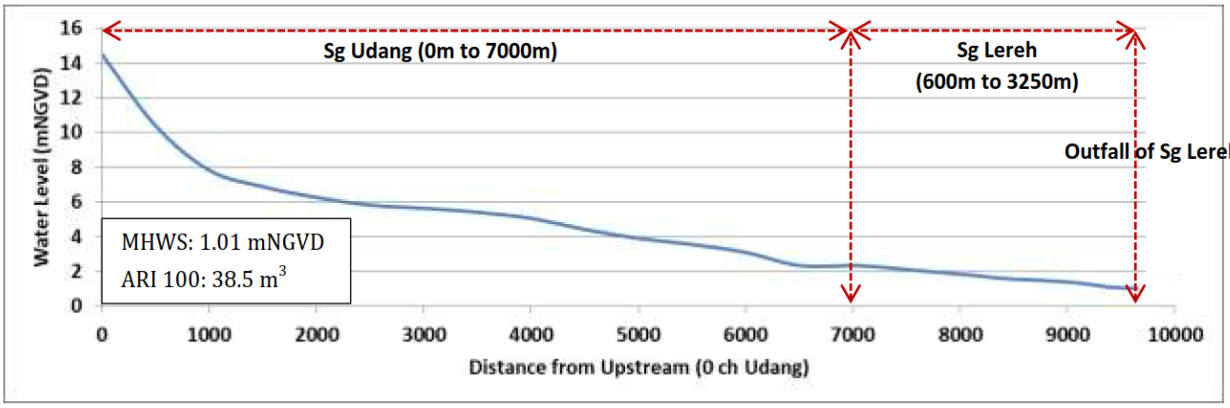
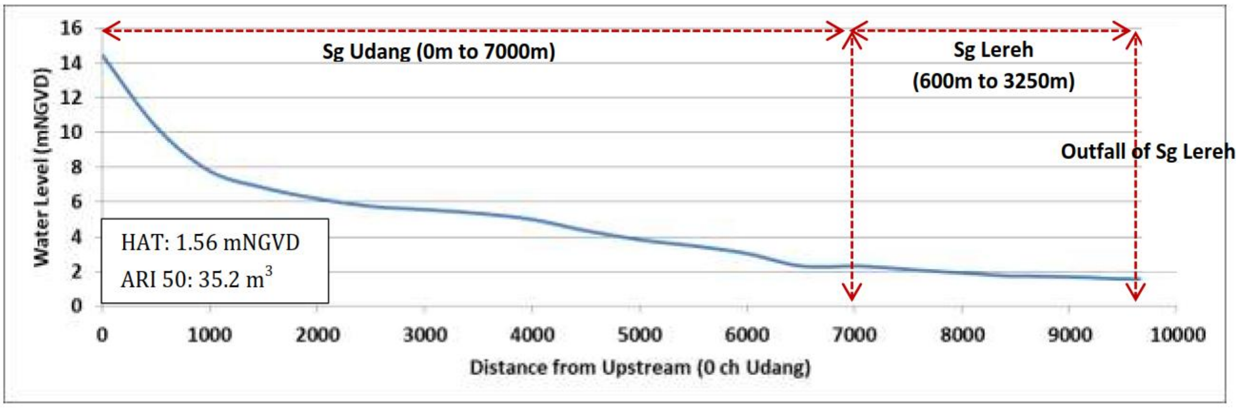


Figure 7-39 Maximum Water Level along Sungai Udang and Sungai Lereh for Scenario-3



7.5.3.2 Summary on Impacts

The main objective of the study is to assess the water level in the Udang-Lereh river system with a characterized flow comes from upstream and a higher tide level occurs in the downstream.

To carry out the study, a Hydrological and a hydrodynamic model have been developed and simulated. Hydrological model was simulated for about 20 years to get yearly maximum flow in the study area for frequency analysis. Flows in the

Udang-Lereh catchment for different ARI were calculated using that yearly maximum flows. After that tidal characteristics at the out fall of the Lereh river were collected from primary sources. Finally, three worst case scenarios were devised based on different ARI flow and tidal characteristics at the outfall of Lereh River.

All the cases were simulated and analysed. The results show that the maximum water level varies from 14 mNGVD to 6 mNGVD within the first 2km length of Udang River. After that, within 3km length, it varies from 6mNGVD to 4mNGVD. After 6.5 km, it reaches to a stable water level about 2mNGVD.

The findings show that the development of the proposed breakwater and the reclamation project is not anticipated to contribute any backwater flow impact at the upstream of the Sg. Lerah and Sg. Udang.

7.5.4 Impacts on Water Quality

It is known that the major source of impact to sea water quality is sediment dispersion due to the filling activities. The detailed assessment of the sediment dispersion is provided in Section 7.5.2.

The increase of surface runoff on the exposed reclaimed land, especially during the heavy downpour is also expected to contribute to the increased suspended solids in the receiving watercourses which subsequently affect the sea water quality of Straits of Melaka.

Besides, any accidental spilling from the sand carrier and other associated vehicles/machineries may also cause water pollution in the receiving water bodies. Spilled oil may disperse over the surface of seawater and may reach the shoreline resulting in contaminating the sediments. While spilled fill material might increase the TSS levels in the seawater and consequently affecting the water turbidity.

Again, ship related operational discharges of oil include the discharge of bilge water from machinery spaces, fuel oil sludge and oily ballast water from fuel tanks may also cause sea water pollution especially surrounding the project site.

7.5.5 Impacts on Air Quality

In respect of the proposed project, the potential pollution during this stage is also associated with engine exhausts and generation of dust during the filling activities. Hence, the regular servicing and maintenance of transport vehicles and fuel-burning machinery is important to minimise the emission of air contaminants. Regular wetting down of the exposed soil surfaces and the washing wheel facilities can eliminate any significant dust nuisance from arising.

7.5.6 Impacts on Noise Level

The reclamation activities involving the use of the high noise generating equipment or machinery should only be permitted during the day time hours between 7.00 am to 8.00 pm. Noise assessment of the reclamation is incorporated in the construction of revetment as presented in **Section 7.6.3** below.

7.5.7 Impact on Marine Environment

In the vicinity of the project site, there is no significant biological site as the areas are predominantly surrounded by residential and commercial areas. In terms of marine ecosystem, the coastal environment has been reclaimed since decade ago, hence, it hardly supports any biological significance.

Coastal reclamation can have adverse effects on the marine environment as the marine habitats are permanently lost where land is reclaimed from the sea. As this activity normally takes place along the coast it mainly influences coastal and near shore marine habitats as well as species occurring in these habitats.

7.5.8 Impacts on Marine Traffic

Based on the statistical data and on-site observation, the marine traffic in the vicinity of the project area is not very heavy. As such the potential impacts are not expected to be serious. However, in order to prevent untoward problems such as collisions, groundings and other accidents, implementation of navigational safety practices which include enforcement of safety zones, installation of navigational safety beacons, use of radar, routine surveillance and hazard notification to the Marine Department of Melaka and other relevant authorities.

7.5.9 Impacts on Fisheries

During the reclamation phase, fishing activities of the local fishermen will be interrupted. These fishermen will not be able to continue with their fishing activities during the reclamation period not just for safety reason but because they would not expect to catch fish with the noise and disturbances associated with the reclamation activities. However, as the entire coastline is continuing to be subjected to extensive land reclamation, the adjacent marine areas are no longer viable as fish breeding grounds.

7.5.10 Impacts on Waste Management

As only suitable fill material will be transported to the proposed project site, there will be no disposal of unsuitable material (USM) involved for the proposed project. Hence, the main waste sources during this stage will be in the form of general rubbish and perishable food waste generated from the base camp, sand carrier and other associated vessels. The estimated amount of the waste is about a tonne per month and the wastes will be collected and disposed on-shore by licensed contractor.

It is also estimated that a total of 1 tonne of gravel or laterite per month will be generated from the construction of revetment. This construction wastes will be temporary stored on-site as shown in **Figure 5-18** and be reused for the next development stage. As for scheduled wastes management, waste oil, lubricants, ballast water, etc. generated by the vehicles and machineries will also be stored and disposed on-shore according to the Environmental Quality (Scheduled Wastes) Regulations, 2005, thereby, the impacts is also anticipated to be insignificant.

7.6 Potential Impact during Construction of Revetment

7.6.1 Impacts on Water Quality

Placement of the rock revetment will also cause resuspension of the bottom material resulting in increase in turbidity. Although the increase in TSS level here may not be as serious as when the reclamation activities are carried, a proper mitigation measures must be taken to prevent the dispersion of the suspended materials away from the proposed project area.

Accidental releases of hazardous materials from vehicles, equipment operator and maintenance work could occur over the period of construction works. These hazardous materials may include oil, lubricants and solvents. Spillage of hazardous materials has the potential to contaminate the nearby water bodies. Nevertheless, the likelihood of accidental spills of such hazardous materials occurring is expected to be small as machinery and equipment used in the construction are limited and there will not be any maintenance workshop that will be located within the project area.

7.6.2 Impacts on Air Quality

Dust may be generated when strong winds blow across exposed surfaces or areas where fine materials are to be found. This problem is more pronounced during the dry season. Vehicular movements, particularly during site preparation and mobilization, give rise to fugitive dust when vehicles travel over unpaved roads, especially when the surfaces are dry. Emissions such as fumes and dust from construction equipment may cause occasional nuisance within the construction sites but not outside of them.

In order to assess the potential air pollution impact from the proposed project into the atmospheric environment, air quality modelling was undertaken. Industrial Source Complex Short Term Version 3 (ISCST3) model, an air modelling software that simulates on the basis of Gaussian plume equation was used to predict the ground level concentration (GLC) of air pollutants. The software simulates on the basis of Gaussian plume equation with the following assumptions:

1. In considering worst case scenario, the emitted dust is entirely assumed to be PM10.
2. Annual hourly wind data was derived from the nearest meteorological station – Melaka Airport in year 2015.
3. Terrain profile adjacent to the project site is elaborated as open and flat land. Building downwash effect is not considered in this case
4. Main access corridors within the site and link bridge were modelled as area sources for this project. As conservative approach, main accesses were assumed to be distributed within the reclaimed land in grid with 200m apart. The area source was set at 10 meters in width for each main access and link bridge.

5. Modelling was carried out for two scenarios: without vs. with mitigating measures; and two averaging time: 24 hour and 1 year.

The modelling results as in maximum incremental Ground Level Concentrations (GLC) of PM10 due to the proposed project are shown in **Figure 7-40** to **Figure 7-43**

Figure 7-40 **Predicted Incremental GLC of PM10 (24 hr Averaging Time) With Mitigating Measures**

Figure 7-41 Predicted Incremental GLC of PM10 (1 yr Averaging Time) With Mitigating Measures

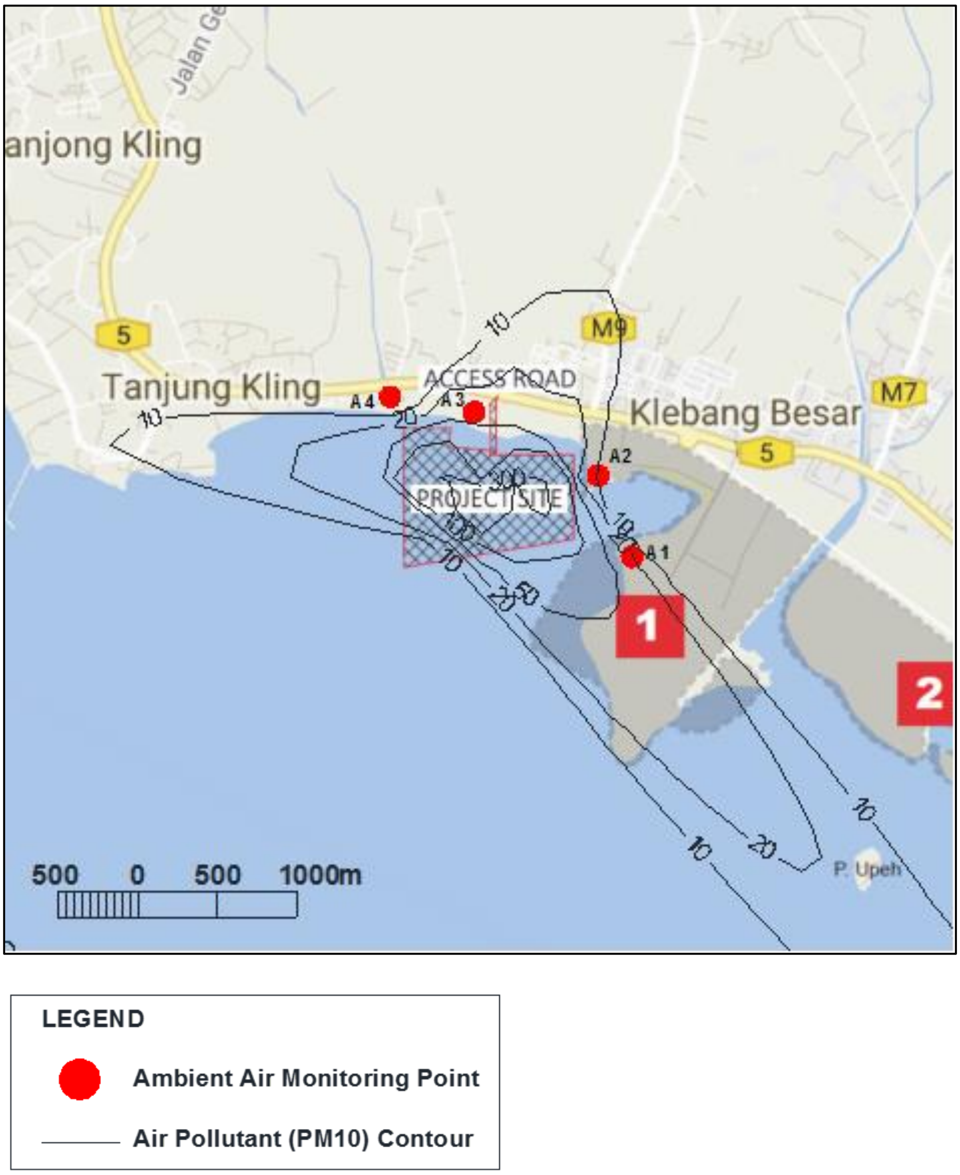
LEGEND

Ambient Air Monitoring Point

Air Pollutant (PM10) Contour

Figure 7-42 Predicted Incremental GLC of PM10 (24 hr Averaging Time) Without Mitigating Measures

Figure 7-43 Predicted Incremental GLC of PM10 (1 yr Averaging Time) Without Mitigating Measures



Air pollutant (PM10) contours during the construction phase for both scenarios – without mitigating measures and with mitigating measures are illustrated in **Figure 7-40** and **Figure 7-43**.

Without control measures, the incremental level of PM10 is estimated from 54 to 120 μg/m3 along the coast during the 24-hour averaging time as shown in **Table 7-9**. With control measures in place, the incremental level of PM10 is lowered to less than 12 $\mu g/m^3$ during the 24-hour averaging time (**Table 7-10**). Similar result is observed for annual averaging time where the incremental PM10 is less than 5 $\mu g/m^3$ with control measures. The incremental levels with control measures are unlikely to contribute any significant impact to the environment.

Baseline ambient air monitoring has been carried out at the coastline in adjacent to the reclamation site, namely A1 to A4. In addition to the background level / existing concentrations, the cumulative ambient PM10 level (24-hour) is above the limit of 100 $\mu g/m^3$ without any control measures, however, it's below the stipulated limit when control measures are implemented.

PM2.5 is a subset of PM10. The ratio of PM2.5 to PM10 depends on the source of the particulate matter. For instance, combustion process may content PM2.5 as high as 80% of total PM. However, for flying dust, content of PM2.5 is expected to be lower than 50% of total PM. In view of the PM10 modelling results are acceptable with control measures in general, modelling of PM2.5 for the proposed project is not necessary in this case.

Giving the impacts are localized, the atmospheric environment is not expected to be adversely affected during the construction phase. However, control measures are recommended to be implemented on site to further minimize the impact.

Table 7-9 Predicted Incremental Ground Level Concentration (GLC) of PM10 due to Emissions from the Proposed Project (without Control Measures)

Sensitive / discrete receptor	Existing baseline concentration	Incremental concentration		Ambient air concentration
		24-hr average	Annual average	24-hr average
A1	42	119.4	19.4	161.4
A2	40	69.3	5.2	109.3
A3	32	119.3	41.7	151.3
A4	30	54.2	5.6	84.2

Table 7-10 Predicted Incremental Ground Level Concentration (GLC) of PM10 due to Emissions from the Proposed Project (with Control Measures)

Sensitive / discrete receptor	Existing baseline concentration	Incremental concentration		Ambient air concentration
		24-hr average	Annual average	24-hr average
A1	42	11.9	1.9	53.9
A2	40	6.9	0.5	46.9
A3	32	11.9	4.2	43.9
A4	30	5.4	0.6	35.4

7.6.3 Impacts on Noise Level

During the construction phase, the bulk of the noise is expected from construction activities involving reclamation, dredging and construction of facilities. The noise levels will be predicted to assess their disturbance onto the sensitive receptors. **Table 7-11** presents typical noise levels from equipment and machinery likely to be used at the construction site for two main activities, namely reclamation and construction of development facilities.

Table 7-11 Typical Noise Level from Construction Equipment

Scenario	Equipment	Typical Sound Level
Reclamation	Trailer Suction Hopper Dredger (TSHD)	106
	Tug Boat	81
	Work Boat	81
	Heavy duty electric generator	85
	High solids pump	85
	Bull dozer	96
	Water and dump truck	89
	Front end loader	88
	Barge	88
	Excavator	87
	Grader	85
	Total Equivalent Noise Level	**106.7**
Construction of Marine and Onshore Facilities (including earthworks activities)	Piling rigs	98
	Floating crane	100
	Bull dozer	96
	Excavator	87
	Crane	100
	Lorries / Transport trucks	96
	Welding and fabrication equipment	102
	Total Equivalent Noise Level	**107.1**

The study on noise level propagation was carried out using the CUSTIC 2.0 model with the following assumptions made for the modelling in considering the worst case scenario:

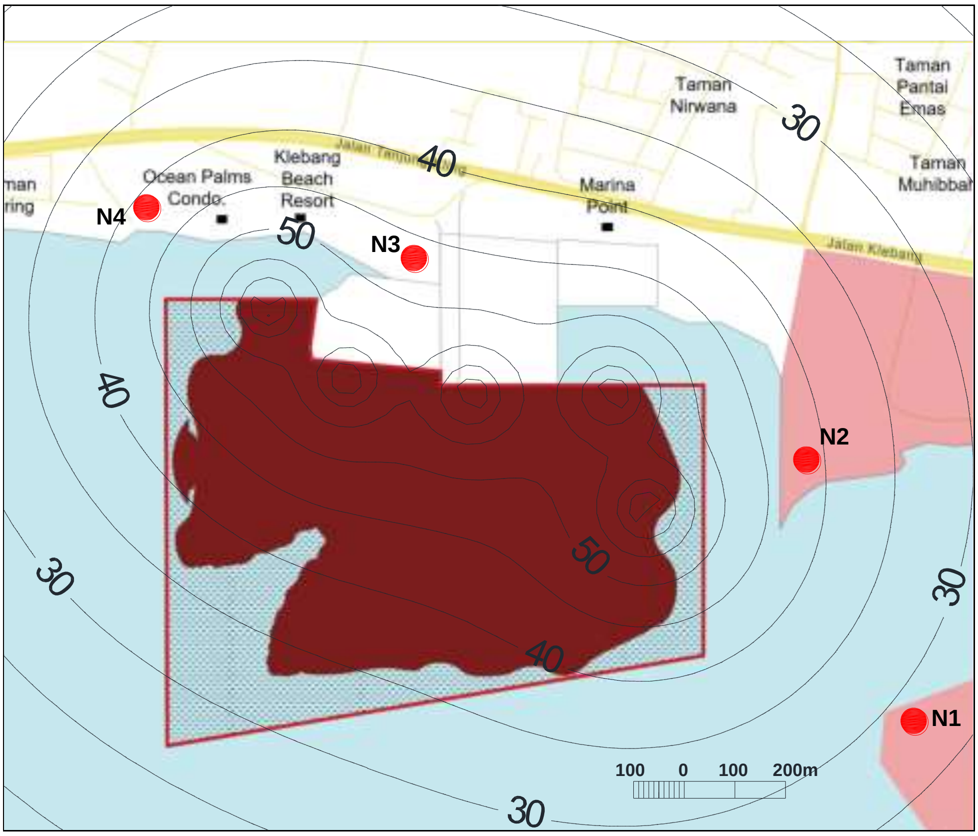
- Between the reclamation activities and construction of facilities, higher noise level (107.1 dBA) is estimated during the construction of development facilities. The modelling adopts the higher noise level (107.1 dBA) as modelling input only as these two activities will not be carried out simultaneously.
- The modelling assumes maximum five (5) sets of machinery are operating and are located closer to the shore.
- All construction equipment are operating simultaneously. Noise source emission level is estimated in the preceding section.

Result of the modeling is the noise source emission contours generated from the proposed project as shown in **Figure 7-44**. Predicted noise source emission level at the receiving land use due to the construction activities is also given in **Table 7-12.**

Table 7-12 Predicted Noise Level at the Receiving Land Uses due to the Proposed Development

Receiving Land Use / Receptor	Predicted Noise Source Emission Level (approx. dBA)
N1, southeast of project site	28.8
N2, east of project site	41.5
N3, north of project site	46.5
N4, northwest of project site	41.2

Figure 7-44 Predicted Noise Source Emission Contours (5 dBA interval) due to the Construction Activities



As shown in **Figure 7-44**, the inland receptors are exposed to less than 50 dBA due to the construction activities. N3 near to the link bridge is expected to experience the highest noise source emission level at 46.5 dBA.

It should be noted that the predicted noise level is solely from the construction activities. With the baseline noise monitoring results as background noise, the cumulative ambient noise level due to the construction noise as well as the background noise is computed by the equation as follows:

$$LAeq = 10 \times \log10\ \Sigma[\,10(LAeq\ i / 10)]\ (dB)$$

Where,

LAeq, total = the total equivalent noise level for a typical workday during a given period; and

LAeq, I = the equivalent noise level for equipment type, i.

Sensitive receptors adjacent to the project site have been identified and baseline noise monitoring at the sensitive receptors was conducted in conjunction with the EIA study. With the baseline results as background noise, the predicted cumulative ambient noise level is computed. **Table 7-13** shows the results of the cumulative noise level at the sensitive receptors.

Table 7-13 Estimated Noise Level at Sensitive Receptors during the Construction Phase

Receptor	Daytime Baseline – Leq (dBA)	Predicted Construction Noise (dBA)	Cumulative Noise Level (dBA)
N1, southeast of project site	62.0	28.8	62.00
N2, east of project site	63.9	41.5	63.92
N3, north of project site	62.5	46.5	62.61
N4, northwest of project site	61.8	41.2	61.84

Based on the estimated results, ambient noise levels at the receptors ranged from 61 to 64 dBA. Compared to the baseline condition, the noise increment is indeed less than 1.0 dBA and they could hardly be detected by human hearing. It should be noted that the estimated values are based on worst case scenario without any control measures. Lower noise level is expected with mitigating measures take place. During the construction phase, noise level guideline limits are referred to Schedule 6 of the Planning Guidelines for Environmental Noise Limits and Control, DOE 2007 as shown in **Table 7-14**. The estimated noise levels are indeed below the daytime Lmax – 90 dBA. Compliance to L90 and L10 during the construction phase could be achieved via mitigating measures and noise control management as highlighted in the following section. Close monitoring should be implemented in this regard.

Table 7-14 Maximum Permissible Sound Level (Percentile LN and LMAX) of Construction, Maintenance and Demolition Work by Receiving Land Use

Receiving Landuse 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: The Planning Guidelines for Environmental Noise Limits and Control, 2007.

Notes:

**1 At these times the maximum permissible levels are stipulated in the Schedule 1 for the respective residential density type shall apply. This may mean that no noisy construction work can take place during these hours.*

***2 A reduction of these levels in the vicinity of certain institutions such as schools, hospitals, mosque and noise sensitive premises (apartments, residential dwellings, hotel)*

Receiving Landuse 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
may be exercised by the local authority or Department of Environment. Where the affected premises are noise sensitive, the limits of the schedule I shall apply. *3. In the event that the existing sound level (L90) without construction, maintenance and demolition works is higher than the L90 limit of the above schedule, the higher measured ambient L90 sound level shall prevail. In this case, the maximum permissible L10 sound level shall not exceed the Ambient L90 level + 10 dBA, or the above Schedule L10 whichever is the higher.* *4. NA = Non Applicable.*				

In conclusion, the proposed project is not expected to cause significant noise disturbance to the nearest receptor during the construction phase. However, the following control measures should be strictly adhered to.

7.6.4 Impacts on Marine Environment

The placement of the rock bunds will most likely annihilate the benthic population of the area but this is not considered a major concern because the benthic survey that was carried out did not identify any endemic species. The impacts on the benthos will be localised. Impacts on local non-sedentary organisms are considered insignificant due to their mobility and ability to recover at a fast rate.

7.6.5 Impacts on Land Traffic

On commencement and at completion of the construction phase, especially the reclamation stage, heavy vehicle such as truck, excavators and compactors needed to go in and out of the site. Other smaller vehicles and equipment will find their own way to and from the site. These vehicle, especially heavy vehicle, however, are within the site and will not impact the road network traffic. Transport of sand materials to the site may not be an issue to territorial traffic because sea transport such as barge will be used to transport the sand to the site.

Other potential impacts attributable to vehicle traffic and their movements during the reclamation phase are:

- Occasional traffic congestion at the approach to the site, most likely at the junction to enter the project site;
- Traffic accident due to increased volume of traffic traveling along the roads;
- Potential damage to the public roads;
- Noise and vibration caused by the movement of heavy vehicles; and
- Air pollution due to movement of and exhaust emission by heavy vehicles along the road.

7.6.6 Impacts on Socio Economic

During the construction of revetment, the socio-economic impacts are mainly directed to public health and safety as below:

- Volume of heavy vehicle traffic entering/leaving the site are expected to increase. There is the possibility that the presence of heavy vehicles plying the main access road can hinder or endanger other road users in the vicinity of the project site.
- The public will have to bear with recurrent noise pollution during the construction of revetment.
- Minor impact on aesthetics is expected from the presence of heavy vehicles, machinery, storage of construction materials and debris during the construction period. During construction, work activities will worsen the aesthetic value as construction materials and debris will be placed within the project site.
- Visiting anglers suffer a loss of satisfaction since their favourite angling site will be disturbed.
- Improper management of sanitary facilities such as sewage and solid waste may affect the general health of workers. In relation to health, the threat of water and food-borne diseases such as food poisoning, diarrhea diseases, typhoid and dysentery as a result of unhygienic living condition, must also be considered.

However, an immediate potential benefit of the proposed project to the local population is the generation of employment and business opportunities. Raw materials, machinery and equipment required for the construction works of the proposed project will create business opportunities for the local suppliers and contractors.

7.6.7 Impacts on Occupational Safety and Health

There are risks of job related injuries and accidents. Accidents can occur during the course of the site clearing and construction activities, especially when one considers that machines and tools are widely used. Improper handling and carelessness in this area will expose workers to accidents and may result in serious injury or death. In addition, open access to the construction site will undoubtedly result in injury and potentially fatal accidents.

The general workers are typically the ones who will carry out activities relating to the development within the project area and are exposed to occupational safety and health hazards. Steps should be taken to minimise these hazards. Impact of occupational safety and health should be addressed, as the impact on workers is significant if no proper mitigation measures are implemented.

Accidents resulting in fatality or injury can occur from the use of hand tools and power tools, as well as vehicle movement and lifting operation. Manual lifting, carrying, pushing and pulling of construction materials and equipment can create tremendous stress and strain on the human body. If the loads are excessive and the manual tasks are carried out frequently and repetitively, workers will place themselves at increased risk of low back pain and musculo-skeletal disorders. This risk increases if these movements are associated with twisting and bending. Construction workers are exposed to the sun and heat during daytime. Workers need to be in thermal balance. Factors that can affect their body temperature include air temperature, radiant temperature, humidity, wind velocity, physical activity and clothing worn by the workers.

7.6.8 Impacts on Waste Management

Improper management of solid wastes could lead to proliferation of disease vectors and degradation of aesthetic value. For the proposed project, it is estimated that 1 tonne of domestic waste per month will be generated from the base camp during the construction phase. As the waste will be proper managed on-site and disposed of to Sungai Udang Sanitary Landfill under the management of local authority or by licensed contractor, only minor impacts are anticipated from the waste disposal activities.

According to the project proponent, a total of 2 tonnes/month of scheduled wastes such as waste oil, lubricants, etc. are expected to be generated during the construction phase. Similarly, these scheduled wastes will be stored, removed and disposed according to the Environmental Quality (Scheduled Wastes) Regulations, 2005, the impacts is anticipated to be insignificant.

7.7 Project Abandonment

In the unlikely event that the proposed project, at any stage of construction, cannot proceed and has to be abandoned due to unforeseen circumstances, the project proponent must endeavour to vacant the project site in an environmentally responsible manner and prepare a Project Abandonment Plan.

Abandonment during or after the reclamation will result in air and water quality impacts due to failure to implement soil erosion measures. The project site will be an eyesore due to the presence of partially completed structures, construction debris left all around the site and neglected offices, stores and sheds. This situation will continue until another Developer/Contractor is called in to take over the site, or the half-completed structures torn down for re-development.

The project site should be left in the best shape possible in terms of the environment. It should also be free of any unexpected hazards to the public. The abandonment plan indicates all the necessary actions and steps to be taken to achieve the objective above and ensure that the site is left in a condition that has no environmental implications.

An outline of the main activities to be addressed in an abandonment plan for the proposed project is as below :

1. Adequate notification of intent to cease operations to be given to relevant authorities and workers.
2. Dismantling of structures, machinery and equipment.
3. Removal and disposal or sale of machinery, equipment and materials where appropriate.
4. Systematic containment, collection and disposal of solid and hazardous wastes to designated disposal area or licensed contractors.
5. Construction or installation of a security system to safeguard against intrusion, ensure safety of general public, and protect against unauthorized entry and illegal use of the site.
6. Post abandonment inspection and monitoring (particularly sea water quality) until conditions have stabilized.

In general, the abandonment plan will include an inventory of materials and equipment and their removal. It will provide details on the demobilization and removal of temporary and semi-built structures, and the closure of work sites. The abandonment plan will also address the need for rehabilitation of cleared areas through turfing, the restoration of all temporary drainage and completion of permanent drainage channels. While, demobilization process is expected to increase the traffic. The relevant parties including the Marine Department, the local fishermen, the Department of Environment etc shall be informed beforehand.

7.8 Residual Impacts and Recommendations

7.8.1 Impact on air and noise emission

It is anticipated that impacts on air and noise are temporary during the site preparation, reclamation and construction activities. The sources are from the construction equipment, transportation barges, material barges, and support vessels during mobilization and reclamation activities. Therefore, it is anticipated that there is little or no additional impact resulting from the combined activities impacting air quality and noise.

7.8.2 Impact on hydrodynamic

Based on the simulations of the hydraulic study, it is clear that the reclamation work will not create any significant change nearby the project site. There is also no significant impact on Sungai Lereh/Sungai Udang. Nevertheless, it is also evident from the morphological model results that there will be significant change in erosion and deposition if the reclamation work continues for a long duration. Hence, a continuous monitoring is needed at some specific locations nearby the project site.

7.8.3 Impact on Water Quality

Water quality will be impacted by increased of TSS level and water turbidity during the sand transportation, reclamation and construction phases. These impacts, however, will be localized and short term.

7.8.4 Impact on Fishing Activities

Fishing activities are likely to decline in view of extensive land and coastal reclamation projects within Melaka state. The proposed reclamation project will cause disturbance to the fishing activities and the adjacent marine areas are no longer viable as fishing breeding ground due to the reclamation works.

7.8.5 Impact on Socio Economic

The proposed project will provide land-bank for the State of Melaka, where tourism-cum commercial development can be expanded. These activities will provide increase revenues for the State and better business opportunities to the locals. The project will also create job opportunities where locals would be recruited and given priority.

7.9 Conclusion

The assessments indicate that the proposed project will cause the following direct impacts that will change the physical, biological and human environment of the Study area:

- Reclamation and construction activities will cause the increase in TSS level. Accidental releases of hazardous materials from vehicles, equipment operator and maintenance work could also occur over throughout the whole development phase. Spillage of hazardous materials has the potential to contaminate the nearby water bodies.
- Permanently loss of marine habitats due to land will be reclaimed from the sea. As this activity normally takes place along the coast it mainly influences coastal and near shore marine habitats as well as species occurring in these habitats.
- Disturbance to the fishing activities and fishing community will incur losses in fish catch and higher cost of fishing efforts including from:
    - Loss of mudflats from areas reclaimed
    - Loss of mudflats from frequent dredging and transportation on mudflat areas
    - The fishing area also is getting limited as the fishing area bounded between new land and ship trading area becomes smaller. Fishermen would have to go further to other fishing areas.
    - Lesser income is generated as the yields along coastal area decreased and higher fishing cost.

Based on the simulations of the hydraulic study, it is clear that the reclamation work will not create any significant change nearby the project site. It is also evident from the morphological model results that there will be no significant change in erosion and deposition if the reclamation work continues for a long duration. In addition, it also noted that the project has the potential to result in significant benefits including employment opportunities for local residents, business opportunities for local vendors/suppliers and provide land-bank for the Melaka state where tourism-cum commercial development can be expanded.

Mitigation measures to reduce or minimise the severity of the all potential impacts are provided in **Chapter 8**.