

The Proposed Forest City Island Reclamation and Mixed Development, Johor

Detailed Environmental Impact Assessment

READING INSTRUCTIONS

Volume 1: Executive Summary

See Chapters 1, 2, 4

Figure ES5.2

Country Garden Pacificview Sdn. Bhd.

October 2014

Skim Chapter 5

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DETAILED ENVIRONMENTAL IMPACT ASSESSMENT

Volume 1: Executive Summary

October 2014

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Executive Summary 1

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Volume 1

Executive Summary

1.0 Introduction

Country Garden Pacificview Sdn. Bhd. (hereafter referred to as the “Project Proponent”) intends to undertake land reclamation activities adjacent to the Port of Tanjung Pelepas and the coastline of Tanjung Kupang, Johor. The development is located on the Western Straits of Johor where the major aspects of it will be the formation of four man-made islands. These islands are intended to be developed as mixed development.

The project for which this Detailed Environmental Impact Assessment (DEIA) report is prepared is titled “DETAILED ENVIRONMENTAL IMPACT ASSESSMENT STUDY FOR THE PROPOSED FOREST CITY ISLAND RECLAMATION AND MIXED DEVELOPMENT, JOHOR” (hereafter referred to as the “Project”).

2.0 Project Background and Chronology

The success of the Iskandar Malaysia project since its establishment in 2006 has paved the way for the viability and realisation of the proposed Project. Following the trend of development in Johor which is concentrated along the coastline, Country Garden Pacificview Sdn. Bhd. has become the Project Proponent for a Project commonly known as “Forest City Project”. All of the land lots of the proposed Project are located in *mukim* Tanjung Kupang, district of Johor Bahru whereby the land for this Project was alienated on 8th November 2013. *Figure ES2.1* shows the land lot numbers and their respective locations.

However, in June 2014 while the Phase 1 reclamation was ongoing, transboundary issues were raised which then led to the requirement of Detailed EIA and Hydraulic studies. In view of the situation, the Proponent has voluntarily stopped its reclamation activities at the site and pledged to resume works once the DEIA and Hydraulic studies are approved.

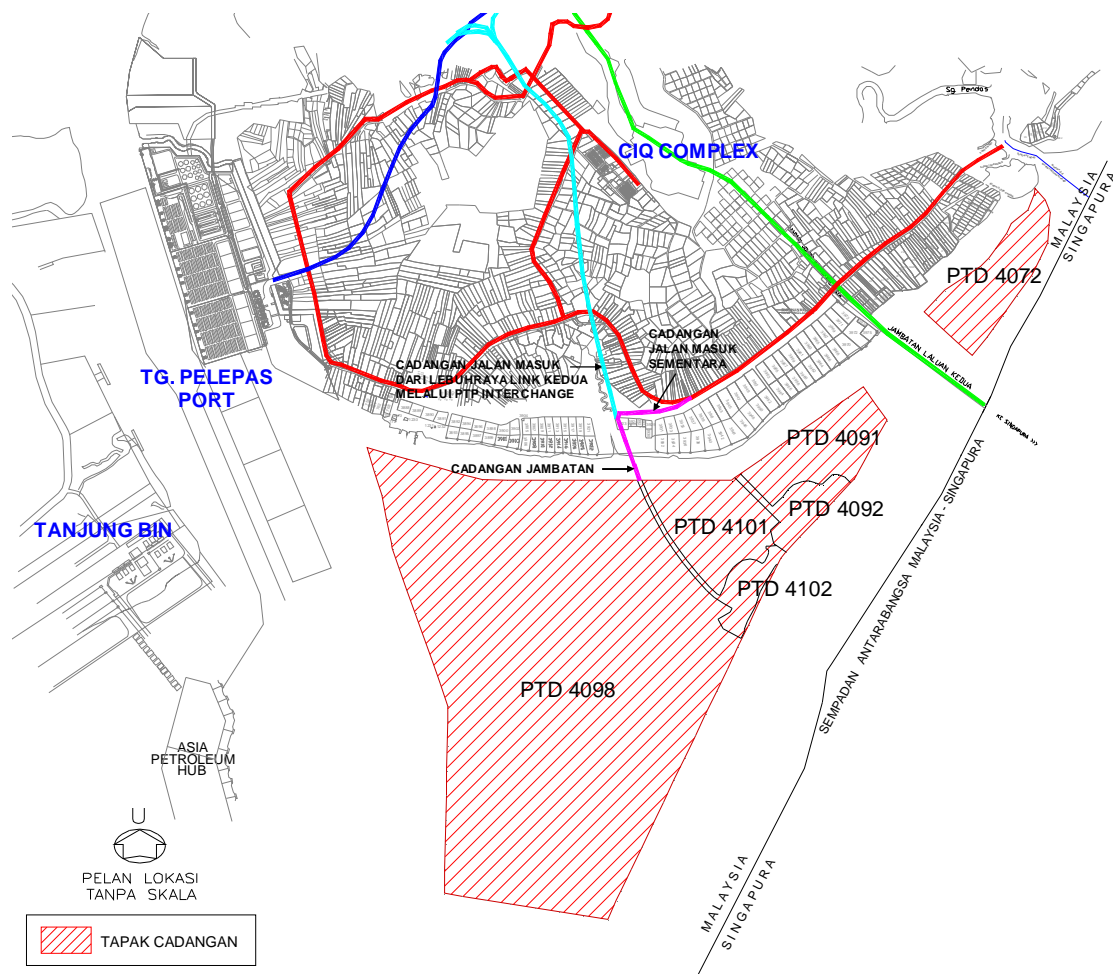


Figure ES2.1
Allocated Land Lots for the Overall Development

DOE Putrajaya has also requested for a Preliminary Assessment to be carried out to assess the impacts of the partially reclaimed Phase 1 and its related transboundary issues. The detailed assessment of Phase 1 reclamation and its related mitigating measures are further described in Volume 4 of the DEIA report.

The Project's chronology is as *Table ES2.1*.

Table ES2.1
Project Chronology

Date	Remarks
2013	Country Garden Holdings Ltd. and Esplanade Danga 88 Sdn. Bhd., a company related to Kumpulan Prasarana Rakyat Johor (KPRJ), have joined forces to create Country Garden Pacificview Sdn. Bhd (CGPV),
8th November 2013	Land alienation was obtained by Country Garden Pacificview for comprising PTD 4091, 4092, 4098, 4101 and 4102. The total area is 4,887 acres.
13 th January 2014	DOE Johor has issued PAT approval for the Phase 1 reclamation.
20 th January 2014	The Proponent intended to implement its Phase 1 reclamation on PTD 4102 encompassing an area of 49.3 ha. A Preliminary Site Assessment (PAT) for Phase 1 was submitted to DOE Johor.
22 nd January 2014	Commencement of Phase 1 reclamation works.
1 st June 2014	KML for PTD 4102 was submitted to MPJBT.
2 nd June 2014	DOE Johor issued a letter for mitigation works to be done on site.
6 th June 2014	DOE Johor issued a letter requesting for a Detailed EIA for the proposed reclamation be prepared for approval.
12 th June 2014	DOE Putrajaya has called the Proponent and the related agencies for a meeting to discuss on the transboundary issues being raised. Following which, the Proponent was requested to submit a Preliminary Assessment Report to assess the impacts of the partially reclaimed Phase 1 and address the transboundary issues for submission to DOE Putrajaya by the 23rd June 2014. In addition to that, Detailed EIA and Hydraulic Studies for the overall reclamation were required to be submitted for approval. Hence, the appointment of Dr. Nik & Associates Sdn. Bhd (DNASB) as the Environmental and Hydraulic Consultant to prepare the Preliminary Assessment Report as well as the DEIA and Hydraulic studies.
15 th June 2014	The Proponent has voluntarily stopped reclamation works and pledged to resume works until the Detailed EIA and Hydraulic studies have been approved by DOE and DID. The progress of reclamation has covered almost 40% of the intended 49.3 ha. This includes a temporary access road (termed as <i>CG Causeway</i>) from the mainland to the partially reclaimed island.
17 th June 2014	Following the voluntarily stop work by the Proponent, DOE Putrajaya has issued a letter to ensure all activities (transportation of sand by barges, sand filling, treatment of fill material, excavation, etc.) at site are put on hold. Meanwhile, the Proponent was requested to undertake the necessary mitigating measures such as installation of double-layered silt curtain, daily water quality monitoring and online water quality monitoring.

Table ES2.1 (cont'd)

Date	Remarks
23 rd June 2014	Submission of the Preliminary Assessment report to DOE Putrajaya on the impacts of the partially reclaimed Phase 1 and transboundary issues.
24 th June 2014	DOE Johor issued a <i>Notis Arahan Serta Merta</i> (Ref: AS(B))/50/011/200/262) to the Proponent which includes an immediate maintenance of the existing silt curtain installed at site; installation of double-layered silt curtain; submission of marine water quality monitoring report; appointment of an Environmental Officer.
9 th July 2014	Presentation of the Preliminary Assessment of Phase 1 to DOE, expert panels and government agencies at DOE Putrajaya. It was agreed upon by the Proponent and DOE that based on the initial assessment, the CG Causeway shall be removed to avoid further impacts on the seagrass bed (Merambong Shoal) and to allow for smooth water flow within the western Straits of Johor.
1 st July 2014	KMP and Building Plan were submitted simultaneously to OSC for Phase 1 reclamation.
7 th July 2014	Submission of DEIA Terms of Reference (TOR) for the initial allocated land lots.
3 rd August 2014	Meeting with State Planning Committee (Technical) at JPBD Johor with regards to planning issues. A final landform upon consideration of hydraulic inputs which consists of four islands (4,012.5 acres) was
4 th August 2014	Meeting with SPC, chaired by the Menteri Besar of Johor.
14 th August 2014	Review Panel Meeting for DEIA TOR at DOE Putrajaya (initial landform of 5000 acres). However, a revised TOR incorporating the new landform was required.
4 th September 2014	Submission of the DEIA Revised TOR which covers the finalized landform of four islands (4,012.5 acres).
14 th September 2014	Focus Group Discussion (FGD) was held with the affected stakeholders namely UEM Sunrise, Sunway Iskandar, Putri Harbour, Medini, PTP and Lido Boulevard.
14 th September 2014	FGD with the villagers was held at Dewanraya Kampung Pok comprising the Penghulu Gelang Patah; Ketua of Kampung Tanjung Adang, Kampung Pok, Kampung Tiram Duku, Kampung Pendas,
21 st September 2014	Public Dialogue was held at Dewan Raya Kampung Pok.
29 th September 2014	FGD with the Village Representatives attended by three Executive Directors from the Proponent.
30 th September 2014	FGD with the representatives from Kampung Pok for discussion on the alternatives for Main Access Road Alignment.

Table ES2.1 (cont'd)

Date	Remarks
30 th September 2014	Engagement with Kampung Pendas Baru residents.
1 st October 2014	Engagement with Kelab Alami Tanjung Kupang.
3 rd October 2014	FGD was held with the residents of Kampung Paya Mengkuang and Kampung Pok.
8 th October 2014	FGD was held with the Orang Asli of Kampung Simpang Arang at Dewan Tarbiah, Kampung Simpang Arang. Also attended by representative from Jabatan Kemajuan Orang Asli (JKOA).
8 th October 2014	Another FGD was conducted in the afternoon with the fishermen and local residents at Restoran Sungai Pendas.
10 th October 2014	FGD was held with the residents of Kampung Tiram Duku and Tanjung Adang.
10 th October 2014	The DEIA Revised TOR has been approved by DOE Putrajaya.

3.0 Project Initiator

The Project Initiator or Proponent is Country Garden Pacificview Sdn. Bhd. with its office in Teluk Danga, Jalan Skudai, Johor Bahru.

This DEIA study was carried out by Dr. Nik & Associates Sdn. Bhd. which head office is in Pusat Bandar Wangsa Maju, Kuala Lumpur.

4.0 Statement of Need

4.1 Concept of "Forest City"

This large-scale, commercial mixed development has the potential of resulting in significant impacts to the surrounding areas which include the Port of Tanjung Pelepas, Tanjung Kupang and Gelang Patah in the southern part of the state and also to Singapore in providing competition in the investment, trade and tourism sectors. The development concept of "Forest City" is an aspiration towards a development that centres on wellness by emphasising a lifestyle that is harmonic and healthy, in a sustainable environment and in an urban setting that is efficient and comfortable to live, work and study in, and for recreation.

4.2 Strengthen Malaysia-Singapore Bilateral Relations

The Project has easy access to the North-South Expressway that connects the three countries of Thailand, Malaysia and Singapore and is close to the Second Link that binds the latter two countries. It has the potential of attracting investors from land-starved Singapore to commit international investments as a way to benefit from the planned facilities and thereby resulting in gains for both countries.

4.3 Southern Johor's Surging Economy Creates a Booming Business Opportunity

The proposed development has the potential of opening international investment opportunities which would then help to propel Johor's economy as the main gateway in the south of the country. Peninsular Malaysia has many advantages and capabilities including efficient accessibility and its proximity to Singapore, which is widely regarded as the most modern centre in the Asian region. The economic impacts would come about through business, investment and job opportunities which could be capitalised by the people, especially the young, and thereby creating a better and more secure life for all through income generation and higher-quality facilities and infrastructure.

4.4 Johor Bahru as an International City

The state and federal governments have the vision to upgrade Johor Bahru into becoming an international city and as a National Regional Centre. This internationalisation is focused towards seven strategic components, of which the proposed Project will significantly contribute towards these.

4.5 Realisation of the State of Johor Being a Global Economic Hub

This Project is expected to encourage international foreign investments and will make Johor capable of competing with the other cities which have become global economic hubs like Dubai, Singapore and so on.

4.6 Generating Local Economic Growth

Forest City will also contribute to bring additional income to the State in the form of tax payment, premiums, quit rent, assessment fee, submission fee, licensing fee and etc.

In addition, upon completion of the development, a projected 62,200 new employment opportunities comprising various sectors will be created.

4.7 Modernisation of infrastructure and Urban Development

There will be investments of around RM 700 million for upgrading works involving the infrastructure in the areas surrounding the proposed Project. These will cover the existing road and public transportation systems, and will benefit the population living around Gelang Patah, Tanjung Pelepas and Nusajaya especially.

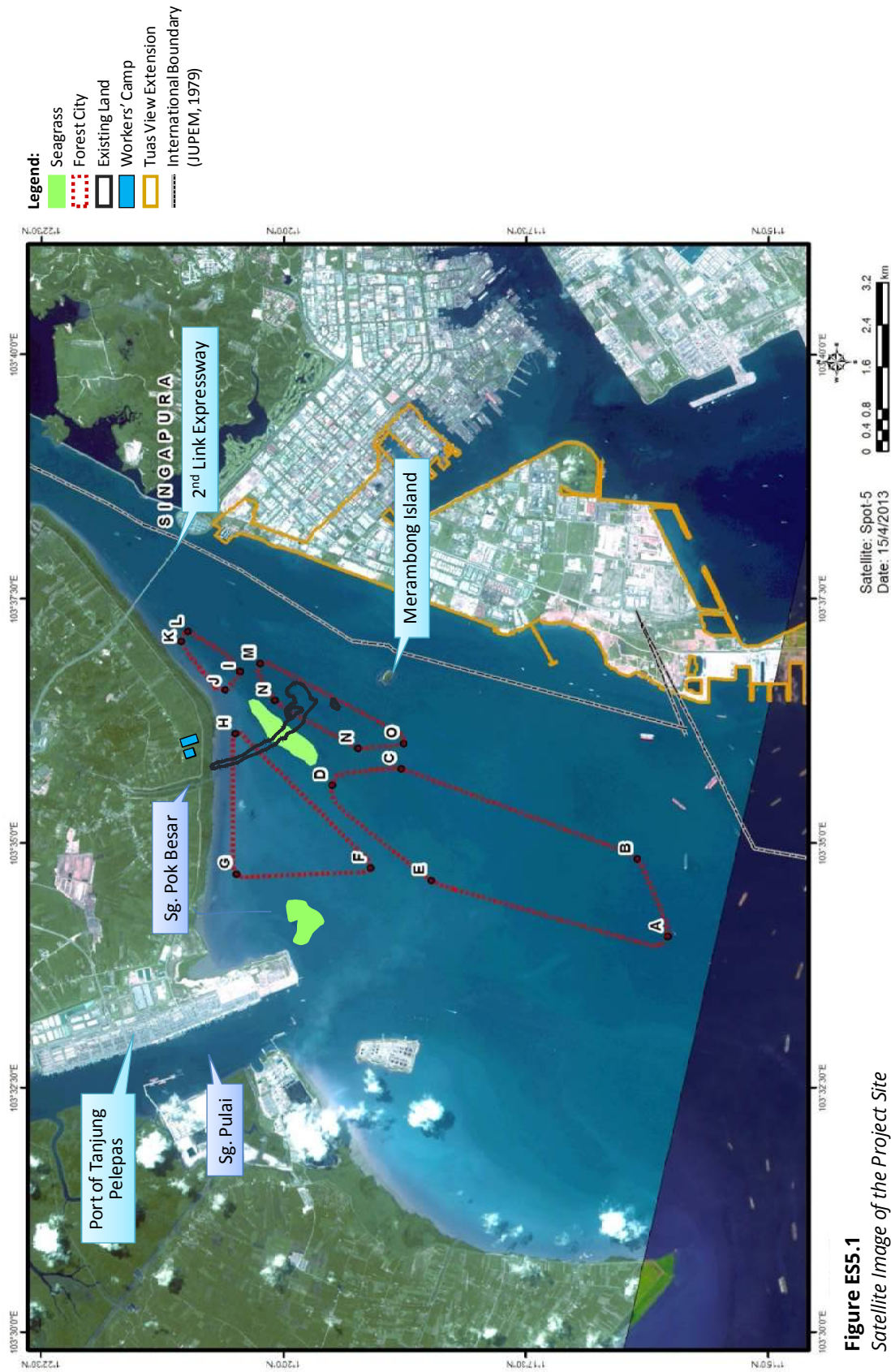
5.0 Project Description

5.1 Project Location

The proposed Project is located on the east of Port of Tanjung Pelepas and south of Tanjung Kupang within the Straits of Johor. The Project area stretches along the coastline of Tanjung Adang to Sungai Pendas where the reclamation will cover an area of 4,012.5 acres. The proposed reclamation is geographically located within the coordinates listed in *Table ES5.1* and as illustrated in *Figure ES5.1*.

Point	Latitude	Longitude
A	103° 34' 2.777" E	1° 16' 2.466" N
B	103° 34' 50.433" E	1° 16' 21.46" N
C	103° 35' 45.719" E	1° 18' 47.609" N
D	103° 35' 35.677" E	1° 19' 30.236" N
E	103° 34' 37.214" E	1° 18' 28.915" N
F	103° 34' 45.033" E	1° 19' 6.23" N
G	103° 34' 40.871" E	1° 20' 29.865" N
H	103° 36' 7.224" E	1° 20' 29.865" N
I	103° 36' 45.284" E	1° 20' 26.967" N
J	103° 36' 33.991" E	1° 20' 36.092" N
K	103° 37' 3.774" E	1° 21' 3.649" N
L	103° 37' 9.965" E	1° 20' 59.267" N
M	103° 36' 50.149" E	1° 20' 14.589" N
N	103° 36' 27.675" E	1° 20' 5.581" N
O	103° 35' 58.152" E	1° 19' 14.092" N
P	103° 36' 1.24" E	1° 18' 45.972" N

Table ES5.1
*Coordinates of the
Project Area*



5.2 General Site Description

The existing site features within the 5-km radius from the Project area are briefly covered in this section. The existing site conditions are described according to the following sections:

- a) Project site (Tanjung Pelepas - Sungai Pendas);
- b) Sungai Pulai;
- c) Western Shoreline (Tanjung Bin – Tanjung Piai); and
- d) Eastern Shoreline (Sungai Pendas - Kota Iskandar).

5.2.1 Project Site

Land clearing has been done at the entrance of the Project site on the mainland for the construction of access road and workers' hostels for the proposed Project. There is an existing piece of reclaimed land (partially completed Phase 1 reclamation) which is connected to the entrance on the mainland by a causeway which runs through Merambong Shoal. Port of Tanjung Pelepas (PTP) which sits on the eastern bank of the Sungai Pulai river mouth is the most dominant landmark within the immediate vicinity of the Project site. Another man-made feature is the Malaysia-Singapore Second Link Bridge that spans across Selat Johor between Kampung Ladang in Gelang Patah, Johor and Tuas in Singapore. There is a seagrass bed namely Merambong Shoal located within the Project area while Merambong Island sits just next to Project site boundary.

5.2.2 Sungai Pulai

Sungai Pulai has a catchment area of approximately 345 km². The river is dominated by mangrove forest known as the Sungai Pulai Forest Reserve. This forest reserve is the largest mangrove forest in Johor and the second-largest in Peninsular Malaysia. It has been declared as a Ramsar site on 31st January 2003 (JNPC 2008). There are five major tributaries within the Sungai Pulai system namely Sungai Karang, Sungai Redan, Sungai Jeram Choh, Sungai Ulu Pulai and Sungai Jeram. Various small rivers also drain into Sungai Pulai namely Sungai Tiram Duku, Sungai Senapang, Sungai Dinar, Sungai Chengkeh and Sungai Boh. Several aquaculture areas can be found within the upstream of Sungai Pulai, comprising fish and prawn cage culture. There are four jetties located on the banks of Sungai Pulai within immediate vicinity of PTP which are the Marine Department jetty, Marine Police jetty, a jetty owned by DynaMac Engineering Sdn. Bhd. and the Customs Department jetty.

5.2.3 Western Shoreline

The western shoreline described herein runs from Tanjung Bin to Tanjung Piai. Tanjung Bin is primarily covered with industrial landmarks namely Tanjung Bin Power Plant, ATB Oil Terminal and APH Oil Terminal. The shoreline of Tanjung Bin is lined with mangroves and of several tributaries that drain into Sungai Pulai which are Sungai Sam, Sungai Chokoh Kecil, Sungai Nibong and Sungai Chokoh Besar. The shoreline of Tanjung Piai is characterised by mangroves and mudflats which were gazetted as a forest reserve as well as a Ramsar site. Tanjung Piai is also known as “the Southernmost Tip of Continental Asia” and has become a tourist attraction.

5.2.4 Eastern Shoreline

The northeast shoreline reaches Kota Iskandar which is the main administrative centre for the Johor State Government. The administrative centre consists of the State Assembly building, and Chief Minister’s and State Secretariat’s offices. Situated next to Kota Iskandar is Puteri Harbour, a waterfront precinct developed as an integrated waterfront and marina that spans 688 acres. There is an international ferry terminal called Puteri Harbour International Ferry Terminal connecting Puteri Harbour with Tanjung Balai, Indonesia. Situated between Puteri Harbour and the Project site are two mangrove forest reserves, namely Kemudi and Sungai Bahan Forest Reserves. These two mangrove forests, which are located next to each other, cover a combined area of 155.6 ha and were gazetted as forest reserves in 1961.

5.3 Project Concepts and Components

The proposed Project consists of a cluster of four man-made islands with a total area of 4,012.5 acre (1,623.8 ha). The total quantity of fill material needed for the reclamation is 161,891,980m³. The main components of the proposed development is made up of serviced apartments, mixed commercial, clubhouse, neighbourhood centre, health centre, education facility, business park and water element.

5.4 Project Phases

The proposed Project is made up of four different islands whereby each island will represent one phase of the overall development. The order of the phases is illustrated in *Figure ES5.2* while the duration for each phase is tabulated in *Table ES5.2*.

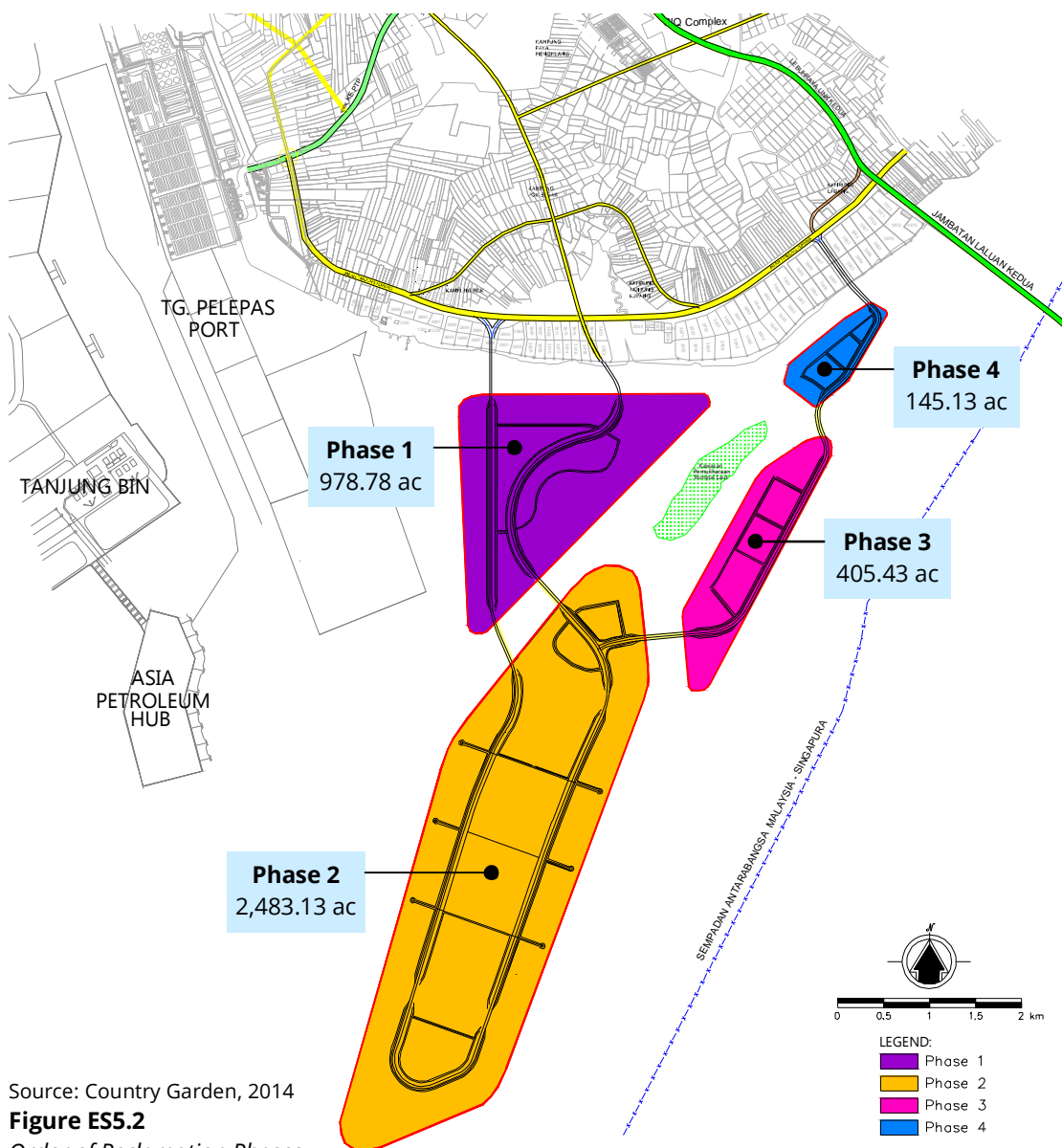


Table ES5.2
Project Phasing

Island	Reclamation Starts	Reclamation Ends	Topside Development Starts	Topside Development Ends
Island 1	2015	2018	2015	2025
Island 2	2018	2028	2020	2045
Island 3	2028	2033	2030	2040
Island 4	2033	2038	2035	2045
Duration	23 years		30 years	

5.5 Project Activities

The Project activities discussed within this section covers land reclamation and dredging works, and topside development. Pre-reclamation consists of installing silt curtain at the Project site. Meanwhile, land reclamation and dredging works comprise of dredging at the designated area, disposal of dredged material, transportation of fill material and placement of fill material at the reclamation area. Post reclamation will cover the topside developments.

5.5.1 Reclamation

5.5.1.1 Silt Curtain Installation

Silt curtain will be installed around the reclamation area as one of the measures in mitigating sediment dispersion. Double-layered silt curtain will be used for the proposed Project. It should be noted that a specific method will be used for silt curtain installation at the seagrass area, where GI pipe will be used instead of the normal sinker block.

5.5.1.2 Placement of Fill Material

The total fill material needed to complete the overall reclamation is 161,891,980 m³. For the first stage, the placement of fill material utilises a combination of CSD, conveyor barge and HDPE pipeline. The conveyor barge will pump the fill material to the CSD via a jointed pipeline, where the CSD in turn will pump sand to the filling area. Meanwhile, for the second stage, land machineries will be used to level and spread the fill materials above the water level. Earth-moving equipment (bulldozers, excavators and dump trucks) will be used for the handling of surcharge materials.

5.5.1.3 Construction of Perimeter Bund

A perimeter bund is constructed in order to contain any dispersion of sediment and plume resulting from the reclamation activities. The perimeter bund will be formed before the placement of fill material. Formation of the bund will be by using 230 g/m² of woven geotextile. The height of the bund shall be above the highest tidal. The slope of the bund will be within the range of 1: 8 to 1: 11 in order to avoid any potential circle slip.

5.5.1.4 Treatment of Fill Material

Soil improvement will be done on the reclaimed area in order to accelerate the consolidation of soft soil. Wick drain (PVD) will be used first for treatment followed by surcharging method. Compaction test is carried out to determine the rate of compaction.

5.5.1.5 Instrumentation and Monitoring of Works

The instrumentation shall be installed to monitor the ground movement and soil/pore water pressure at the construction boundary (slope) and other adjacent structures. It enables evaluation of impact of the changes in the soil on the stability of the reclamation fill and adjacent structure before, during and after reclamation works.

5.5.1.6 Construction of Shore Protection Structure

The construction of shore protection works will commence once the sand reclamation has been filled up to the required level and the profile slope is within the acceptable tolerance. Levelling and trimming of slope profile will be done as preparation before the geotextile can be laid. Geotextile fabric (with a width of 15 m and length of 40 m) will be laid at each panel using a laying barge. For construction of primary armour, flat-top barges will be used to lay the rocks which will act as the core material from the seabed until they reach the water level. As for secondary armour, temporary rock bund will be constructed at the water level along the 40 m interval. Then, the laying of armour rocks will be done using long arm excavators from the water level until the top of the platform level.

5.5.2 Source and Transportation of Fill Material

For initial phases of the reclamation, the fill material required will be sourced from Ramunia Shoal as shown in *Figure ES5.3*. The fill material will be extracted from the sand borrow area utilizing dry dredging method. Three Conveyor Barges will transport the sand from the borrow area to the reclamation site.

5.5.3 Dredging

The area between Island 1 and the coastline of Tanjung Kupang will be deepened in order to prevent sedimentation from occurring at that area. The areas to be dredged are shown in *Figure ES5.4* while the design summary of the proposed dredging works is tabulated in *Table ES5.3*. Based on the hydrographic survey, most of the dredging will be done in areas with shallow water of less than 2 m in depth during low tide. Therefore, Cutter Section Dredger (CSD) with hopper barges will be utilized for the dredging work. High-density polyethylene (HDPE) pipeline will connect the CSD with the barges. The dredged material will be pumped through the pipe. The estimated target of daily output is 20,000 m³

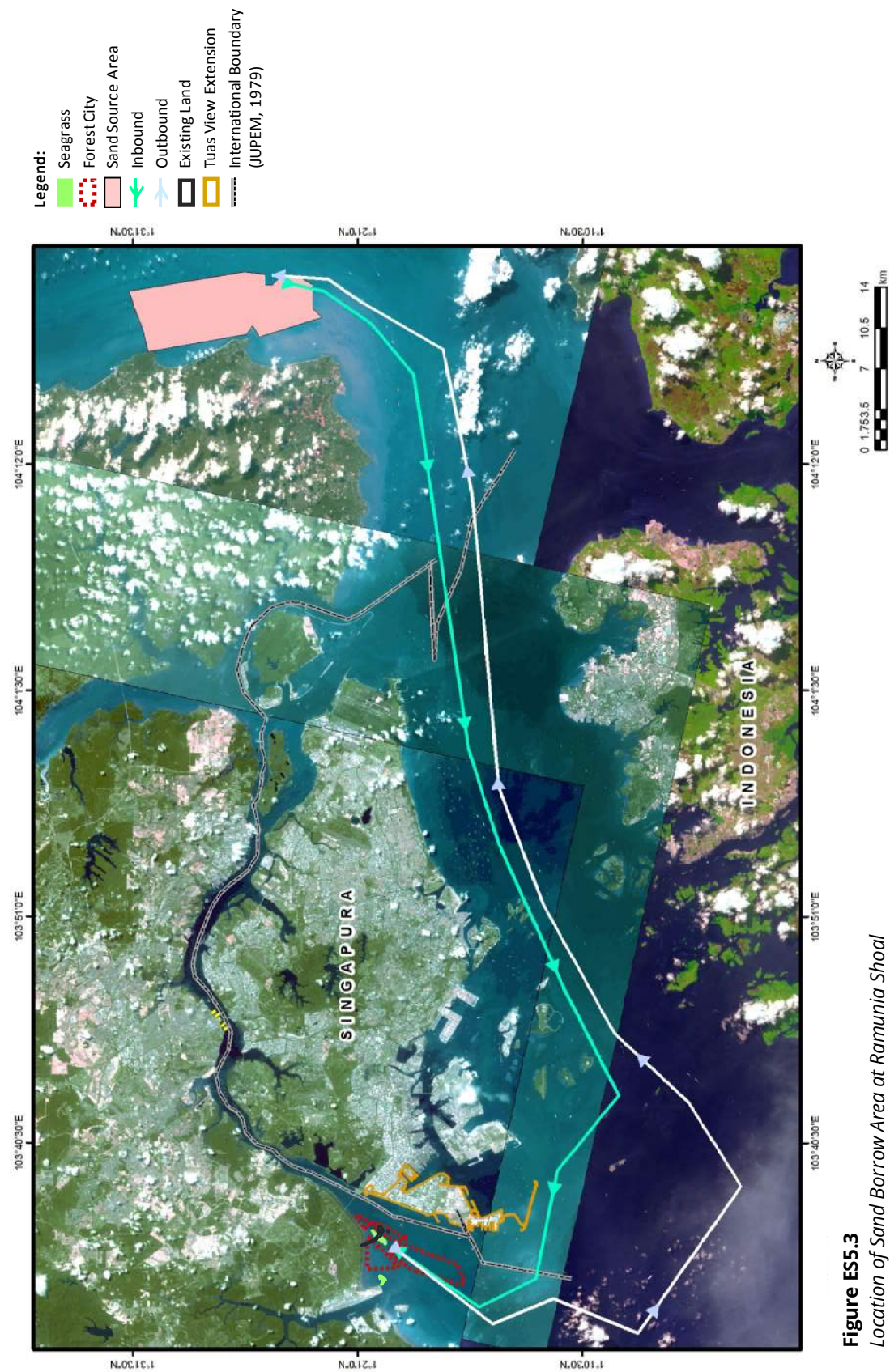


Figure ES5.3
Location of Sand Borrow Area at Ramunia Shoal

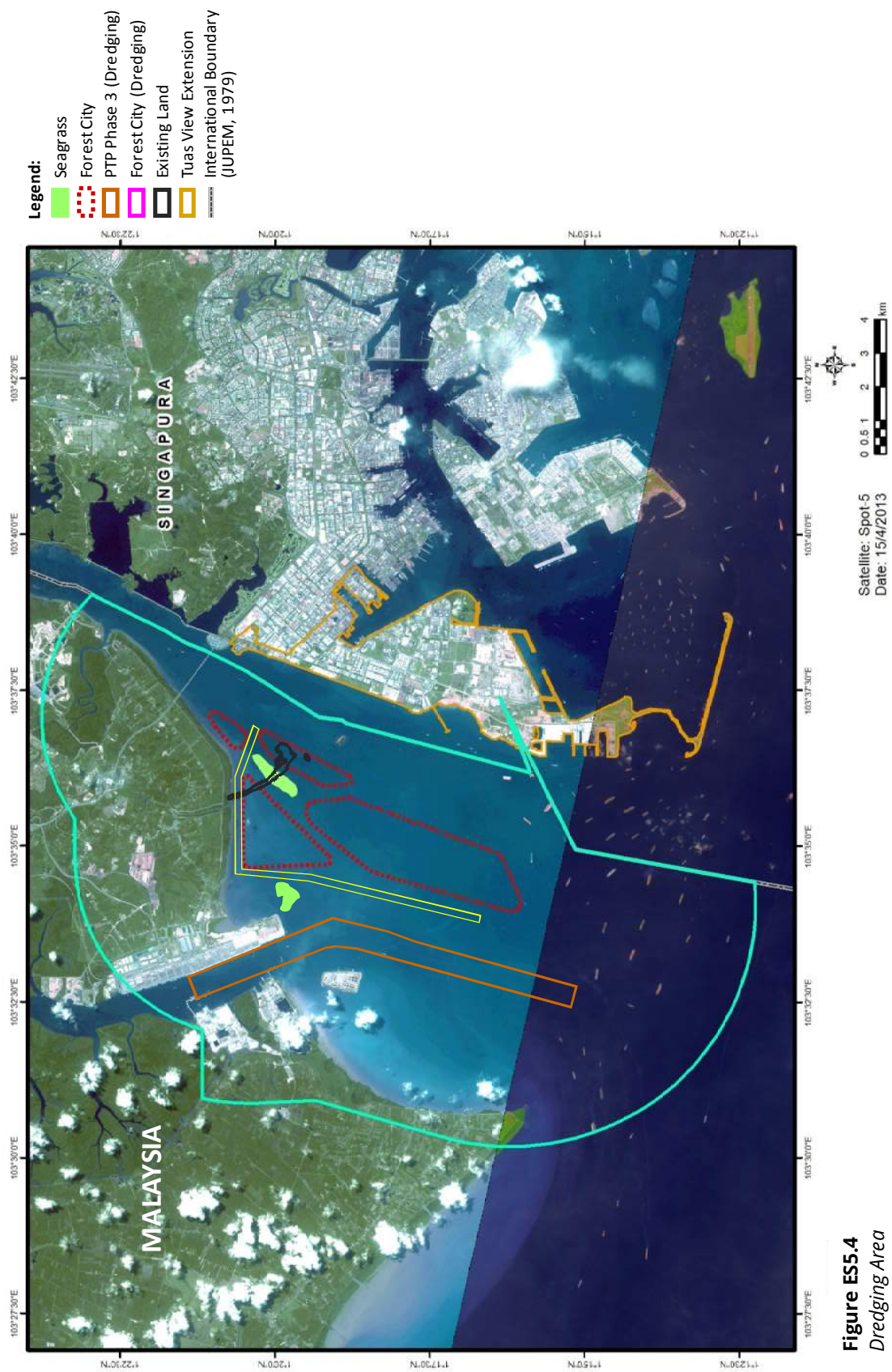


Figure ES5.4
Dredging Area

Design Characteristics	Properties	Table ES5.3 <i>Design Criteria of the Dredging Works</i>
Design depth	3.0 m below CD	
Channel width	200 m	
Channel length	11,900 m	
Estimated Area	2,594,200 m ²	
Estimated volume	7,500,000 m ³	
Dredging rate	3,000 m ³ /day	
Side slope	1V: 3H	
Dredge material	Mixture of sand, shale and clay	

5.5.4 Disposal of Dredged Material

A potential disposal area that is Tanjung Balau which is approximately 80 NM away. 7,500,000 m³ of dredged material will be transported to the disposal site using barges. Bottom discharge method will be used for the disposal operations.

5.5.5 Development on Newly-Reclaimed Land

5.5.5.1 Roads and Bridges

The four islands will be interconnected via bridges. The construction of bridge will involve cast-in-place bored pile foundation, bearing platform construction, pier construction, capping beam construction, pre-casting and installation of U girders, pre-casting and installation of T girders, bridge decking, etc. Meanwhile, the road construction will entail sub-grade works (surface cleaning, sub-grade filling, drainage, side slope protection, culvert pipe construction, etc.), pavement works (including graded base and asphalt concrete surface) and traffic facilities.

5.5.5.2 Water Supply

Source of water supply for the proposed Project will be tapped from the existing water supply tapping point or existing reservoir in *mukim* Tanjung Kupang, subject to the approval of Syarikat Air Johor (SAJ). Once the overall development is completed, it is expected that the total demand for water supply will be 40.63 MGD. The plan for water reticulation and the locations of reservoir sites are illustrated in *Figure ES5.5*.

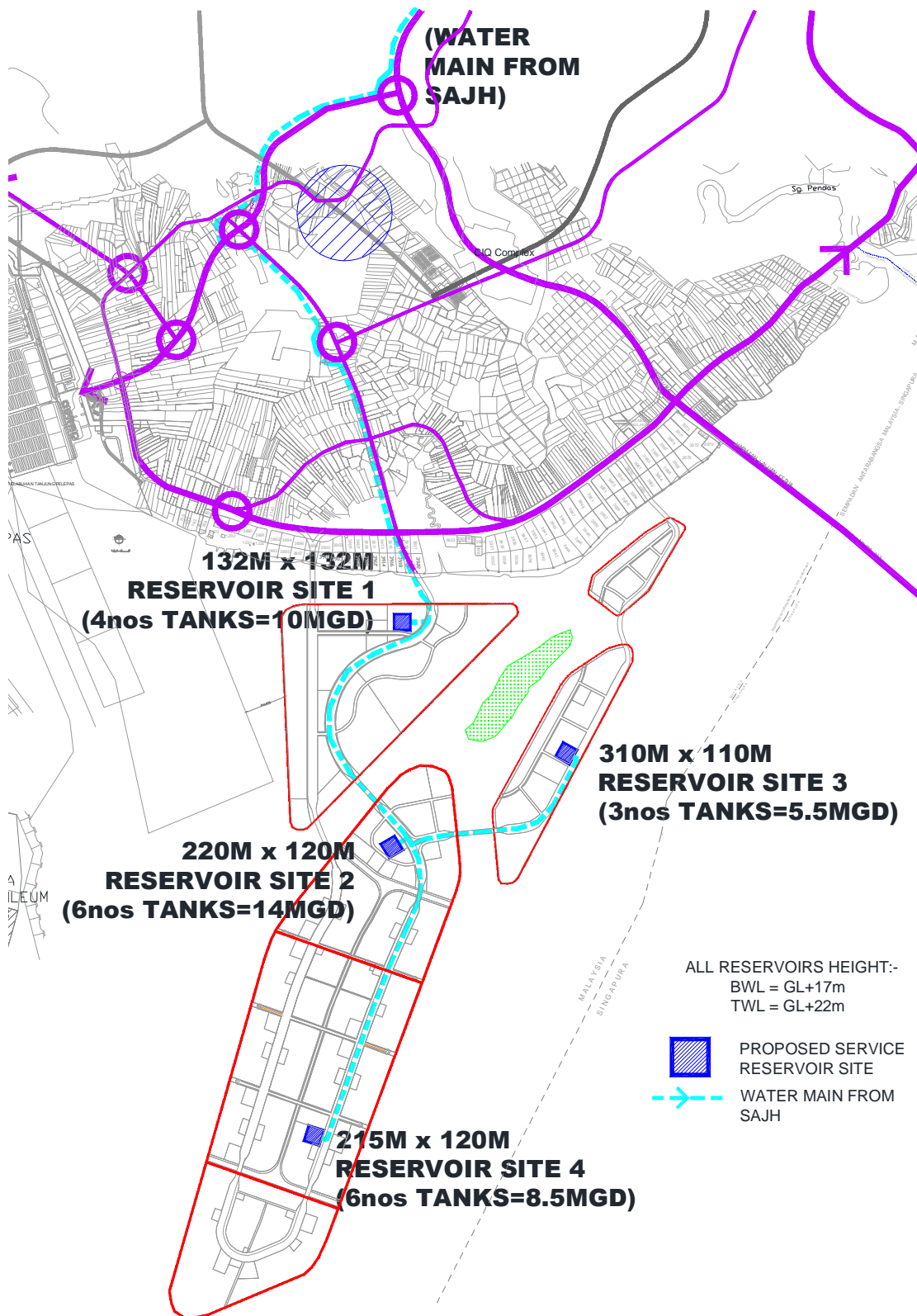


Figure ES5.5
Location of Reservoir Sites

5.5.5.3 Sewage Management

The Proponent has proposed for two Sewage Treatment Plants (STP) and two Intermediate Pumping Station (IPS) to be built in order to handle the sewage produced from the proposed development. The proposed type of STP to be built is Sequential Batch Reactor (SBR). The sewer of Phase 1 will be discharged to two modules of 200,000 PE STP1 while four modules of 400,000 PE STP2 will be built to cater for further development (Phase 2 until completion). The location of STP and IPS are shown in *Figure ES5.6*.

5.5.5.4 Solid Waste/Municipal Waste Management

At full operation, the total amount of municipal solid waste generation is expected to be at 720 tonnes per day. The solid waste produced will gradually increase until it hit 145 tonnes per day by the year 2020 when Island 1 is fully occupied. In this regard, the existing landfills at Seelong and Tanjung Langsat should be able to receive the waste from the development.

5.5.5.5 Drainage and Stormwater Management

The design of the drainage system was based on the new Urban Stormwater Management Manual (Manual Saliran Mesra Alam – Masma II). All main drains within the development area will be grass-lined channel with RC dry weather flow and turfed slope embankment, designed base on 100-year ARI. These are designed to cater for all surface runoff from the development area and outfall discharge from inland flow through the Project site. There are two types of main drain designed with 30 and 60 m reserve areas. *Figure ES5.7* shows the typical cross section of the main drain. The main drain will cut through the development area and flow into the Straits of Johor via Tidal Control Gate.

5.5.5.6 Power Supply

The total estimated load for the whole development is approximately 1,000 MVA. In order to cater for the estimated demand, a 275 kV TNB Transmission Main Intake (275 kV PMU) is required for the development. This 275 kV PMU will be built on mainland and the supply source is either from the PTP TNB Exchange or Tanjung Bin Power Station, subjected to TNB's review and approval. The 275 kV PMU will then distribute the supply to 12 other proposed 132 kV PMUs located across the development as shown in the *Figure ES5.8*.

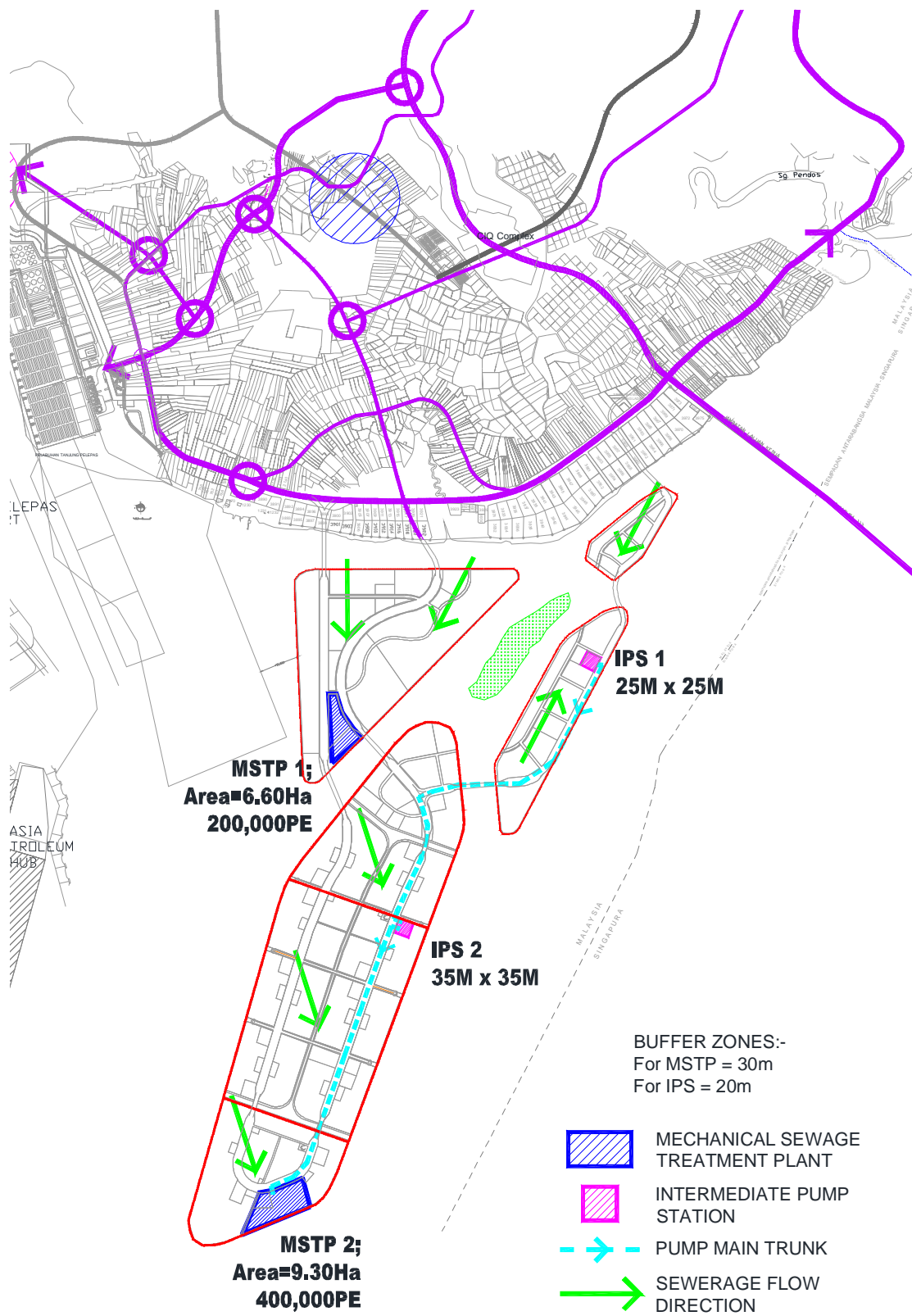


Figure ES5.6
Location of STP and IPS

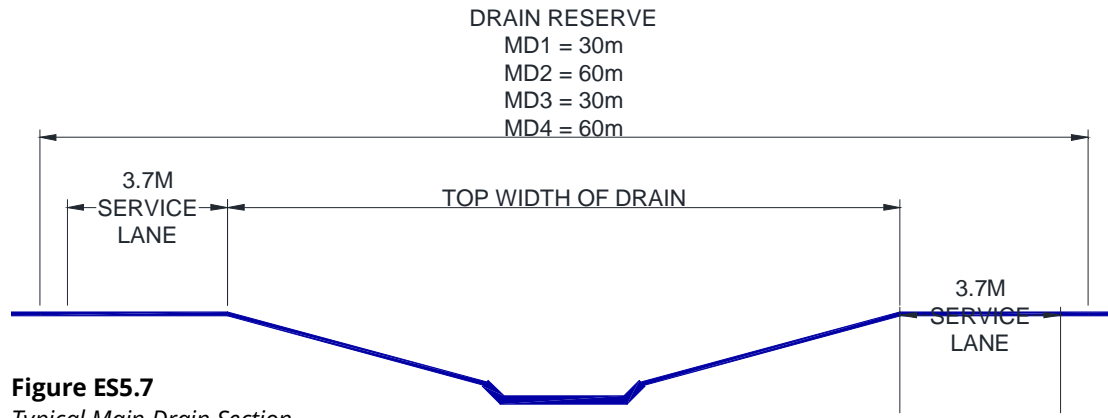


Figure ES5.7
Typical Main Drain Section

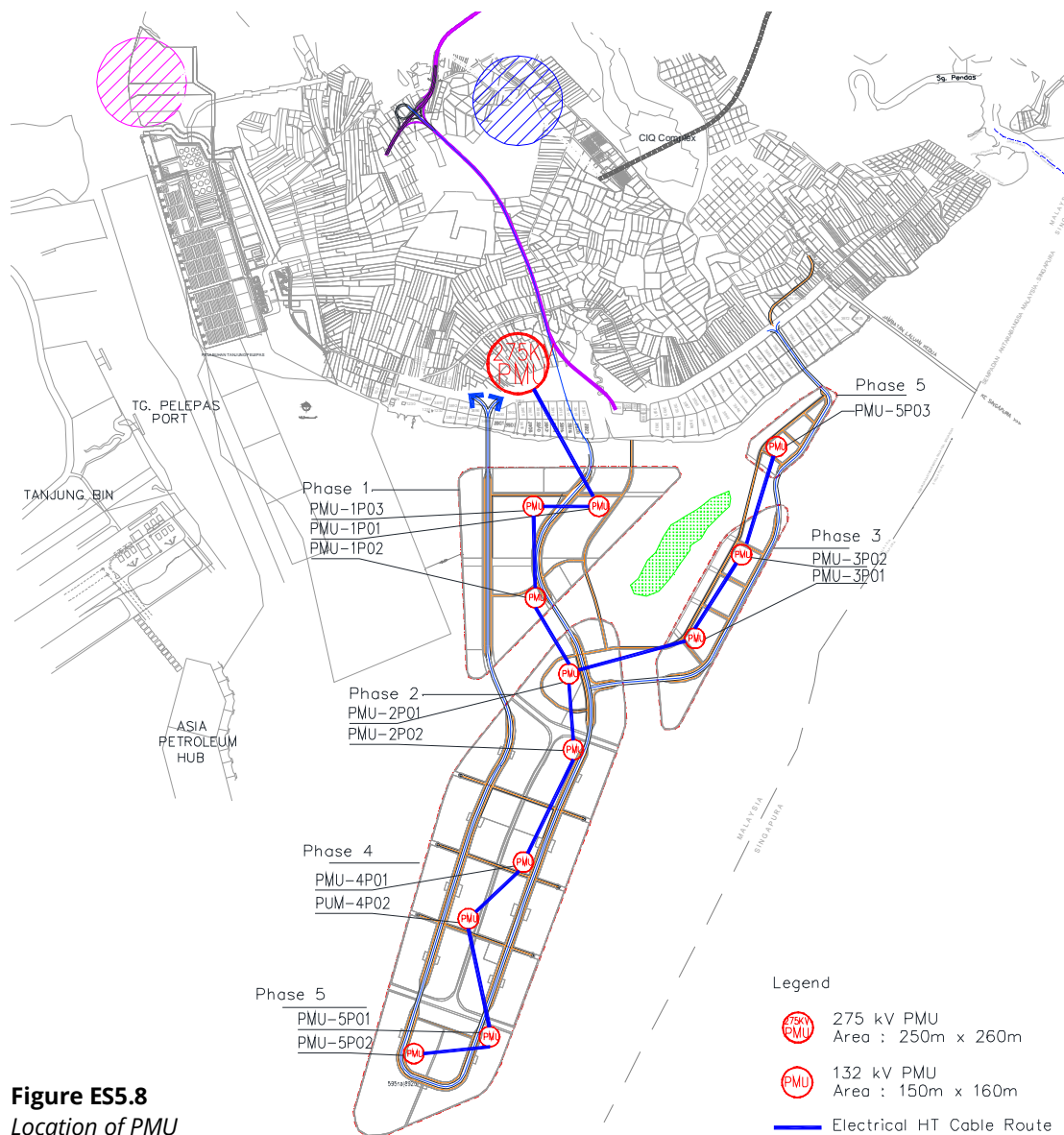


Figure ES5.8
Location of PMU

5.5.5.7 Telecommunications

For the whole development, it is estimated that the number of telephone lines required is approximately 147,580 lines. The proposed supply source for the telephone line will be from the existing TM (TMX F002) at the mainland and JC9Cs along the new proposed road and main link bridge to the development, subjected to TM's review and approval.

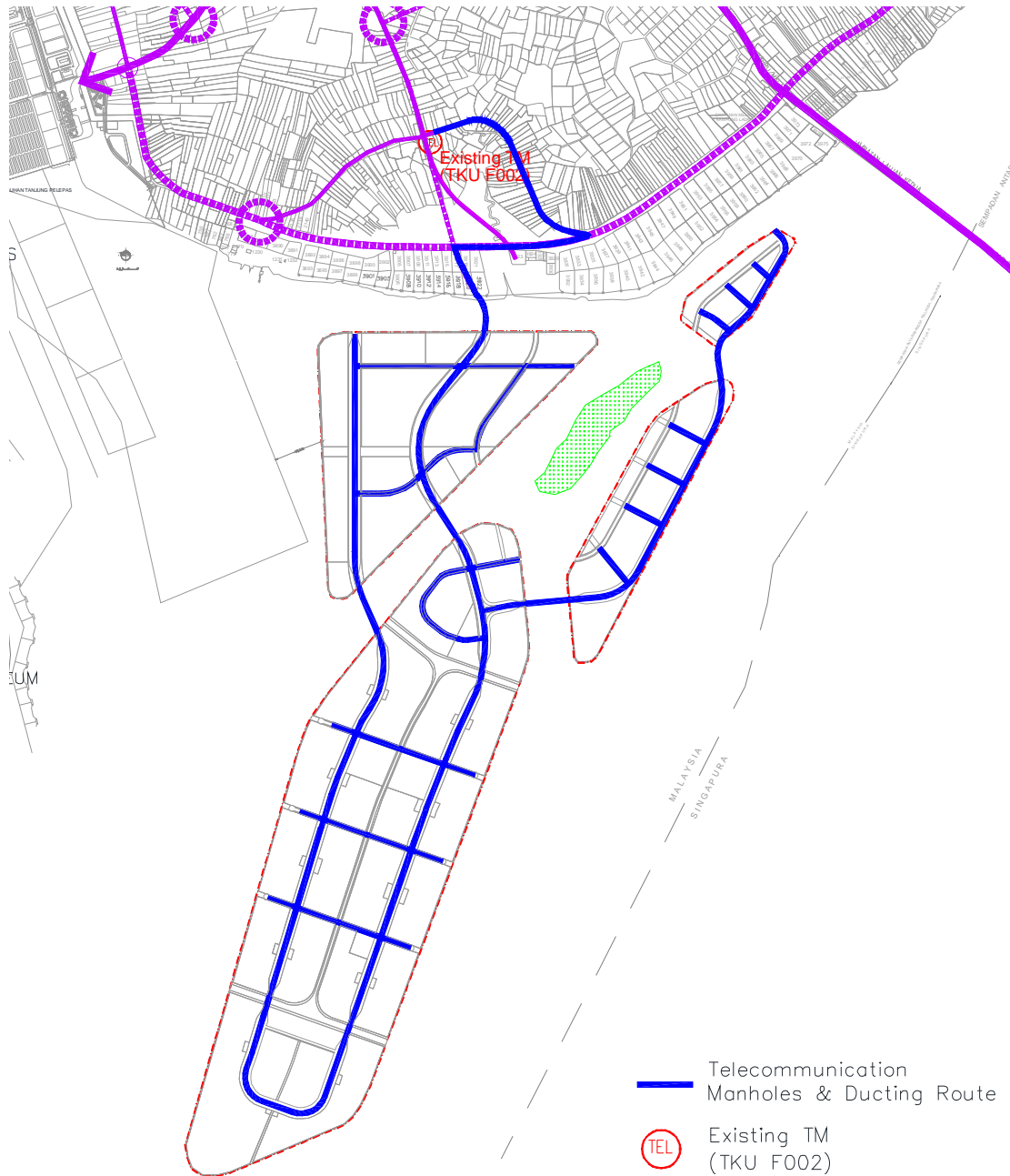


Figure ES5.9
Location of Source Supply and Telephone Line Route

6. Project Options

6.1 Reclamation Configuration

The initial plan to reclaim the islands was mainly to utilise the whole 5,000 acres of land based on the Land Title awarded to the Project Proponent (*Figure ES6.1*). However, various considerations and requirements were then looked into and assessed to refine the best possible landform to be opted. Among the major determining criteria that set the final landform of the islands are:

- Environmentally Sensitive Areas (ESA) nearby;
- Hydraulic components such as wave, current, flow, bed level changes, etc.;
- Malaysia-Singapore International Boundary;
- Existing structures nearby; and
- Committed development surrounding the proposed Project area.

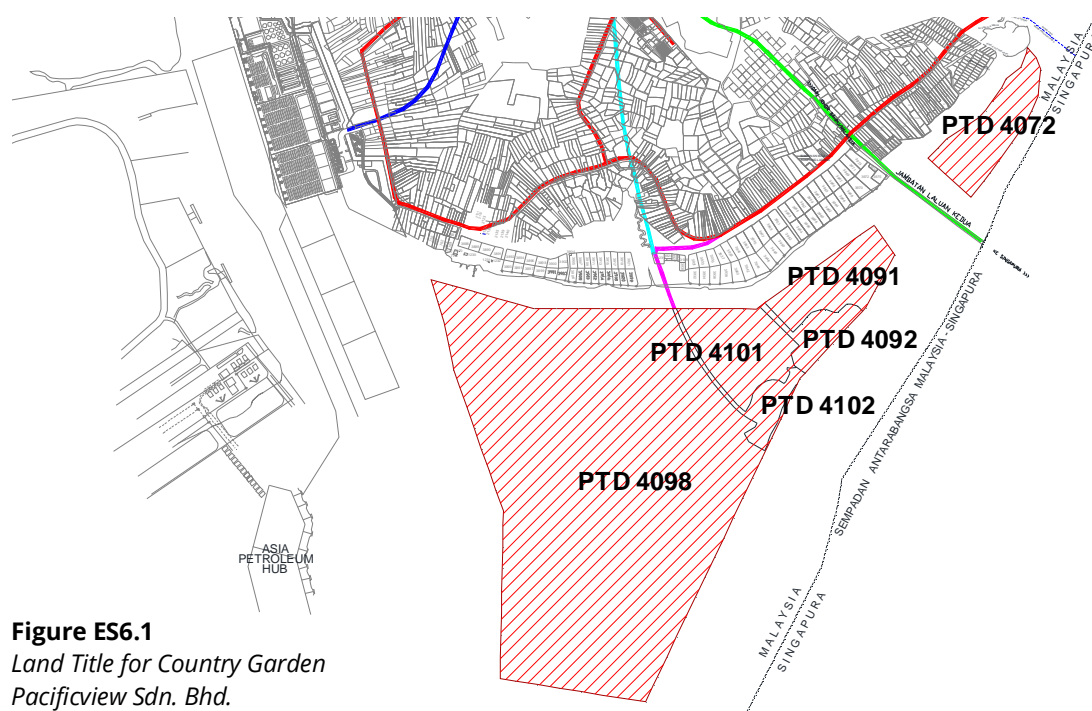


Figure ES6.1
*Land Title for Country Garden
Pacificview Sdn. Bhd.*

The final layout (Option 4) which will involve 4,012.5 acres is chosen because its landform has taken into consideration the following requirements:

- 200 to 500 m buffer zone for Environmentally Sensitive Area (ESA) namely Merambong Shoal;
- 600 m from the Environmentally Sensitive Area (ESA) of Merambong Island;
- Removal of the existing causeway (CG Causeway) for temporary access road of 1.5 km in length and 50 m in width. The CG Causeway was reclaimed partly on the

Merambong seagrass bed and has split the ecosystem into two. Hence, its removal is an immediate action plan to rectify and prevent it from further demolishing the seagrass area and its associated fauna;

- d) A 1 km buffer from Port of Tanjung Pelepas' future expansion works (Phase 3);
- e) 200 to 300 m away from the mainland (Tanjung Kupang) to accommodate access for small boats (local fishermen);
- f) A distance of at least 1 km away from the Second Link;
- g) A distance of at least 1 km away from the Malaysia—Singapore International Boundary;
- h) $\pm 10\%$ allowable maximum change of current speed within Singapore waters; and
- i) $\pm 10\%$ allowable maximum change of current speed within Malaysian waters (if unmitigated).

6.2 “No Build” Option

The coastline of Tanjung Kupang and the surrounding waters of Merambong Island will remain as they are. However, the Government will lose a source of income through foreign investments, premiums, land taxes, assessment fees, submission fees and licensing fees. The RM700 million for infrastructure upgrading works will not materialise. In addition, the 62,200 new employment opportunities and various new businesses will also not come about.

7.0 Existing Physical Environment

7.1 Land Use

The land use of the study area refers to the area within the 5 km radius from the proposed Project (*Figure ES7.1*). In general, the land use pattern in the area is mainly residential, mangrove forest reserves and swamps/wetland forest with PTP, Tanjung Bin power plant and its supporting industrial cluster concentrated around the confluence of Sungai Pulai to Johor Straits as well as along the north-eastern coast of Johor Straits.

The proposed site is covered under two separate Local Plans, namely Johor Bahru District Local Plan (Amendment) 2020 and Pontian District Local Plan (Amendment) 2020, and is also accounted under the Iskandar Malaysia Blueprint 2025 (Integrated Land Use). The proposed development area falls under the jurisdiction of Majlis Perbandaran Johor Bahru Tengah (MPJBT) and Majlis Daerah Pontian (MDP).

Water bodies are the main land use component which constitutes 37.40% of the overall land use within the sub-planning block. These water bodies are mainly derived from Sungai Pulai and its tributaries within the Tanjung Pelepas planning block as well as the waters of the Straits of Johor.

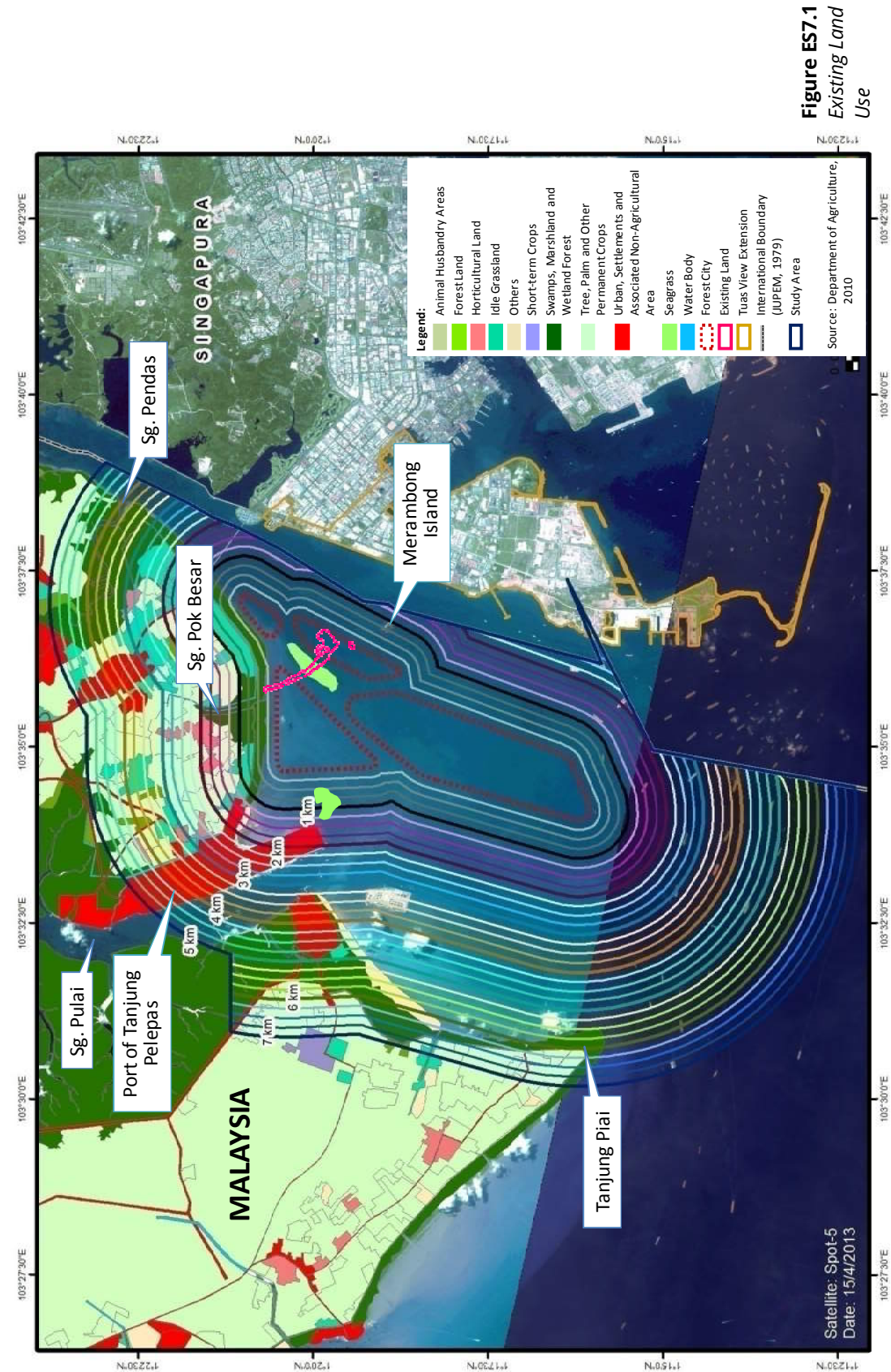


Figure ES7.1
Existing Land
Use

Mangrove forest covers 23.14% of the overall land usage within the Tanjung Pelepas planning block. The mangrove forest coverage is inclusive of a portion of the Sungai Pulai Ramsar site (total area is 9,126 ha), which was declared by the Ramsar Secretariat as “Internationally Important and Significant”, as well as indigenous wetland forest surrounding the Sungai Pulai Ramsar site.

With regards to the Integrated Land Use Blueprint for Iskandar Malaysia, the proposed Project is closest to Flagship B: Nusajaya and Flagship C: Tanjung Pelepas—Tanjung Piai. The majority of land usage for Iskandar Malaysia accounts for urban (existing and future) which is 42.95% of the overall area. The second-highest land usage is agricultural land, which is 27.35% and is the focus in the development of Iskandar Malaysia. The existing urban footprint indicates areas which are already built-up and in general being served by urban services, particularly infrastructures and utilities.

Tanjung Bin is one of the special management areas and the largest privately owned Rank 1 Core Conservation Area. It is situated within the estuary of Sungai Pulai, which is the most important ecological site in Iskandar Malaysia. There are two major activities in Tanjung Bin which are the Tanjung Bin Power Plant and Port of Tanjung Pelepas. The other main activities at Tanjung Bin are eco-tourism, research and education. The Ramsar site, mangrove forests, forest reserves and seagrass are areas of high conservation value and of importance to Iskandar Malaysia.

7.2 Committed Developments

There are 4 main committed developments close to the proposed Project. These are the Tanjung Piai breakwaters, Port of Tanjung Pelepas (PTP), Integrated Petroleum Hub and Maritime Industrial Park and Sunway Iskandar. The shoreline of Tanjung Piai had long been reported to have experienced coastal erosion. Action is being taken by the Department of Irrigation and Drainage (DID) to alleviate the erosion problem considering the importance of the Tanjung Piai shoreline which also houses the Tanjung Piai Ramsar site. It is approximately 9 km from the proposed Project.

PTP intends to implement its Phase 3 development from its overall master plan which will involve dredging and land reclamation works. The existing berth will be further extended where new berths will be constructed, hugging the navigational channel, and expected to begin in 2015.

The Integrated Petroleum Hub and Maritime Industrial Park is situated off Tanjung Piai and within *mukim* Serkat in Pontian district and involves reclamation. The reclamation will cover a total area of 3,485 acres where an integrated petroleum hub and maritime industrial park will then be developed.

Sunway Iskandar is a proposed mixed development to be built within Iskandar Malaysia’s “Flagship Zone B”. The Project will be developed on 1,800 acres of land surrounding

Sungai Pendas comprising of low-density residential and commercial properties. There will also be riverine estates traversed via Sungai Pendas.

7.3 Hydraulic Components

Currents within Malacca and Singapore Straits flow into Western Straits of Johor during flood flow. The presence of the Johor-Singapore Causeway prevents the flow from mixing with waters from the Eastern Straits of Johor. Water flows out from Western Straits of Johor during ebb flow. The mudflats and mangrove-forested area within the Project area are exposed at various stages of low water events. The current speed is quite variable in the Project area.

The orientation of the coastline around the Project site and reclamations at Singapore Island as well as the mudflat provide varying degrees of wave sheltering to the coastline depending on the direction of wave propagation.

There is a slight change in the erosion and sedimentation patterns within and around the Project site for the Northeast and Southwest Monsoon conditions.

7.4 Geology and Geotechnical

A geological and geotechnical study was undertaken to evaluate the subsurface soil/rock condition on the Project site. The evaluation encompasses determination of the soil profiles and corresponding design parameter for key geotechnical issues namely the stability of the reclaimed land and coastal protection structure. The geological map of Malaysia indicates that the site is situated over marine and continental deposits from the Quaternary Period.

The soil stratigraphy of the site generally consists of the following soil composites:

- a) Layer 1: Soft marine clay;
- b) Layer 2: Alluvium soil consists of deposited silt or gravel; and
- c) Layer 3: Boulders consists of granite/shale/quartzite.

7.5 Hydrology and Drainage

The proposed Project will be built entirely on reclaimed land situated within the Straits of Johor. Therefore, it is not expected to cause any disturbance to the catchment area for the existing river system. However, as most of the river regimes empty within the immediate vicinity of the Project site, the presence of new landmass may influence the current course of the river regimes. The main river catchments are Sungai Pulai, Sungai Pok Besar, Sungai Pok Kecil and Sungai Pendas.

7.6 Water Quality

Fifteen water quality sampling stations were established within the study area as shown in *Figure ES7.2*. *In-situ* measurements of the physical parameters and sampling of water were carried out on 2^{6th} June 2014. Details of the water-quality sampling are as listed below. The water samples taken from the study area were analysed by an accredited laboratory, and in situ analyses were made using portable analytical meters which comply with the standard methods as specified by the U.S. Environmental Protection Agency procedures.

- a) **Dissolved Oxygen (DO)** - Although saline, and in the straits sea, the existing DO levels are already rather low, at about 3 to 4 mg/L (3.08 to 4.75 mg/L). Low DO values are common in forested or mangrove areas due to the presence of tannic and humic acids. There was no significant stratification of DO values between the three water-column layers, indicating well-mixed waters.
- b) **Turbidity and Suspended Solids** - The in-situ measured turbidity values recorded at all stations were low i.e. all values were below 5 NTU, indicating very clear waters. Overall, the SS values were generally below the Malaysian Marine Water Quality Standard and Criteria (MWQSC) level of 50 mg/L, indicating excellent marine water quality with respect to Suspended Solids (SS).
- c) **Oil and Grease** - In this study, it was found that O&G levels were below 10 mg/L at all points and depths where the recorded values ranged from non-detectable (ND) to about 3 mg/L. Seeing that the straits is plied by ships and boats, the 1 - 3 mg/L values are expected, where such traffic occurs.
- d) **Organic Contents** - The COD values range from very low (3 mg/L) to relatively high (127 mg/L). The elevated COD values (around 100 mg/L) could also be due to mangrove-region organics. Those COD and BOD values show that the water at the proposed Project area is already polluted by dissolved organics.
- e) **Ammoniacal Nitrogen** - The levels of ammoniacal nitrogen in the sea water samples taken ranged from moderate (1.06 mg/L) to very high (5.71 mg/L) for sea water, indicating contamination by sewage and confirming the suggestion by the BOD values as mentioned above.
- f) **Coliform** - The levels of faecal coliform were all non-detectable, that is less than 2 MPN/100mL at all points.
- g) **Heavy Metals** - Levels for all metals in the straits waters at the proposed Project site are non-detectable except for Chromium and Iron. However, those for Chromium are still well below the MWQSC level of 0.01 mg/L while there is no stated limit for Iron.

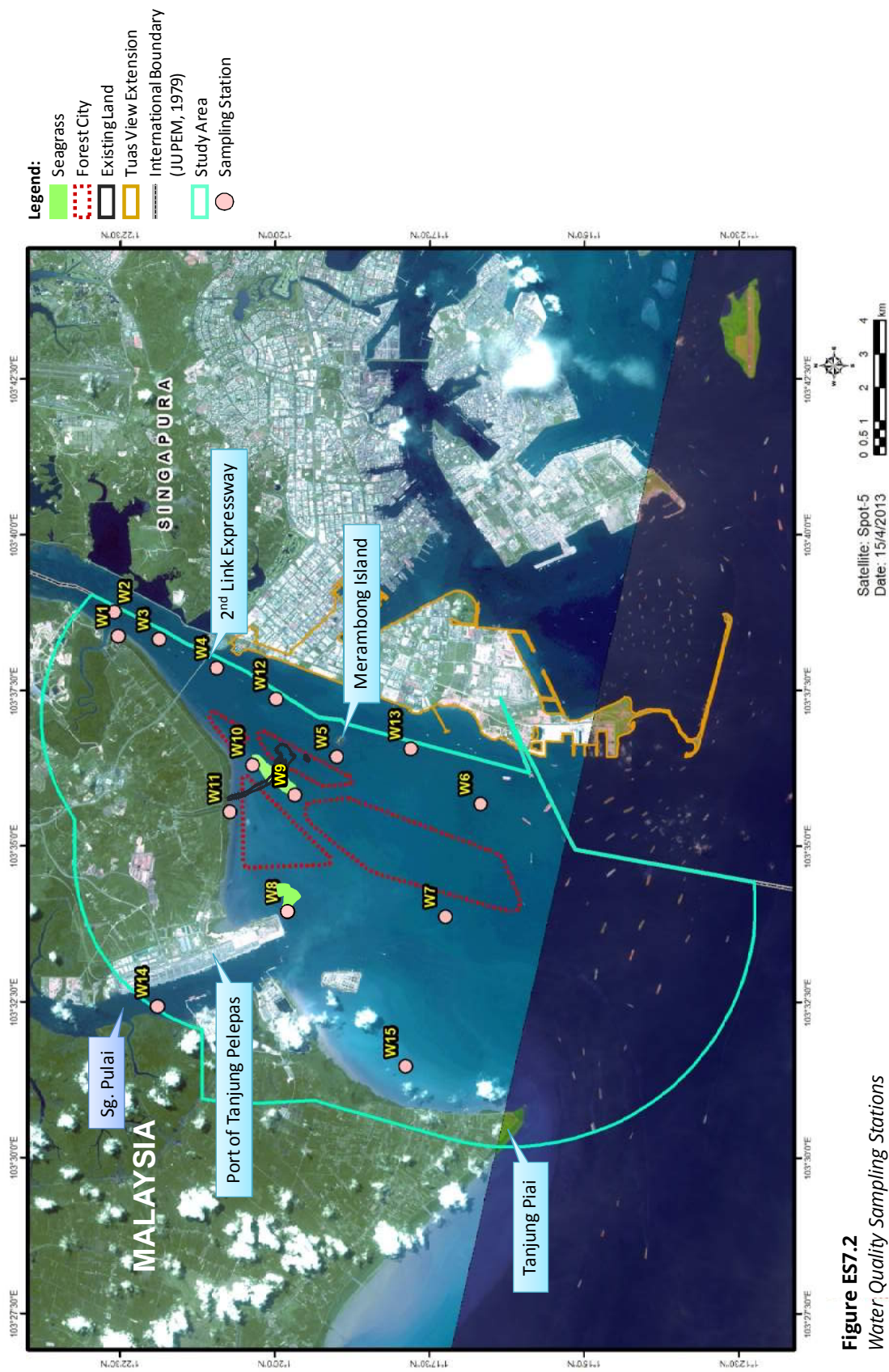


Figure ES7.2
Water Quality Sampling Stations

Table ES7.1*Water Quality Sampling Stations*

Points	Coordinate	Type of Water	Description
W1	1° 22' 32.33" N, 103° 38' 22.26" E	Estuarine	River mouth of Sungai Pendas
W2	1° 22' 35.94" N, 103° 38' 45.84" E	Saline	Approximately 4 km northeast of the Project site
W3	1° 21' 52.71" N, 103° 38' 19.33" E	Saline	Adjacent to the Malaysia-Singapore international boundary
W4	1° 20' 56.59" N, 103° 37' 51.56" E	Saline	Near Tuas Checkpoint
W5	1° 18' 59.93" N, 103° 36' 26.09" E	Saline	Merambong Island
W6	1° 16' 41.00" N, 103° 35' 41.00" E	Saline	Approximately 1 km from south of the Project site
W7	1° 17' 14.83" N, 103° 33' 52.48" E	Saline	Nearby the anchorage point
W8	1° 19' 47.72" N, 103° 33' 57.00" E	Saline	Tanjung Adang Shoal
W9	1° 19' 40.56" N, 103° 35' 49.38" E	Saline	Merambong Shoal (South)
W10	1° 20' 21.96" N, 103° 36' 18.06" E	Saline	Merambong Shoal (North)
W11	1° 20' 43.87" N, 103° 35' 33.34" E	Estuarine	River mouth of Sungai Pok
W12	1° 19' 59.18" N, 103° 37' 21.95" E	Saline	Near international boundary
W13	1° 17' 48.53" N, 103° 36' 34.10" E	Saline	Near international boundary
W14	1° 21' 53.74" N, 103° 32' 25.72" E	Estuarine	River mouth of Sungai Pulaui
W15	1° 17' 53.31" N, 103° 31' 28.18" E	Saline	In front of Sungai Nibong

Items	Marine
Physical	Temperature, salinity, pH, conductivity, turbidity, dissolved oxygen (DO), total suspended solids (TSS)
Anions	Ammoniacal nitrogen, phosphate, nitrate, sulphide
Cations/Heavy Metals	Cr, Cd, Cu, Ni, Fe, Pb, Mn, As, Hg
Organics	BOD, Total Organic Carbon (TOC), oil and grease
Microbial	Faecal coliform, <i>E.coli</i> , <i>Enterococci</i>
Number of Stations	Fifteen (15)
Depths	Three depths (surface, middle and bottom)
Tides	Spring (Flooding)

Table ES7.2*Details of Water Quality Sampling*

7.7 Sediment Quality

Three sediment quality sampling stations were established within the study area. Sediment samples were taken using a Van Veer Grab. Chemical analyses were done in accordance to the relevant standards. Baseline sediment quality results as per the table below show that all parameters fall under the "Non Polluted" category as stipulated by the US EPA Standard. In general, the sediment quality surrounding the Project area can be considered to be in good condition.

Table ES7.3
Sediment Quality Analyses

Parameter	Unit	US EPA Standard			Results		
		NP	MP	HP	S1	S2	S3
Zinc as Zn	mg/kg	<90	90-200	>200	51.500	22.530	40.769
Nickel as Ni	mg/kg	<20	20-50	>50	5.625	0.602	8.284
Copper as Cu	mg/kg	<25	25-50	>50	13.125	0.904	3.846
Chromium as Cr	mg/kg	<25	25-75	>75	11.500	2.952	19.763
Lead as Pb	mg/kg	<40	40-60	>60	15.813	5.000	22.071
Arsenic as As	mg/kg	<3	3 – 8	>8	<0.001	<0.001	<0.001
Cadmium as Cd	mg/kg	-	-	>6	0.875	0.361	0.473

7.8 Air Quality

The ambience air quality sampling was done on 17th to 19th July 2014. The parameters observed were Total Suspended Particles (TSP), Sulphur Dioxide (SO₂), Carbon Monoxide (CO) and Nitrogen Dioxide (NO₂). Seven stations have been selected for the study. The stations' locations are as shown below while the baseline air quality results are tabulated in *Table ES7.5*.

Table ES7.4
Air Quality Stations

Station	Coordinates	Location	Malaysian Recommended Environmental Air Quality Guideline
A1	1° 21' 35.44" N, 103° 36' 45.25" E	Kampung Ladang	TSP :260 µg/m ³ SO ₂ :105 µg/m ³ NO ₂ :320 µg/m ³ CO :35 µg/m ³
A2	1° 21' 03.34" N, 103° 35' 57.26" E	Kampung Tanjung Kupang	
A3	1° 21' 18.38" N, 103° 33' 50.00" E	Kampung Tanjung Adang	
A4	1° 19' 50.04" N, 103° 36' 35.74" E	On reclaimed land (Island 3)	
A5	1° 18' 53.09" N, 103° 36' 46.21" E	Merambong Island (facing Singapore)	
A6	1° 19' 07.95" N, 103° 35' 30.47" E	At proposed Island 2	
A7	1° 19' 40.20" N, 103° 31' 20.43" E	Kampung Sungai Dinar	

Table ES7.5*Air Quality Monitoring Baseline Results*

Parameter		Total Suspended Particles (TSP)		
Monitoring Date		17—18/07/2014	17—18/07/2014	18—19/07/2014
Sampling Time	Start	8.45 am	8.30 am	8.00 am
	Stop	8.45 am	8.30 am	8.00 am
Sampling Duration (min)		1,440	1,440	1,440
Air Volume Samples (m ³)		1,627	1,627	1,627
Weight of Suspended Particulates Collected (µg)		60,190	40,670	43,920
Concentration of TSP (µg/m ³)		37	25	27
Parameter		Sulphur Dioxide (SO ₂)		
Monitoring Date		17—18/07/2014	17—18/07/2014	18—19/07/2014
Sampling Time	Start	8.45 am	8.30 am	8.00 am
	Stop	8.45 am	8.30 am	8.00 am
Sampling Duration (min)		1,440	1,440	1,440
Air Volume Samples (m ³)		2.909	2.880	2.880
Concentration of SO ₂ (ppm)		<0.001	<0.001	<0.001
Parameter		Nitrogen Dioxide (NO ₂)		
Monitoring Date		17/07/2014	17/07/2014	18/07/2014
Sampling Time	Start	8.45 am	8.30 am	8.00 am
	Stop	9.45 am	9.30 am	9.00 am
Sampling Duration (min)		60	60	60
Air Volume Samples (m ³)		0.122	0.121	0.121
Concentration of NO ₂ (ppm)		<0.001	<0.001	<0.001
Parameter		Carbon Monoxide (CO)		
Monitoring Date		17/07/2014	17/07/2014	18/07/2014
Sampling Time	Start	8.45 am	8.30 am	8.00 am
	Stop	9.45 am	9.30 am	9.00 am
Sampling Duration (min)		60	60	60
Air Volume Samples (m ³)		2.82	0.122	0.121
Concentration of CO (ppm)		<5	<5	

Note: Malaysian Recommended Environmental Air Quality Guideline = 260 µg/m³

7.9 Noise

Noise measurements were carried out to measure and establish the existing background noise levels at the surrounding area along the proposed plant in order to establish the existing background noise levels at the affected residential and sensitive areas. Existing background noise levels' measurements were performed according to the International Electro-technical Commissioning (IEC) specifications. The noise descriptors are L_{eq} , L_{10} , and L_{90} . The levels were monitored simultaneously for a duration of at least fifteen minutes in dBA. In addition, the minimum and maximum noise levels, L_{min} and L_{max} , which define the range of noise level data during the measurements' undertaking, were also recorded in dBA. Seven locations (*Figure ES7.3*) were chosen as the noise sampling stations while the baseline noise results are tabulated in *Table ES7.6*.

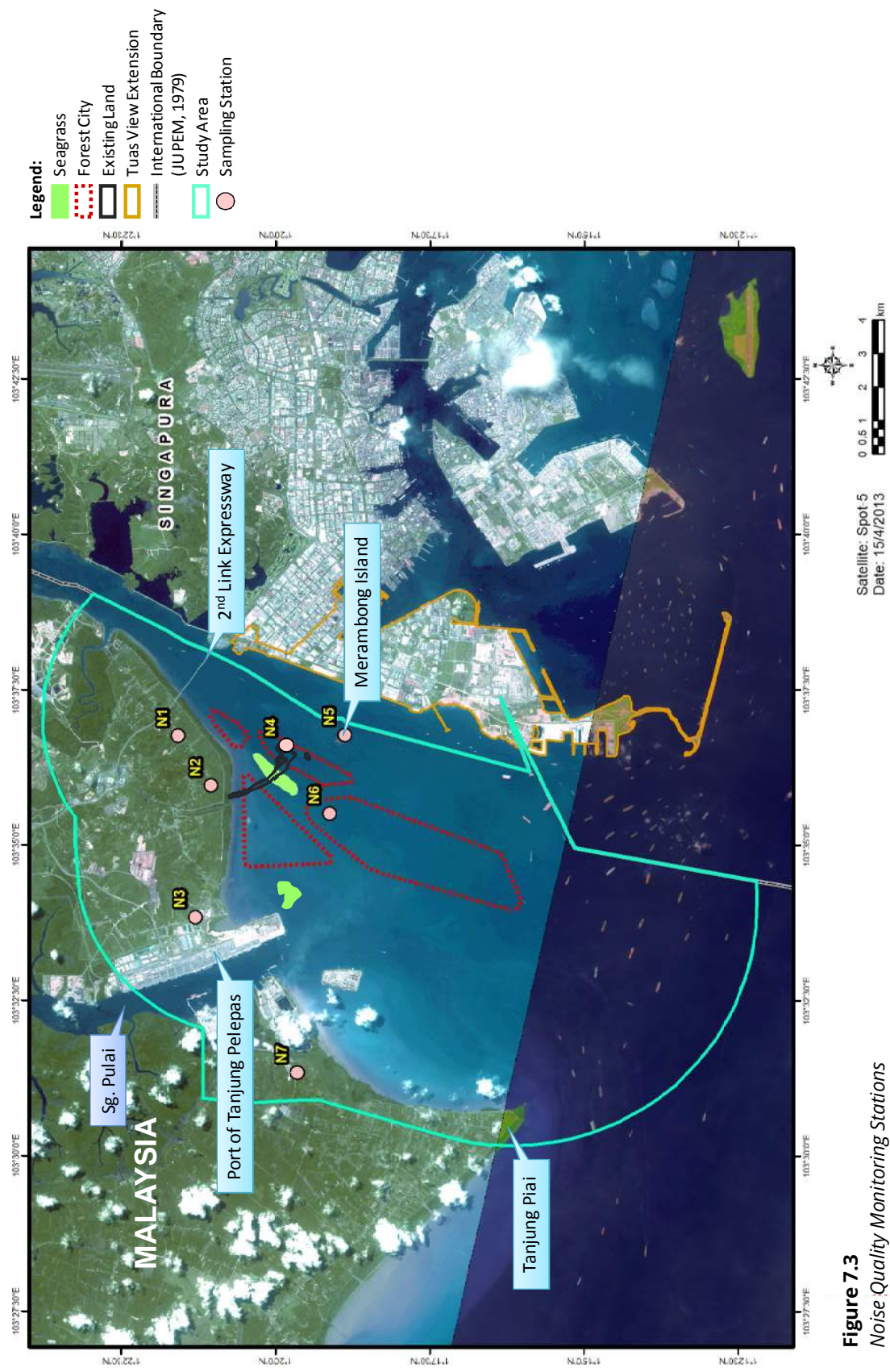
Table ES7.6
Noise Sampling Stations

Station	Coordinates	Location	Measurement
N1	1° 21' 35.44" N, 103° 36' 45.25" E	Kampung Ladang	L_{min} , L_{max} , L_{10} , L_{50} , L_{90} , L_{eq} (24 hours profile)
N2	1° 21' 03.34" N, 103° 35' 57.26" E	Kampung Tanjung Kupang	
N3	1° 21' 18.38" N, 103° 33' 50.00" E	Kampung Tanjung Adang	
N4	1° 19' 50.04" N, 103° 36' 35.74" E	On reclaimed land (Island 3)	
N5	1° 18' 53.09" N, 103° 36' 46.21" E	Merambong Island (facing Singapore)	
N6	1° 19' 07.95" N, 103° 35' 30.47" E	At proposed Island 2	
N7	1° 19' 40.20" N, 103° 31' 20.43" E	Kampung Sungai Dinar	

7.10 Existing Land Traffic

The proposed development site is located in the western part of Nusajaya, which is easily accessible from the Tanjung Pelepas Highway and the Second Link Expressway. The existing road networks nearby the Project area are shown in *Figure ES7.2*. The major routes in this network are Jalan Pendas Laut and Jalan Tanjung Kupang, which form the state road of J4. Other existing routes are Second Link Expressway and the Tanjung Pelepas Highway.

Traffic survey for roadways and intersections was carried out on 6th February 2014. The survey involved roadside count surveys, field reconnaissance survey and road inventory survey. Data on vehicular movements, compositions, turning volume, roadway and intersection inventories were also recorded. The classified manual counts for both roadways' and intersections' turning movements were carried out following the standard



as suggested in the “Arahan Teknik (Jalan) JKR 8/86” to enumerate the actual volume of traffic along the selected roadways and intersections. *Table ES7.7* below summarises the existing roadway operating conditions and their corresponding level of service (LOS).

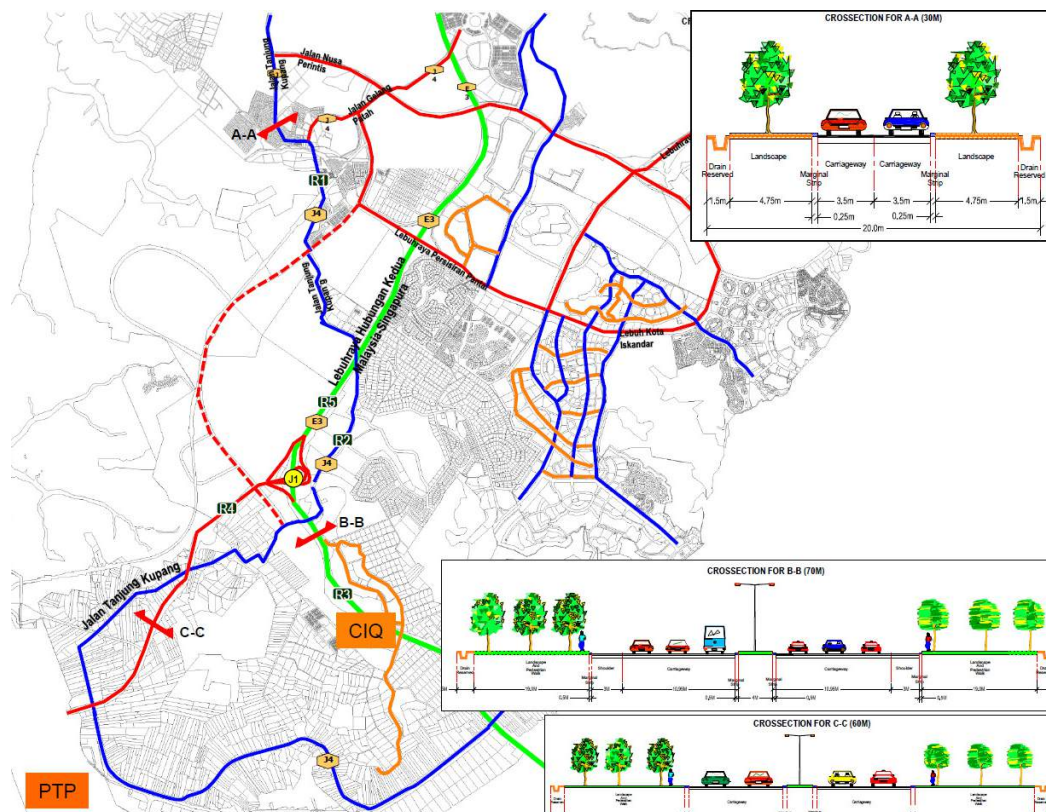


Figure ES7.4
Existing Road Network

Table ES7.7
Existing Roadway Operating Conditions

Stations	Type of Lanes	Flow Direction	Existing Peak Hour Traffic (pcu)	Peak Hour Flow Rate (pc/h)	Level of Service (LOS)
R1 – Jalan Pendas Laut	S1	North Bound	585	1,328	C
	S1	South Bound	677		
R2 – Jalan Tanjung Kupang	S1	North Bound	505	1,090	C
	S1	South Bound	529		
R3 – Second Link Expressway (Near CIQ)	D3	North Bound	461	169	A
	D3	South Bound	3,871	1,419	D
R4 – Tanjung Pelepas Highway	D2	East Bound	473	260	A
	D2	West Bound	1,666	916	D
R5 - 2 nd Link Expressway (near Leisure Farm)	D3	North Bound	864	317	A
	D3	South Bound	5,468	2,005	D

8.0 Environmentally Sensitive Areas

There are several Environmentally Sensitive Areas (ESAs) found within the vicinity of the proposed Project site. It should be noted that the NPP2 has clearly stated the importance of preserving environmentally sensitive areas when undertaking any development. The ESAs found within the port area are highly valuable to the local ecosystem with several of them being classified as “Rank 1”. These ESAs, their locations and distances to the Project site are as shown in *Table ES8.1*.

Table ES8.1

List of ESAs within the Vicinity of the Project Area

ESA Rank	ESA	Location	Closest Distance from the Project Site (km)
Rank 1	Seagrass	<ul style="list-style-type: none"> Tanjung Adang Shoal Merambong Shoal 	0.69 0.28
	Island	Merambong Island	0.80
	Coral Reefs	Merambong Island	0.80
	Mangrove Swamps	<ul style="list-style-type: none"> Coastline of Tanjung Piai Coastline of Tanjung Kupang Sungai Pulai Estuary 	5.63 0.43 5.45
	Ramsar Site	<ul style="list-style-type: none"> Tanjung Piai Sungai Pulai 	5.67 5.63
	Tourist Attraction/ Landmark	The Southernmost Tip of Mainland Asia	5.93
Rank 2	Populated Area (within study area circumference)	<ul style="list-style-type: none"> Kampung Tanjung Adang Kampung Tanjung Kupang Kampung Pekajang Lurus Kampung Pekajang Bengkok Kampung Tiram Duku Kampung Pok Besar Kampung Pok Kechil Kampung Ladang Kampung Paya Mengkuang Pendas Kampung Pendas Laut Kampung Bukit Kuching Kampung Sungai Sam Kampung Sungai Dinar Kampung Sungai Chengkeh Besar Kampung Chengkeh 	1.34 1.03 3.12 4.06 4.54 2.60 2.00 1.32 3.57 1.32 4.06 5.12 6.01 5.63 6.70 6.55
	Mudflat	<ul style="list-style-type: none"> Northern Shoreline (Tanjung Kupang - Pendas) Western Shoreline (Tanjung Bin - Tanjung Piai) 	5.67 5.63

Table ES8.1 (cont'd)

ESA Rank	ESA	Location	Closest Distance from the Project Site (km)
Others	Aquaculture	Near Sungai Pendas	4.00
	International Boundary	Malaysia—Singapore International Boundary	1.59
	Eroding Coastline	Tanjung Piai	6.33

8.1 Seagrass Bed (Tanjong Adang and Merambong Shoal)

The seagrass beds at Merambong and Tanjung Adang Shoals are considered as the most important in Peninsular Malaysia. The seagrass beds sustain a diverse mixture of animals and some of them are considered as endangered species such as seahorse and dugong while the commercially important fishes, crabs, prawns and invertebrates like sea stars, sea cucumbers and anemone also thrive in the area.

These seagrass beds are expected to be heavily impacted by the proposed development as both seagrass beds are located within the Project site. The close proximity and very little buffer between the beds and the Project site will render mitigation measures to be less effective. In order to protect the seagrass beds, the mitigation measures proposed must be properly planned, flawlessly implemented and reliably maintained.

8.2 Merambong Island

Merambong Island is a 2.75 ha of rocky island that demarcates the Malaysia-Singapore border and is vegetated by patches of mangroves and shrubs. From the field survey done for this Project, there are a total of 59 taxa in 53 genera from 35 families. The flora includes not only trees but also palms, shrubs, herbs, ferns and climbers.

There are also patches of seaweed and soft and hard corals that inhabit the water around the island. The area is recognized as a habitat for seahorse (*Hippocampus kuda*), pipefishes and sea hares. Merambong Island is also an important research site for local universities conducting researches on marine organisms as rich marine ecosystems are known to inhabit the island.

8.3 Ramsar Site (Sungai Pulai and Tanjung Piai)

Sungai Pulai Forest Reserve is the biggest mangrove forest reserve in the state of Johor. Covering a broad area of 8,353.23 ha, it is also the largest intact riverine mangrove area

in Malaysia. It has been declared as a Ramsar site on 31st January 2003. Diversity-wise, the Sungai Pulai mangrove habitat supports 24 true mangrove plant species and 21 associate species, representing 84% of Malaysia's mangrove species, 79% of Malaysia's exclusive mangrove species and 37% of the world's true mangrove species.

The Tanjung Piai mangrove forest consists of 8 km coastal mangrove and approximately 400 ha of intertidal mudflat. The mangrove habitat here is double-gazetted. Most coastlines within the area are exposed. The coastline is primarily in various degrees of erosion. The mudflats are relatively wide and extensive. Diversity-wise, a total of 59 taxa in 41 genera from 31 families of plant species were reported. From the 59 mangrove flora species, 36 species were exclusive mangrove (94.8% of Malaysian total exclusive), 19 non-exclusive and four associates.

8.4 Mudflat

There are substantial proportions of mudflat ranges from Tanjung Piai to Tanjung Bin and along the coastline of Tanjung Kupang. The mudflat has a span of about 11.1 km with coastal bund present at most part of the coastline. The mudflat area extends up to about 2 km adjacent to PTP wharves tapering to about 100 m at Sungai Pulai western estuary. The presence of PTP Phase II wharves create a calm condition in the lee of the structure that has resulted in the formation of extensive mudflat.

8.5 Aquacultures

There are aquaculture activities nearby to the Project area. These aquaculture activities, including fish cage cultures, are found scattered along the estuary of Sungai Pendas. The major systems being practised were brackish water cage culture and canvas rearing. Most fishermen do not have other incomes and their wives are mostly home-makers, which make them highly dependent on the fisheries activity to survive for their living. The fishermen may lose their source of income should any deterioration of water quality and marine life occurs.

8.6 Populated Areas

The locale surrounding the proposed Project area are mainly small fishermen villages. Most of the families were local residents living in the area for more than 30 years. Considering the magnitude of the proposed Project, it is expected that the impacts from the implementation of the proposed development will not only be on the environment but also on the population of the surrounding area. The condition on the existing human environment is described extensively in *Chapter 11—Existing Human Environment*.

8.7 Coastline Conditions

The coastline around Tanjung Bin Power Plant, located across the Sungai Pulai river mouth, is stable while the coastline between PTP's Phase 2 and Tanjung Kupang is accreting. Coastline stability is afforded by coastal protection provided for Tanjung Bin power plant. As noted in the Shoreline Management Plan for Iskandar Malaysia (SMP), the Project site is relatively sheltered from offshore waves. The permitted current and future land use within the management unit is primarily port-based industry.

Oil spills from the open waters have also impacted the mangroves along the coastline resulting in diebacks and a receding shoreline. Mangroves along the coastline have previously been cleared for agriculture and aquaculture; this has further stressed the coastal mangroves contributing to the erosion process.

9.0 Existing Biological Environment

The main biological components assessed within the study area are terrestrial flora (mangrove), mammals, birds, reptiles, amphibians, fishes and aquatic macro-invertebrates. The description of these components is based on the field surveys conducted and supplemented by available published and unpublished data of the various institutes and government agencies.

9.1 Terrestrial Flora (Mangroves)

The survey of mangrove flora was conducted using two approaches. Firstly, general survey following 11 transects along coastline/rivers to document all coastal/riverine and mangrove plant species. Secondly, 14 of the study plots measuring 50 m x 20 m (0.1 ha) were established to gain information on species composition, diversity and also estimation of above-ground biomass. All trees with a diameter at breast height (DBH) of 5 cm and above were recorded. Species of conservation interest or are rare were highlighted based on the IUCN Red List Categories and Criteria for mangrove species. However, all flora surveys are secondary data and for plots study, 11 of 14 plots study results are primary data. The locations for the flora survey and plot study are as listed in *Table ES9.1*.

From all 23 study sites, a total of 144 plant species were recorded that include trees, shrubs, palms, herbs, ferns, grasses, sedges and climbers. Most of the species are commonly found in wetland areas except for three rare tree species. Based on the IUCN Red List Categories and Criteria, *Bruguiera hainesii* is "Critically Endangered", *A. rumphiana* is "Vulnerable" and *Brownlowiatera*, *C. zippeliana* and *S. ovata* are "Nearly Threatened".

Table ES9.1*Locations for Flora Survey and Plot Study*

Sites	Types	Location	GPS Coordinates	Data Status
A	Flora survey	Tanjung Adang—Tanjung Kupang—Sungai Pendas	01° 21' 8" N 103° 36' 48.822" E	Secondary
B	Flora survey	Sungai Pok	01° 21' 02" N 103° 35' 28" E	Secondary
C	Plot study	Sungai Pendas	01° 24' 39" N 103° 38' 44" E	Secondary
D	Flora survey	Kampung Tanjung Adang/PTP	01° 20' 51" N 103° 33' 42" E	Secondary
E	Plot study	Sungai Redan I	01° 25' 30" N 103° 28' 42" E	Primary
F	Plot study	Sungai Redan II	01° 25' 22" N 103° 28' 46" E	Primary
G	Plot study	Sungai Karang I	01° 22' 36" N 103° 30' 04" E	Primary
H	Plot study	Sungai Karang II	01° 22' 47" N 103° 29' 45" E	Primary
I	Plot study	Sungai Karang III	01° 23' 15" N 103° 20' 49" E	Primary
J	Plot study	Sungai Karang IV	01° 23' 04" N 103° 30' 58" E	Primary
K	Flora survey	Sungai Dinar	01° 20' 26" N 103° 32' 00" E	Secondary
L	Flora survey	Sungai Chengkih Besar	01° 20' 55" N 103° 31' 22" E	Secondary
M	Flora survey	Sungai Chengkih Kecil	01° 21' 30" N 103° 31' 57" E	Secondary
N	Flora survey	Sungai Chokoh to Fish Farm	01° 18' 27" N 103° 30' 16" E	Secondary
O	Flora survey	Sungai Chokoh to Kampung Perepat Timbul and Tanjung Piai Resort	01° 17' 42" N 103° 30' 40" E	Secondary
P	Plot study and flora survey	Taman Negara Tanjung Piai to border of Ramsar Site	01° 16' 18" N 103° 30' 14" E	Secondary
Q	Plot study and flora survey	Menara Pemerhati Satu	01° 16' 04" N 103° 30' 24" E	Secondary
R	Plot study	Tanjung Piai National Park 1 (TPNP1)	01° 16' 07" N 103° 30' 35" E	Primary
S	Plot study	Tanjung Piai National Park 2 (TPNP2)	01° 16' 06" N 103° 30' 38" E	Primary

Table ES9.1 (*cont'd*)

Sites	Types	Location	GPS Coordinates	Data Status
T	Plot study	Tanjung Piai National Park 3 (TPNP3)	01° 16' 01" N 103° 30' 41" E	Primary
U	Plot study	Tanjung Piai National Park 4 (TPNP4)	01° 15' 59" N 103° 30' 42" E	Primary
V	Flora survey	Merambong Island	1°18'55.632"N 103°36'41.676"E	Secondary
W	Plot Study	Sungai Kemudi—Sungai Bahan	01° 24' 39" N 103° 38' 44" E	Secondary

9.2 Terrestrial Fauna

Fauna assessments within the proposed Project are carried out for the following objectives:

- To establish baseline information of the terrestrial volant and non-volant mammals and birds within the immediate area of the proposed Project (within a 5 km circumference); and
- To identify the presence of any protected or rare species.

The location of field survey and trapping sites are as listed in table below:

Table ES9.2

Locations of Field Survey and Trapping Sites

Sites	Location	Birds	Herpeto-fauna	Mammals	GPS Coordinates
1	Sungai Pendas (Kampung Pendas Jaya)	/		/	01°22.502'N, 103°38.391'E
2	Sungai Simpang Arang	/		/	
3	Sungai Tiram Duku	/		/	
4	Tanjung Piai National Park	/	/	/	01° 15' 59" N, 103° 30' 42" E
5	Sungai Pulai Ramsar Site	/	/	/	01° 20' 51" N, 103° 33' 42" E

In addition, secondary data is sourced from the combination of SMP for Iskandar Malaysia (2010) and DEIA for Phase 3 Dredging and Reclamation at PTP (2014).

- a) **Mammals:** Large-mammals surveys were conducted at least for 3 days at each study site along existing trails in mangrove forest. At each study site, surveys were conducted at least within 1 km transect. Mammals are identified through footprints and droppings that are found during surveys. Reports from interviews with the locals and other agencies will be included in the mammal species list.
- b) Information regarding the mammal species from primary data pointed out to being forest species and generalists, which are uniquely adapted to hard life on the coastal areas. Although there are relatively low in number of species, a variety of mammal species do exist in the mangrove ecosystems, but their ecology and association with the mangroves are poorly known.
- c) The Long-tailed macaques are prevalent in the study area. The most prevalent large mammal in the study area is the wild pig (*Sus scrofa*). The wild pigs and primates are all protected under the Wildlife Conservation Act 2010.
- d) **Birds:** The shore and water birds are very much dependent on the intertidal mud flats, sand flats and associated mangrove areas because these important wetland habitats support very rich benthic fauna, especially the actively accreting mangrove forests. The mudflats serve as a rich feeding ground for migratory shorebirds and resident water birds.

Overall, there are no record of any threatened species because of the short duration of sampling. The total number of bird species does not reflect the true picture of bird diversity in this area. A more comprehensive work is required to include the migratory seasons.

9.3 Marine Biology

9.3.1 Seagrass

Seagrass is an ecologically important habitat that forms the basis of many complex marine ecosystems of the sea. The seagrass sheltering effects and plethora of sufficient food make it the preferred breeding site, nursery ground and temporary shelter for fishes and crustaceans.

There are established seagrass beds at Tanjung Adang Laut Shoal, Merambong Shoal and other areas along the Sungai Pulai. The Macrophytes (seagrass and seaweed) present at the shoal were assessed both qualitatively and quantitatively. Details of the seagrass species recorded from the field survey conducted are as in *Table ES9.3*.

Tanjung Adang Shoal	Merambong Shoal	Table ES9.3 Seagrass Species in Tanjung Adang Shoal and Merambong Shoal
<i>Enhalus accoroides</i> <i>Halophila</i> spp. <i>Halophila spinulosa</i> <i>Syringodium isoetifolium</i>	<i>Enhalus accoroides</i> <i>Halophila ovalis</i> <i>Halophila spinulosa</i> <i>Thalassia hemprichii</i> <i>Cymodocea rotundata</i> <i>Halodule pinnifolia</i> <i>Halodule uninervis</i>	

9.3.2 Fish and Fisheries

The Straits of Johor provides a complex macrocosm of fresh-estuarine and marine ecosystem for fish communities. The Ramsar site of Sungai Pulai provide a good protected areas for both terrestrial flora and fauna as well as their associated aquatic organisms. Therefore, the ecosystem provides and plays an integral roles as the major habitat/biotope for wide spectrum of fish species ranging from fresh, estuarine and marine waters fish communities.

Artisanal fishermen from the surrounding coast have traditionally exploited the fishes resources surrounding the areas using various traditional gears such as *kelong*, traps, trolling, long lining and gill/trammel netting.

Survey and assessment of marine fishes are based on the occurrence of demersal and pelagic species during ebbing and flooding tides in the study area. Gill nets and trammel nets were used and set up at random at different tidal regimes, to capture the pelagic and demersal fish species. In addition to the field survey, data of fish landing also were gathered from the traditional fishermen operating in the study areas. A checklist of the fish species in the Study Area is as *Table ES9.4*.

Seahorse and pipefish have become iconic fish species living in the seagrass of Merambong Shoals. The results of the present survey denoted that this cryptic species uses seagrass bed as their primary habitats and major disturbance presently exerted on the ecosystem will most likely drive them away.

Dugongs are one of the twenty marine mammals inhabiting Malaysian waters. In Malaysia, little is known about these creatures due to a lack of trained personnel and also limited funding to study the animal. The dugongs' presence are made aware of from occasional sightings, stranding and deaths which attracted public and media attention, especially in the year 1999. They are also known as "sea cows" due to their main feeding activity which is grazing seagrass meadows in coastal waters. The present dugong seagrass e.g. *Halophila* and *Halodule* provide a major grazing habitat for the dugong species. Data gathered from past stranding recorded confirmed the existence of this marine mammal species in the vicinity of the study area.

Table ES9.4*Past Stranding Recorded of Dugong (Dugong dugong) in Vicinity of the Study Areas*

No of Cases	Date	Number	Gender	Localities
1	14.05.2003	1	Cow	Tanjung Pelepas, Johor Bahru
2	23.07.2003	1	Female cow	Merambong Island, Johor Bahru
3	18.10.2004	1	Unrecorded	Merambong Island, Johor Bahru
4	14.01.2006	1	Unrecorded	TLDM Pengerang, Kota Tinggi
5	11.04.2006	1	Unrecorded	Simpang. Arang, Gelang Patah, Johor Bahru
6	28.07.2006	1	Female	Pengkalan Pendas Laut, Johor Bahru
7	2.09.2006	1	Female	Pulau Kapas, Terengganu
8	23.01.2007	1	Female	Pulau Tuba, Pulau Langkawi, Kedah
9	11.09.2007	1	Male	Sungai Pendas, Johor Bahru

10.0 Marine Traffic and Navigation

The primary aim of this marine traffic and navigation study is to address the environmental issues associated with the proposed development towards navigation within the Project area. The report has been made based on the information received and from research specifically done on the subject matter, and has taken into account various factors regarding:

- Existing marine facilities and utilisation;
- Existing marine traffic and navigation channel;
- Marine traffic accident statistics;
- Conditions of local climate; and
- Existing marine traffic procedure and safety rules.

The assessment was done using qualitative and quantitative methods including local knowledge, experience, data available from the Project Proponent, adjacent port-operating companies, government authorities and agencies; interviews with fishermen, their associations and local communities, etc.

10.1 Existing Marine Facilities and Utilisation

- Existing major marine facilities close to the proposed project include Port of Tanjung Pelepas, Port of Singapore, ATB Oil Terminal, Tanjung Bin Power Plant, and APH Oil Terminal. There are also STS Operations which involve the sitting of a mothership anchored at a designated location and functioning as a floating storage unit (FSU).

b) Fishing Vessels' Activities

Fishing activities have traditionally been carried out in the estuary of Sungai Pulai, which is now the location of the approach channel to PTP, Tanjung Bin Power Plant, APH Terminal and the turning basin leading to the ATT Tanjung Bin Oil Terminal abreast of PTP Container Terminal Berths.

There are numerous small wooden jetties situated along the coastline to the east of PTP as far as the bridge linking Malaysia and Singapore (Second Link) are normally small boats powered mainly by outboard engines of between 15 to 60 hp. The total number of fishing boats based in the estuary of Sungai Pulai is estimated to be 200. These consist of both licensed and unlicensed fishing craft. It should be noted that fishing takes place all over the study area, by day and by night, and at various stages of the tide.

c) Existing Marina

There are two (2) marinas located on the eastern side of the Second Link, namely Puteri Harbour and Danga Bay. It should be noted that the Danga Bay marina has been closed permanently and it is no longer possible to berth there. The area will be absorbed into a huge satellite residential development that has been taking place in the area for the last 2 years.

10.2 Existing Marine Traffic and Navigation Channel

PTP can be approached via the Southern entrance of the navigational channel. This channel is 420 m wide and 7,000 m in length. The declared depth is 16.0 m ACD at the approach channel and 17 m at the Phase 2 turning basin. In addition to the anchorage areas, there are a number of licensed Ship-to-Ship (STS) transfer operations close to the southern port limit to the south of Tanjung Piai.

Besides the PTP navigation channel, there is another navigation channel that lies between Merambong Island and the Malaysia-Singapore international boundary. This channel traverses approximately 7 km from south to the 2nd Link and it is located within the Johor Port limit. Recreational boats and yachts use this channel to and from Johor Bahru.

10.3 Conditions of Local Climate

The visibility in the area is generally good although periods of heavy rainstorms may temporarily cause a reduction in this visibility. These periods last only a few hours and are not expected to have an overly significant impact on the movement of vessels to and from the waterfront facility.

The area is also subject to “the Sumatras”, which are actually lines of thunderstorms that usually occur between March and November each year.

The tides within the area are co-oscillating tides of the Pacific and Indian Oceans. The area has two low tides and two high tides a day with the tidal range (difference between the high and low water) being as low as 0.86 m during low tide and as high as 3.34 m during some spring tides.

The currents in the western side of Johor Straits generally flow in a northerly and eastwards direction during flood tides. The ebb current tends to be stronger and flows in the reverse direction.

10.4 Existing Marine Traffic Procedures and Safety Rules

The International Maritime Organisation (IMO) has adopted STRAITREP – the Mandatory Ship Reporting System in the Straits of Malacca and Singapore that was proposed by Indonesia, Malaysia and Singapore. The objectives of STRAITREP are to: (a) Enhance the safety of navigation; (b) Protect the marine environment.

10.5 Port Control Centre

PTP Port Control Centre (PCC) monitors and regulates marine traffic in the proposed Project area and the respective navigable waters within the port limits. Movements of all vessels in port must obtain prior permission from PCC. All vessels operating within the port limits are under the surveillance of the Port Radar System (PRS). Pilotage is compulsory within the limits of PTP.

11.0 Existing Human Environment

11.1 Introduction

This section discusses and highlights the socio-economic profile of the locals including the fishermen who will be impacted and to gauge their level of awareness and perception towards the impending Project as the area fronting the vicinity of the Project site is strung with rows of traditional fishing villages.

The study also seeks to establish the level of social acceptability of the area with regards to the proposed Project. This is because social acceptability would be crucial in determining the smooth implementation of the proposed development. For the purpose of this study, the zone of impact will be confined to the coastline and settlements within a circumference of 5 km from the Project boundary, which mainly comprise of traditional and fishing villages.

11.2 Methodology

Primary and secondary data were collected for the socio-economic analysis, which included a household survey that was conducted within the zone of impact of the proposed Project area. This survey was conducted by direct enumeration using four enumerators. Besides the survey, published and unpublished secondary data from various government departments and agencies such as from the Fisheries Department, Ketua Kampung, Penghulu and Ketua Unit Nelayan were also utilized.

As the study area is relatively specific, exact social statistics on its surroundings are not available. The procurement of such micro data could only be feasibly generated by conducting a social survey which, among others, would enable not only the background of the residents in the area to be known but, more importantly, their views and assessment of the proposed Project.

A sample of 180 or about 10% respondents comprising heads of households from among the local residents and fishermen numbering 143 (79.4%) and 37 (20.6%) respectively were drawn randomly from the study area using a random sampling technique, as shown in table below:

Table ES11.1

Distribution of Respondents by Components and Settlements nearby the Proposed Project Area

Sampling Area	Estimated Population*	Estimated Household No.	Sample Size		
			Public	Fishermen	Overall
Kampung Tiram Duku	1,100	220	8	2	10
Kampung Pekajang Bengkok	1,600	320	6	2	8
Kampung Pekajang Lurus	700	140	8	-	8
Kampung Pok Besar	1,200	240	14	1	15
Kampung Pok Kechil	600	120	15	-	15
Kampung Tanjung Kupang	400	80	16	6	22
Kampung Tanjung Adang	400	80	19	4	23
Kampung Ladang/Pendas	1,100	220	12	8	20
Kampung Pendas Baru	600	120	2	6	8
Kampung Paya Mengkuang	300	60	12	-	12
Kampung Bukit Kucing	400	80	14	-	14
Sub-Total	8,400	1,680	126	29	155
Kampung Sungai Dinar**	1,000	200	17	8	25
Total	9,400	1,880	143	37	180

*Source: Penghulu Gelang Patah/Tanjung Kupang

** In the *mukim* of Serkat, Pontian

A public dialogue was also conducted on 21 September 2014 at Dewan Raya Kampung Pok, Tanjung Kupang to enable the rest of the interested public to participate in a dialogue about the Project, providing an opportunity for them to air their views and seek clarification on matters that are vague or which they are concerned with. Two Focus Group Discussion (FGD) sessions were previously conducted before that involving the local leaders and the nearby developers.

11.3 Findings

The community or the respondents' profile is necessary in order to discern the type of population prevailing at the study area. It is the makeup of a society that often determines the kind of reaction, impacts and degree of acceptability. The analysis of data gathered from the questionnaire survey revealed the community profile in respect of its demography, social and economic characteristics.

The survey managed to capture 64.4% of the general target respondents i.e. the household heads and the remaining 35.6% the respondents' spouse and other adult household members/sons in place of the absent heads. However, among the fishermen, 97.3% were successfully interviewed with the remaining 2.7% comprising the adult children. The study area is a Malay-dominated area; hence almost all of the respondents were Malay. The Chinese respondents captured among the general public was less than 1%.

Economically, with the exception of the fishermen who were solely employed in their respective sector, two occupational categories i.e. private sector employees and entrepreneurs stood out as the main occupations of the general public as seen in the table below:

Respondents' Economic Background	Public	Fishermen	Overall
Occupation:			
Fisherman	0.0	100.0	20.6
Public sector employee	6.3	0.0	5.0
Private sector employee	37.8	0.0	30.0
Entrepreneurs	14.0	0.0	12.2
Others	19.6	0.0	15.6
Not working	21.0	0.0	16.6
Total	100.0	100.0	100.0

Table ES11.2
Economic Profile of the Respondents

11.3.1 Perceptions Towards the Proposed Project

An analysis of the respondents' ratings pointed to an almost consensus agreement among the locals, both the public and the fishermen, that the Project would only bring about improvements in basic amenities, increase in property value and living standards whilst increased business opportunities was fairly significantly perceived only by the public and not the fishermen. Nonetheless, the locals did not concur with increased employment opportunities which normally is perceived as the benefits that would come with a new Project. They also did not see that it would bring about increased opportunities of property ownership for them.

Perception	Public	Fishermen	Overall	Table ES11.3 <i>Rating of Perceived Socio-economic Advantages and Disadvantages Brought about by the Proposed Project (Percent Saying Yes)</i>
Advantages:				
Employment opportunities to your household members	30.8	24.3	29.4	
Employment opportunities to local population	57.3	40.5	53.9	
Improvement of basic amenities	89.4	81.1	80.6	
Increased value of land/property	88.1	89.2	88.3	
Increased standard of living	81.1	83.8	81.7	
Increased business opportunities	60.8	48.6	58.3	
Increased opportunity for property ownership	30.8	21.6	28.9	
Disadvantages:				
Loss of employment	11.2	21.6	13.3	
Loss of source of income	10.5	43.2	17.2	
Shrinkage of fishing ground	79.7	94.6	82.8	
Displaced	2.1	0.0	1.7	
Loss of property	9.8	18.9	11.7	
Marginalization of existing population	48.3	75.7	53.9	

On the positive side, most felt that it would create opportunities for commercial ventures and house rental as well as the fulfilment of the need for the population threshold to initiate and support local economic development. The area would also be faced with rapid development. For those who were not sure, their hesitancy was due to not being able to predict what will happen as they have not been faced with such a situation before.

11.3.2 Project Assessment and Local Acceptability

Analysis of the data on respondents' assessment of the Project showed that they were split in opinion, with the Project perceived to be more advantages to the public but more disadvantages to the fishermen. Nevertheless, more than two-thirds of the public agreed to the implementation of the Project. On a whole, more than half of the respondents agreed to the implementation of the Project whilst 35% disagreed and the remaining 6.7% was not sure.

The reasons given by respondents for agreeing and disagreeing with the Proposed Project are as in the following table:

Table ES11.4

Respondents' Reasons for Agreeing with the Proposed Project

Perception	Public	Fishermen
Reasons for Agreeing:	n=100	n=6
Attract outsiders and increased property value	29	16.7
For progress and development	23	16.7
Employment opportunities and improved infrastructures	17	0.0
Increased business opportunities to the locals	13	50.0
Benefit to future generation	7	16.6
No choice, already developed	11	0.0
Total	100.0	100.0
Reasons for Disagreeing:	n=35	n=28
Marginalization of locals and influx of outsiders	14.3	0.0
Worry of marine water pollution	42.9	14.3
Environmental problem and affecting mangroves	11.4	10.7
Income and livelihood of fishermen will be affected	5.7	32.1
Shrinkage of fishing ground	11.4	14.3
Obstruction to local fishing route	14.3	28.6
Total	100.0	100.0
Other Reasons:	n=87	n=23
Excessive dust along Project route, need monitoring	36.8	21.7
Threat to safety from movement of construction vehicles	18.5	13.0
Fishermen's income affected, to compensate	8.0	8.7
Locals and fishermen should be consulted regarding location of reclamation	8.0	8.7
Too close to fishing ground	8.0	21.7
Tugboats, etc., pose danger to fishermen and destruction to fishing gears	12.7	8.7
Disturbance to spawning of marine life	8.0	17.5
Total	100.0	100.0

11.3.3 Feedbacks from the Public Dialogue

The public dialogue was intended to provide a platform for those who did not participate in the social survey to air their grievances, views and opinions. Those who attended the public dialogue generally were rather mixed with the presence of more non-locals with a few coming from as far as Kuala Lumpur. A few familiar faces that were around during the KPTC public dialogue in Pengerang in 2013 were also seen present in the Tanjung Kupang public dialogue. The local Malay population was seen to be less discernible among the crowd.

The main concerns made about the Project can be summarized as follows:

- a) The Project planning aspects,
- b) The components of development and utilities,
- c) The influx of foreigners, and
- d) The benefits to the locals.

Nevertheless, there are still issues of concern that are worrying to the locals which had been voiced in the dialogue. The locals' concerns and fear could be summarised as:

- a) They being left out in the development of their area, from influx of foreigners,
- b) The future fate of fishermen when their fishing area will be turned into islands, and the issue of compensation, and
- c) Land acquisition to make way for overland access road.

11.4 Existing Public Health

Most of the households have good coverage for safe drinking water supply. For sanitary latrines, Johor has a very excellent coverage in both rural and urban. These data indicate the tremendous efforts by the government in reducing and controlling food- and water-borne diseases in the state.

The study area is otherwise free from cholera, diphtheria, leptospirosis, malaria, measles, melioidosis, influenza A, acute poliomyelitis, typhus and viral encephalitis. Thus, diseases like STDs, dengue fever, hand-foot-mouth disease and tuberculosis are among the important communicable diseases in the study area that need more attention and appropriate mitigating measures.

11.5 Conclusion

The social profile of the existing communities in the study area is characterized by a young population of educated background, mainly working as salaried workers, business persons and fishermen. Majority were local residents having been living in the area for

30 years or more. Only about 40% knew about the proposed Project but perceived that it would not be economically advantageous to them and that it would prove to be a source of water pollution and loss of income as a result of shrinkage or limited fishing ground. Being highly dependent on fishing as their main source of livelihood, it is not surprising that 75.7% of the fishermen respondents disagreed with the proposed Project. Reasons being the shrinkage of their fishing ground would jeopardise their source of livelihood and income and obstruction to local fishing route.

12.0 Erosion and Sediment Control

Soil erosion and sedimentation is one of the most crucial environmental impacts arising from a new development, especially one that is located near water bodies. Soil erosion is the process by which the land surface is worn by the action of wind, water or gravity. Sedimentation is the deposition of detached particulate matter that has been eroded or otherwise detached from its source (soil surface) and transported by flowing water (surface runoff).

12.1 Erosion and Sediment Control Plan (ESCP)

The proposed Erosion and Sediment Control Plan (ESCP) is based on the Urban Storm Water Management Manual for Malaysia (2000). The ESCP will be read with the engineering plans or written instruction that may be issued in relation at the Project site.

12.2 ESCP Measures

Barrier fencing will be installed as shown on the plan and elsewhere at the discretion of the Supervision Engineer to ensure traffic control and prohibit unnecessary site disturbance.

Soil material will be replaced in the same order they are removed from the ground. It is particularly important that all sub soils are buried and top soils remain on the surface at the completion of the works.

All earthworks, including waterways, drains and spillways and their outlets, will be constructed to be stable in at least the design storm event. During windy weather, large, unprotected areas will be kept moist (not wet) by sprinkling with water and keeping dust under control.

Water will be prevented from directly entering the permanent drainage system unless it is relatively sediment free.

12.3 Design of Sediment Fence

Sediment fence will be installed to contain the coarse sediment fraction (including aggregate fines) as near as possible to their source. The fence will have a catchment area not exceeding 0.4 ha, a length not exceeding 30 m, or a total outflow not exceeding 50 L/s for a 1-year ARI. The fence also will have a storage depth (including both settling and settled zones) of at least 0.6 m, and internal dimensions that provide maximum surface area for sediment to settle.

12.4 Design of Sediment Basin

Sediment basin will be constructed according to the guidelines provided in the Urban Storm Water Management Manual for Malaysia, based on the design event of 3-month ARI. The collected sediment will be flocculated first before discharging.

12.5 Site Inspection and Maintenance

A self-auditing programme will be established in order to maintain the measures put into place are working as intended. The site inspection should be done at least weekly immediately before site closure and immediately following any rainfall event that has caused runoff.

12.6 Overall ESCP

Since the slope of the existing ground is very gentle due to the entire site being newly-reclaimed land, the quantity of the soil loss due to erosion and sedimentation is very minimal and can be adequately controlled with the implementation of ESCP.

The existing soil type mostly consists of coarse sand (reclaimed land) with high water permeability; therefore soil erosion will be tremendously reduced due to the major portion of the rainfall infiltrating into ground rather than translating into surface runoff across soil surface (a major cause of soil erosion).

13.0 Potential Impacts and Mitigation Measures on the Physical and Biological Environment

A summary of the potential impacts and mitigation measures on the physical and biological environment is shown in *Table ES13.1*.

Table ES13.1
Summary of Impacts on Environmental Components due to Project Activities

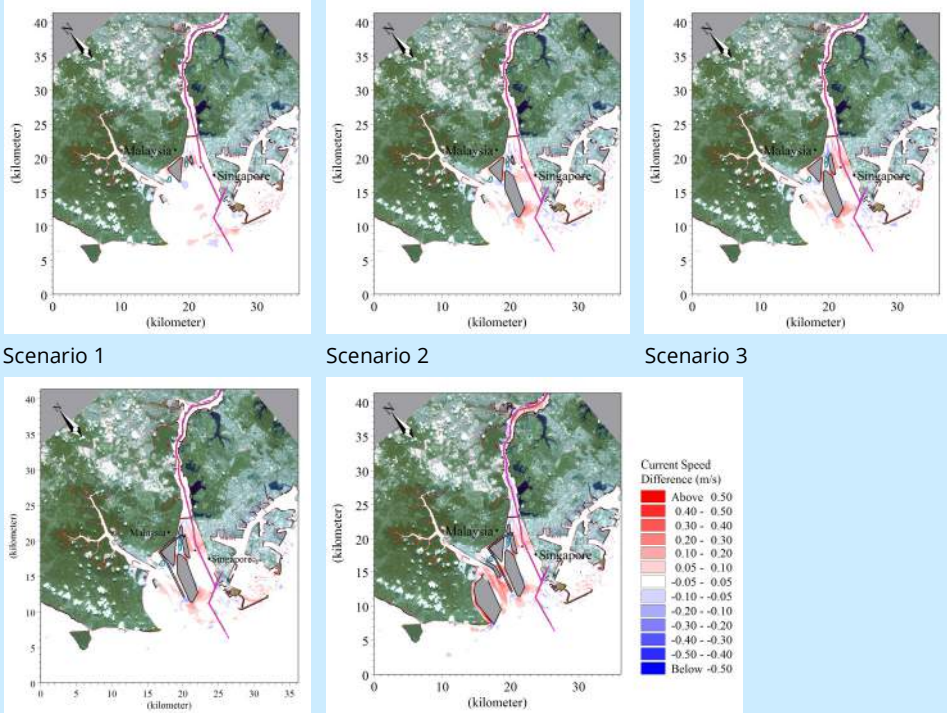
Affected Environmental Components	Project Activities	Potential Impacts	Mitigation Measures
Hydraulic and Hydrology	<p>Land Reclamation and Dredging</p> <p>Land Reclamation Area: 4,012.5 acre Volume of Fill Material: 161,891,980 m³ Phases: 4 Duration: 23 years</p> <p>Dredging Depth: 3 m below CD Width: 200 m Length: 11,900 m Area: 259.42 ha Volume: 7,500,000 m³ Dredging Rate: 16,000 m³/day Slope: 1V:3H</p>	<p>Currents</p> <ul style="list-style-type: none"> ■ Mean and maximum speed decrease is about 12 and 7% at Merambong Shoal for the full development and with the presence of the other committed developments respectively; ■ The mean and maximum speed at Tanjung Adang Shoal is 0.1 and 0.3 m/s respectively. The current speed change is up to about 48 and 43% for full development and with other committed developments respectively; ■ The mean and maximum speed at Merambong Island is less than 0.3 and 0.8 m/s respectively. The current speed change is less than 7 and 9% for full development and with other committed developments respectively. This indicates an improvement in flow with the presence of the other surrounding developments; ■ The mean and maximum speed decrease is less than 7 and 6% for with full development and with committed developments' scenario respectively at the Second Link Bridge; ■ The baseline mean and maximum current speed Sungei Buloh Wetland, Merawang Beacon and mangroves at Pergam is less than 0.1 and 0.4 m/s respectively. The mean and maximum speed change is less than 10 and 25% respectively at these locations with full development. ■ The mean and maximum speed at Tuas Checkpoint is 0.2 and 0.6 m/s respectively. The current speed change is less than 3 and 7% for full development and with the presence of the other committed developments respectively; ■ The mean and maximum current speeds at various locations near PTP's berths are less than 0.2 and 1.1 m/s. The current speed change due to the Project and including the other committed developments is up to 13 and 68% respectively. <p>Maximum current speed change</p>  <p>Scenario 1 Scenario 2 Scenario 3</p> <p>Scenario 4 Scenario 5</p>	No mitigating measures are required.

Table ES13.1 (cont'd)

Affected Environmental Components	Project Activities	Potential Impacts	Mitigation Measures
Hydraulic and Hydrology	Land Reclamation and Dredging	<p>Waves</p> <ul style="list-style-type: none">General wave height decrease in the lee of the reclaimed land based on individual wave propagation resulting in calmer waters of varying degree;Tanjung Adang shoreline will primarily experience wave height reduction due to the presence of the man-made islands;Localised wave height decrease of up to about 0.6 m occurs along the shoreline in the lee of the reclamation of Islands 1, 3 and 4 towards Sungai Pok Besar outlet for waves propagating from 180 and 210°N;The changes in wave heights due to the full development do not affect Tanjung Piai and the adjacent environmentally sensitive areas. <div><div><p>Scenario 1 150°N</p></div><div><p>Scenario 1 180°N</p></div><div><p>Scenario 1 210°N</p></div><div><p>Scenario 1 240°N</p></div><div><p>Scenario 2 150°N</p></div><div><p>Scenario 2 180°N</p></div><div><p>Scenario 2 210°N</p></div><div><p>Scenario 2 240°N</p></div><div><p>Scenario 3 150°N</p></div><div><p>Scenario 3 180°N</p></div><div><p>Scenario 3 210°N</p></div><div><p>Scenario 3 240°N</p></div></div>	No mitigating measures are required.

Table ES13.1 (cont'd)

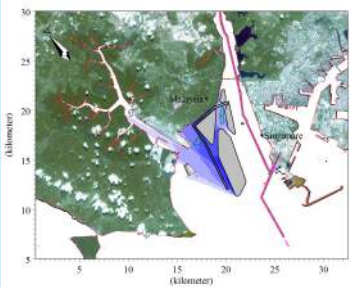
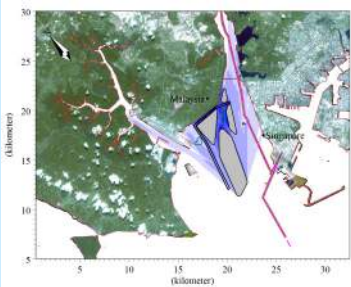
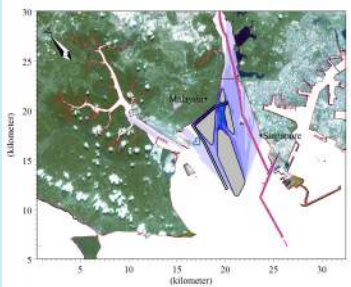
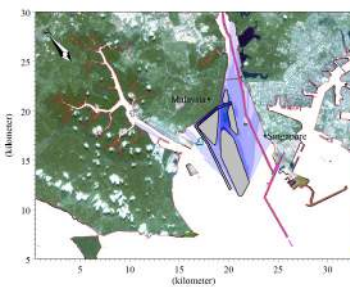
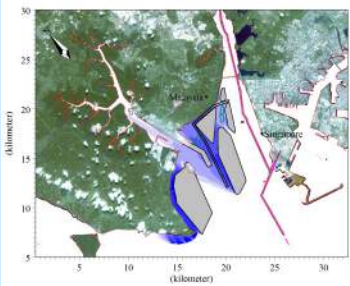
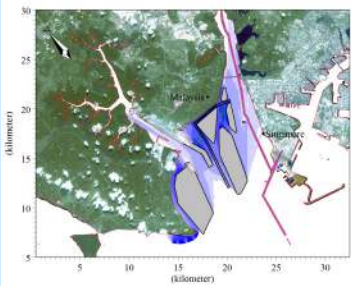
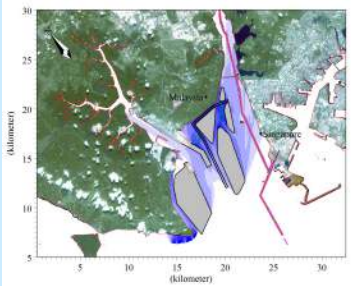
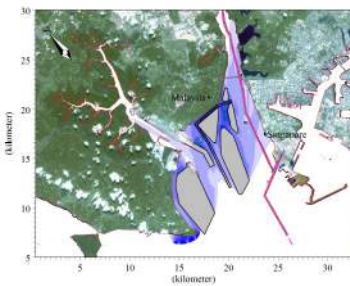
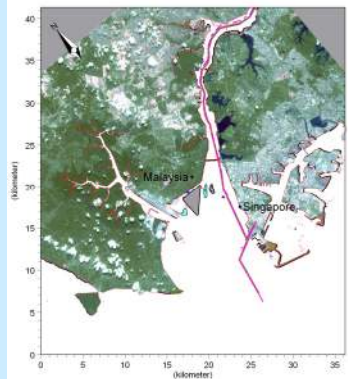
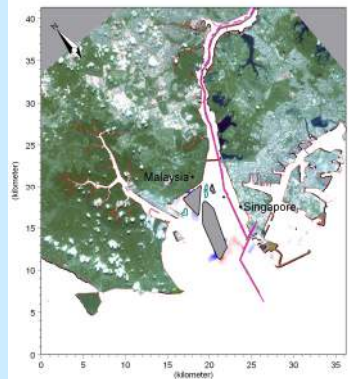
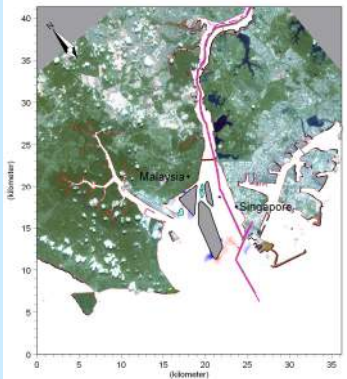
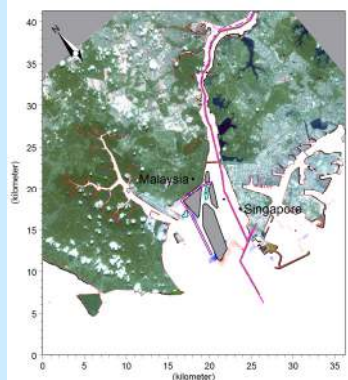
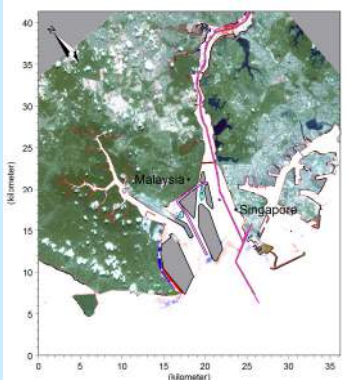
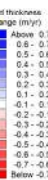
Affected Environmental Components	Project Activities	Potential Impacts	Mitigation Measures
Hydraulic and Hydrology	Land Reclamation and Dredging	<p>Waves (cont'd)</p> <div><div><p>Scenario 4 150°N</p></div><div><p>Scenario 4 180°N</p></div><div><p>Scenario 4 210°N</p></div><div><p>Scenario 4 240°N</p></div><div><p>Scenario 5 150°N</p></div><div><p>Scenario 5 180°N</p></div><div><p>Scenario 5 210°N</p></div><div><p>Scenario 5 240°N</p></div></div>	

Table ES13.1 (cont'd)

Affected Environmental Components	Project Activities	Potential Impacts	Mitigation Measures																																																																	
Hydraulic and Hydrology	Land Reclamation and Dredging	Sedimentation and Erosion Average Sedimentation Rate at ESAs	Erosion: <ul style="list-style-type: none">The Project Proponent shall mitigate coastal erosion that is caused by the proposed development.Perimeter treatment at these areas needs to be properly designed to account for potential erosion.The type and level of protection as well as ship wakes are to be accounted for in the engineering design.Monitoring is recommended to ensure mitigation works are conducted promptly.A collective approach to apportionate the cost of the mitigation works is suggested should the erosion be found to be caused by the proposed development and development(s) conducted by other developer(s) along Western Johor Straits. Sedimentation: <ul style="list-style-type: none">The Project Proponent shall conduct periodic maintenance dredging works at intervals of 3 to 5 years within the waterways of the development that experience sedimentation to ensure effective flushing.Monitoring is recommended to ensure mitigation works are conducted promptly.A collective approach to apportionate the cost of the mitigation works is suggested should the sedimentation be found to be caused by the proposed development and development(s) conducted by other developer(s) along Western Johor Straits.																																																																	
		<table><thead><tr><th rowspan="2">Point</th><th rowspan="2">Location</th><th colspan="5">Average Sedimentation Rate (m/yr)</th></tr><tr><th>Scenario 1</th><th>Scenario 2</th><th>Scenario 3</th><th>Scenario 4</th><th>Scenario 5</th></tr></thead><tbody><tr><td>SA</td><td>Mangroves at Sungai Mandai Kechil</td><td>0</td><td>0</td><td>0</td><td>0</td><td>-0.1</td></tr><tr><td>SC</td><td>Sungei Buloh Wetland</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0.1</td></tr><tr><td>SD</td><td>Lim Chu Kang Fish Farms</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><td>ME</td><td>Aquaculture at Sungai Melayu</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0.3</td></tr><tr><td>MF</td><td>Mangroves at Sungai Melayu</td><td>0</td><td>0</td><td>0</td><td>0</td><td>-0.4</td></tr><tr><td>MO</td><td>Mangroves along Tanjung Kupang</td><td>0</td><td>0</td><td>0</td><td>0.1</td><td>0.1</td></tr><tr><td>MR</td><td>Tanjung Adang Shoal</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0.2</td></tr><tr><td>MT</td><td>Tanjung Piai bird habitat</td><td>0</td><td>0</td><td>0</td><td>0</td><td>-1.3</td></tr></tbody></table> Projected annual bed level change <div><div></div><div></div><div></div><div></div><div></div><div></div></div>		Point	Location	Average Sedimentation Rate (m/yr)					Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	SA	Mangroves at Sungai Mandai Kechil	0	0	0	0	-0.1	SC	Sungei Buloh Wetland	0	0	0	0	0.1	SD	Lim Chu Kang Fish Farms	0	0	0	0	0	ME	Aquaculture at Sungai Melayu	0	0	0	0	0.3	MF	Mangroves at Sungai Melayu	0	0	0	0	-0.4	MO	Mangroves along Tanjung Kupang	0	0	0	0.1	0.1	MR	Tanjung Adang Shoal	0	0	0	0	0.2	MT	Tanjung Piai bird habitat	0	0
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Erosion:

- The Project Proponent shall mitigate coastal erosion that is caused by the proposed development.
- Perimeter treatment at these areas needs to be properly designed to account for potential erosion.
- The type and level of protection as well as ship wakes are to be accounted for in the engineering design.
- Monitoring is recommended to ensure mitigation works are conducted promptly.
- A collective approach to apportionate the cost of the mitigation works is suggested should the erosion be found to be caused by the proposed development and development(s) conducted by other developer(s) along Western Johor Straits.

Sedimentation:

- The Project Proponent shall conduct periodic maintenance dredging works at intervals of 3 to 5 years within the waterways of the development that experience sedimentation to ensure effective flushing.
- Monitoring is recommended to ensure mitigation works are conducted promptly.
- A collective approach to apportionate the cost of the mitigation works is suggested should the sedimentation be found to be caused by the proposed development and development(s) conducted by other developer(s) along Western Johor Straits.

Table ES13.1 (cont'd)

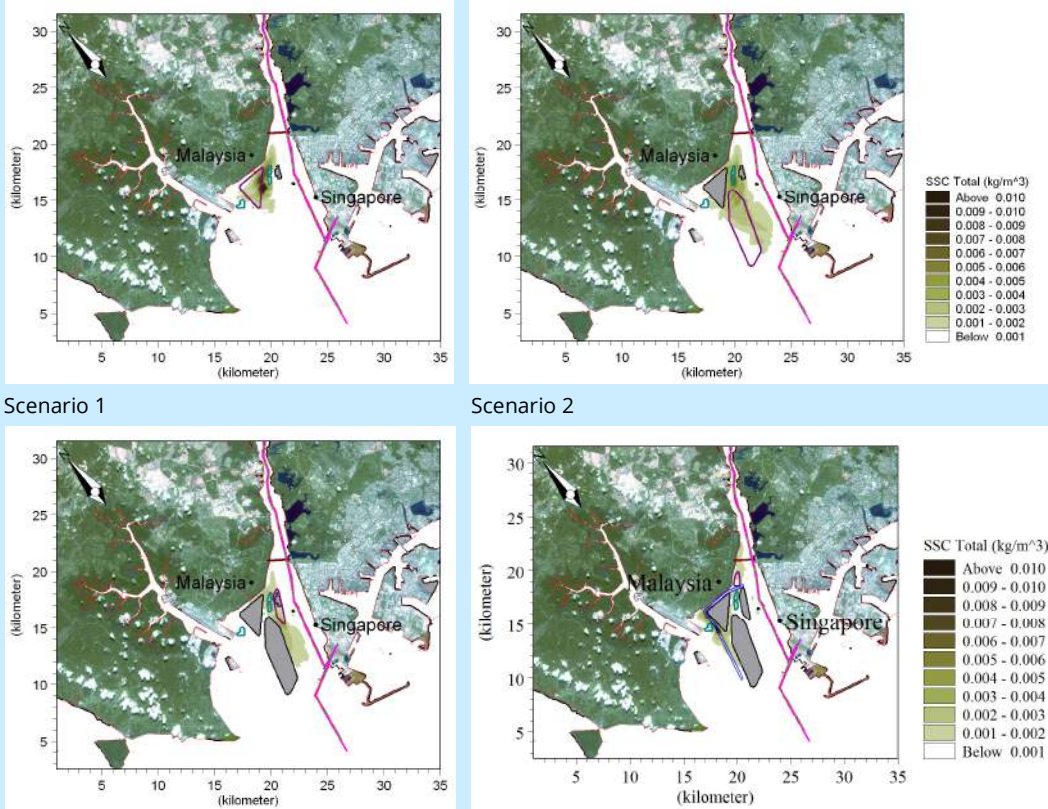
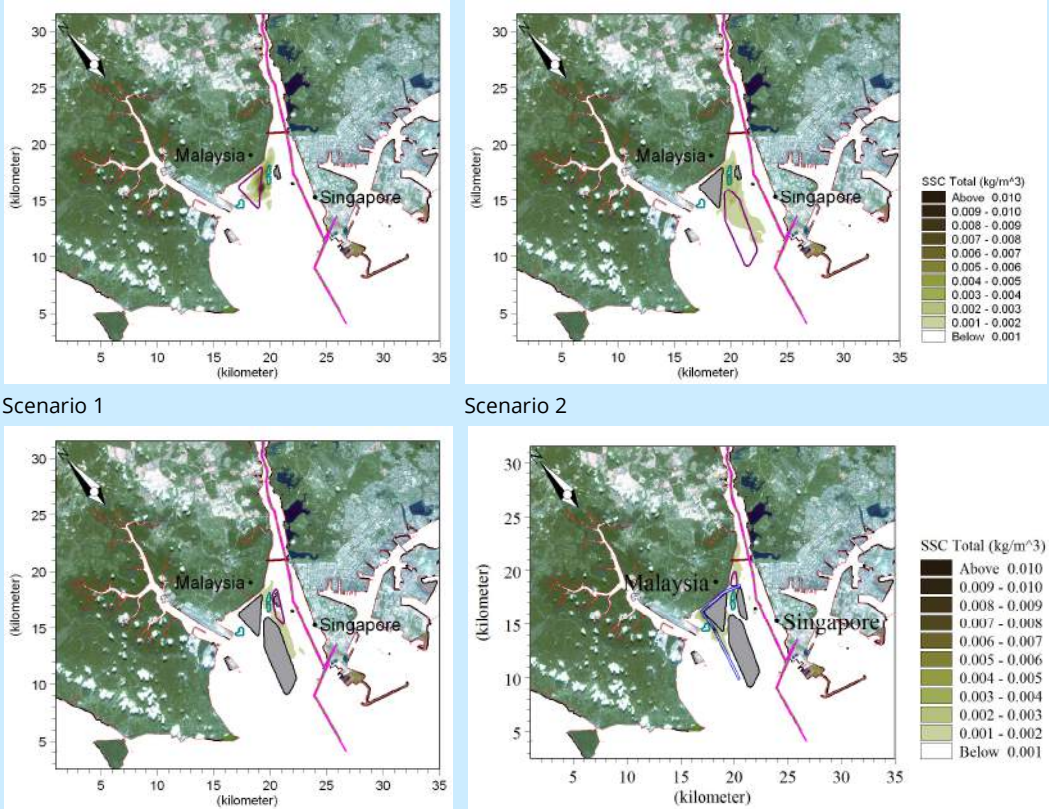
Affected Environmental Components	Project Activities	Potential Impacts	Mitigation Measures
Hydraulic and Hydrology	Land Reclamation and Dredging	<p>Sediment Dispersion</p> <ul style="list-style-type: none">Dispersion of suspended sediment to the surrounding water causing high turbidity level and TSS concentration;Under worst case scenario, maximum suspended sediment concentration of above and 5 mg/L disperses as far as 6.0 km and 1.8 km respectively. <p>Maximum excess concentration for uncontained condition</p>  <p>Scenario 1 Scenario 2 Scenario 3 Scenario 4</p>	<ul style="list-style-type: none">A silt curtain should be used to prevent or divert suspended sediment away from reaching environmentally sensitive areas.It is to be placed extending far enough to allow suspended sediment to settle.The use of silt curtain may not be feasible at areas with high current flows. This can be mitigated by temporarily stopping the contributing activities during periods of fast current flows during spring period. <p>Maximum excess concentration for contained condition (with silt curtain)</p>  <p>Scenario 1 Scenario 2 Scenario 3 Scenario 4</p>
Water Level and Flooding	Land Reclamation and Dredging	There is insignificant change in water levels after full development. Thus, there will be no impacts of backwater flow on the existing river systems surrounding the project area.	No mitigating measures are proposed.

Table ES13.1 (cont'd)

Affected Environmental Components	Project Activities	Potential Impacts	Mitigation Measures
Water Quality	<u>Land Reclamation and Dredging</u>	<ul style="list-style-type: none"> Resuspension of contaminants found in sediment in the water column. Oil and grease from the vessels may spilled into the sea. Improper handling of waste from the vessels. 	<ul style="list-style-type: none"> Barge operator must operate according to the correct methods in order to avoid material spillage. Overloading is strictly prohibited. Vessels involved in the transportation of dredged material must be well -maintained and working properly.
	<u>Transportation of Fill Material</u> Source: Ramunia Shoal Type: Sand Volume: 161,891,980 m ³ Vessels: Conveyor Barge (3 units) Sailing Time: 10-15 hours	Spillage of material along the transportation route.	
	<u>Transportation of Dredged Material</u> Disposal Site: Tanjung Balau Type: Mixture of sand, shale and clay Volume: 7,500,000 m ³	Benthic communities will be smothered at the disposal site.	<ul style="list-style-type: none"> The movement of the dredgers to the disposal sites must be monitored at all times using the Dredging and Disposal Management Systems (DDMS) and Vessel Traffic Management System (VTMS); Recommended guidelines formulated by DOE regarding disposal site and method of disposing must be strictly followed.
	<u>Post-Reclamation</u> Construction on the Newly-Reclaimed Land	<ul style="list-style-type: none"> Waste discharge from the base camps. Sewage and sullage generated by the workers. Substantial amount of construction waste will be produced. 	<ul style="list-style-type: none"> Sufficient mobile toilets must be provided at the base camps. All mobile toilets and treatment units provided must comply with specifications stipulated by the Ministry of Health (MOH) and National Water Services Commission (SPAN) Only treated effluents which comply with the Environmental Quality (Sewage) Regulation 2009 (EQ(S)R, 2009) can be discharged to the environment. A sufficient number of covered garbage bins should be provided at suitable locations Open burning of waste is strictly prohibited.
	<u>Operation</u>	<u>Water Quality Modelling</u> <ul style="list-style-type: none"> Changes in water quality are seen to be relatively similar for Scenarios 2 to 5 and for Scenarios 6 and 7. The impacts for Scenarios 2 to 5 show a reduction in DO and increase in BOD, nitrate, phosphate ammonia concentration occurring in a localised manner at the Project site. Faecal coliform concentrations are concentrated at river mouths. The changes due to the operation of the STP and 10-year stormwater event discharge (non-point source) are relatively small. The impact is localised at the outfall location with the STP in operation. The impact for non-point source is insignificant as the concentration released from the Project area is similar with the surrounding waters for DO and BOD. The nitrate, ammonia and phosphate concentrations are well-diluted in the open waters due to good mixing within the relatively wide and deeper waters at the straits' entrance. The changes for each parameter are mainly due to the presence of the respective developments within Western Johor Straits. 	<ul style="list-style-type: none"> The STP should have a polishing stage to ensure the STP effluent, even at Standard A, would not further degrade the water quality in the surrounding area. A polishing stage with media to protect and breed the slow growing nitrifiers would help precipitate the phosphate as the biofilm formed would have both aerobic and anoxic layers. Regular monitoring of the STP condition is necessary to optimize its performance and minimize operating costs. Monitoring of MLSS concentration and composition should be carried out every month in the first six months or until the system is stable. After that measurements once every six months should be sufficient.

Table ES13.1 (cont'd)

Affected Environmental Components	Project Activities	Potential Impacts	Mitigation Measures
Marine Traffic and Navigation	Land Reclamation and Dredging	<ul style="list-style-type: none"> Erosion of up to about 0.3 m/year would probably occur within the PTP navigation channel. This will assist in keeping the PTP channel open and requiring less maintenance dredging. Island 2 of the proposed reclamation intrudes into the heavily-used anchorage area. This will adversely impact vessel movements. Reclamation and dredging may interfere with existing navigational aids. 	<ul style="list-style-type: none"> The Project Proponent is required to submit all relevant documents and Standard Operating Procedures (SOP) pertaining to their Project to the Authorities, namely Johor Port Authority and Marine Department. A pre-operational meeting is proposed if there is a navigational and operational constraint/risk to other port users. Ship Simulation Study and Marine Risk Assessment are required to be undertaken for approval by the relevant authorities. Adhere to all the Rules, Regulations, Guidelines and other requirements of the relevant Malaysian marine authorities, namely the Port Authority which is the Johor Port Authority, the Marine Department Malaysia, Southern Region, and all other relevant government agencies, and in addition, ensuring that when transiting international waters all vessels fully comply with the International Regulations guidelines at all times. The navigation channel to and from Project area is adequately marked by lighted navigational aids Project Proponent is required to submit all relevant documents and Standard Operating Procedures (SOP) pertaining to their Project to the Authorities namely Johor Port Authority and Marine Department All fixed and movable structures, such as pipelines, barges, floating pipelines and any other structures erected in the water ways must be well illuminated by night and clearly marked so as to be highly visible by day Additional Aids to Navigation should be established if deemed necessary
	Transportation of Material	<ul style="list-style-type: none"> Barges transporting fill and dredged material will cause additional traffic load in the approach to PTP and at the traffic load at the current pilot boarding ground. Low visibility at night or during inclement weather may heighten the risk of vessel collision. 	
	Post-Reclamation	<ul style="list-style-type: none"> The newly-reclaimed islands will occupy massive space on the western Straits of Johor which will impose restriction on the available manoeuvrable space for vessel plying through the area. High number of vessels sharing the limited space will cause high probability for collision to occur. 	
Environmentally Sensitive Areas	Land Reclamation and Dredging	<p>Seagrass</p> <ul style="list-style-type: none"> Increasing level of TSS and turbidity will affect sunlight penetration which will disturb the photosynthesis process. Settled suspended sediments may smother seagrass. <p>Aquatic Organisms</p> <ul style="list-style-type: none"> Potential spawning ground may be smothered by sediment. <p>Mangrove</p> <ul style="list-style-type: none"> Mangroves are sensitive to oil spill. Oil may cover the tree pores, causing asphyxiation. Susceptible to toxic elements. 	<ul style="list-style-type: none"> Online monitoring of turbidity and TSS level Sedimentation monitoring at seagrass bed (Merambong Shoal) must be carried out. Installation of silt curtain at critical areas. The movement of sediment plume should be monitored closely. Intervention program should be formulated with various parties i.e. the Proponent, IRDA, NGOs, local universities. Relocation of sensitive marine life at Merambong Shoal to seagrass meadows located nearby.
	Operation	<ul style="list-style-type: none"> Effluent discharges may introduce contaminants such as BOD and nutrient. Excessive nutrient may cause eutrophication. Degradation of water quality will affect plankton productivity. Changing hydrodynamics may threaten seagrass survivability. 	

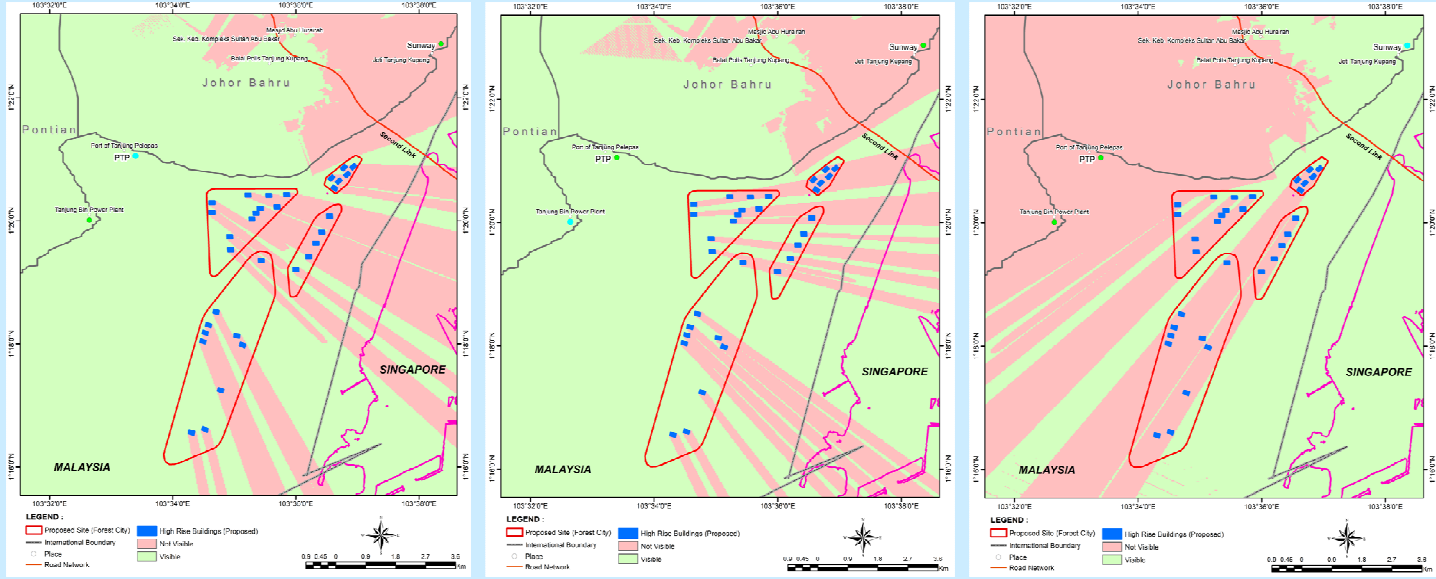
Table ES13.1 (cont'd)

Affected Environmental Components	Project Activities	Potential Impacts	Mitigation Measures
Aquatic Flora and Fauna	Land Reclamation and Dredging	<ul style="list-style-type: none"> ■ Dredging of the sea bottom will cause a total loss of living benthic organisms while land reclamation will completely smother the seabed forever. ■ High TSS and turbidity level will trigger stress on the aquatic life as turbid water will reduce the light penetration and hence, will retard primary productivity rate. ■ High water temperature and reduction in dissolved oxygen caused by sediment load will impair the metabolism of most benthic organisms. ■ Dredging activities may cause nutrient and contaminants that are present in the sediment to be released into the water body. 	<ul style="list-style-type: none"> ■ Mitigating the occurrence of algal bloom should be carried out through constant monitoring of nutrient content in the water column. Should there be a sudden increase in the content of nutrients, the Department of Fisheries, DOE, local fishermen and aquaculture operators should be notified immediately. ■ Good practice on land reclamation and dredging works should be employed to minimize sediment dispersal at the Project site ■ Online monitoring of turbidity level and TSS concentrations will provide real time data on the water quality on the area surrounding the Project activities. All reclamation and dredging should cease operation if the TSS and/or turbidity level has reached the trigger value ■ Installation of silt curtain at several identified locations will reduce the impact of sedimentation and turbidity. Regular maintenance of the silt curtain should be done so it will remain effective.
	Transportation of Fill Material and Disposal of Dredged Material	<ul style="list-style-type: none"> ■ Oil discharge or leakages from the vessels may pollute the pelagic and benthic ecosystems. ■ Spillage of material will increase turbidity which in turn will affect the marine life. 	
	Operation	<ul style="list-style-type: none"> ■ Effluent discharged from the islands may contain high number of nutrient which will trigger eutrophication. 	
Mudflats	Land Reclamation and Dredging Dredging area= 259.42 ha	<ul style="list-style-type: none"> ■ Mudflat supports various benthic and sessile organisms such as polychaete, gastropods and bivalves which will be totally wiped out from the area. ■ However, this is only a temporary and short term impact. ■ Over the years, a new sea bed will form along the dredged channel via resettlement of sediment and subsequently form new soft bottom substrates. 	<ul style="list-style-type: none"> ■ Since the loss of benthic community during dredging activities is a temporary impact, there will be no mitigating measures. The communities will be restored in due time by the natural processes. ■ Mitigating the episodes of algal bloom should be carried out through monitoring of nutrient content in the water column. ■ Monitoring of algal bloom before, during and after dredging should be carried out. The monitoring programme should also include satellite imageries (ocean colours) taken several days before and after the event. ■ Good dredging practices should be employed to minimize sediment dispersal at the dredging sites. ■ As for the aquaculture business which may be affected by dredging, due compensation must be paid through fair negotiation. However, it is important to note that there are no aquaculture activities within this area. ■ Loss of the existing mudflat due to creation of the new islands is permanent and unmitigated. However, a new coastline will be created. In due course, the marine intertidal life will be re-established and the coastal birds (residents and migrants) are expected to resume their feeding and foraging activities in the newly established coastline.
Terrestrial Fauna		<ul style="list-style-type: none"> ■ No significant impacts on the fauna as the Project does not physically intrude into any of the gazetted natural reserves. ■ Migratory birds may be affected by the loss of mudflats. 	<ul style="list-style-type: none"> ■ Birds will move away to richer and less disturbed foraging grounds such as Pulau Kukup, thus no mitigating measures is needed for the terrestrial fauna.

Table ES13.1 (cont'd)

Affected Environmental Components	Project Activities	Potential Impacts	Mitigation Measures
Fishing Ground	Land Reclamation and Dredging	<ul style="list-style-type: none"> The overall size of this fishing ground would be reduced and may affect the fishing activities of the local fishermen and their catch. Reclamation and dredging may cause an economic loss as they may have to move to other fishing grounds further away. Additional fuel cost and high fuel price would reduce their profit margin further. 	<ul style="list-style-type: none"> If seawater pollution from suspended solids is unavoidable, the fishermen ought to be given prior warning or be informed of the impending activities well in advance to reduce loss or potential loss of income. The fishermen's fear of losing their livelihood should not be overlooked or unheeded. Some forms of compensation, where applicable, should be looked into and worked out with the affected parties through their representatives and should be settled accordingly and amicably. Compensation ought to be based on several considerations, such as claims from genuine cases, the types of inconveniences faced and the duration affected etc. in order to arrive at the quantum of the compensation. Other aspects of payment such as its nature (in cash or kind), frequency (one-off or over a period of time) and the paying agency such as UPEN should also be considered.
Air Quality	Land Reclamation and Dredging	<ul style="list-style-type: none"> Open surface with loose soil is susceptible to wind erosion. Movement of lorries and machineries will generate significant dust problems if unmitigated. 	<ul style="list-style-type: none"> The soil at the cleared areas for access road on the mainland must be stabilised. Several stabilising techniques that can be used are hydromulch, chemical stabilisation, vegetation or water. Hoarding that acts as a wind screen can be erected at the access road area that is located nearby sensitive receptors. Dust abatement procedure such as water spray must be carried regularly at the access road especially during dry and windy condition. Wash trough should be installed at the access point. Wheels and undercarriage of the vehicle should be regularly unsoiled. Stockpiles should be covered at all time.
	Post-Reclamation	<ul style="list-style-type: none"> Movement of lorries and machineries will generate significant dust problems if unmitigated. Stockpiles of construction materials such as sand and cement may become a source of airborne particulate. 	
	Operation	No impact on air quality is expected during this phase.	
Land Traffic		<ul style="list-style-type: none"> Analysis shows that the existing state road of Jalan Pendas Laut and Jalan Tanjung Kupang will be able to accommodate the increasing traffic volume until 2025. Tanjung Pelepas highway will reach capacity by 2025. Second Link Expressway will reach capacity by 2045. 	<ul style="list-style-type: none"> The proposed main access road (Access 1) need a minimum of 3 lanes for each carriageway in 2025 Unless a new access with a direct tapping from the Second Link is instigated, the Tanjung Pelepas highway need to be upgraded to three, four and five lanes by the year 2025, 2035 and 2040 respectively The Second Link Expressway needs to be upgraded to 4 lanes by the year 2045. Comprehensive development of integrated public transportation system.
Noise	Land Reclamation and Dredging	As these activities take place far from the mainland and generate minimal land traffic, it is expected that there will be no significant impacts on the ambient noise level.	<ul style="list-style-type: none"> Full operation of construction works should be done from 7.00 am to 10.00 pm only. It is advisable that only minimal works are carried out during the night time and public holidays; The movement of vehicles involve during the construction phase should be minimised during night time; Ancillary plants, such as generators, compressors and pumps should be placed behind existing physical barriers; Noise monitoring must be conducted periodically to ensure the noise level does not exceed the guidelines set by the DOE which is not more than 65 dBA during daytime and 55 dBA during night-time; and Plant, machineries and equipments used should be fitted with the effective exhaust silencers and are maintained in good working order.
	Post-Reclamation	<ul style="list-style-type: none"> The machineries and equipment deployed for the construction works may contribute to noise pollution. Additional land traffic and vehicular movement generated will increase the ambient noise level. 	
	Operation	Additional land traffic and vehicular movement generated will increase the ambient noise level.	

Table ES13.1 (cont'd)

Affected Environmental Components	Project Activities	Potential Impacts	Mitigation Measures
Viewscape	Operation	<p>Areas that could be impacted by the proposed development are Sunway Iskandar, PTP and Tanjung Bin Power Plant.</p> <p>Viewscape</p>  <p>From PTP</p> <p>From Tg. Bin Power Plant</p> <p>From Sunway Iskandar</p>	No mitigating measure is required.

14.0 Potential Impacts and Mitigation Measures on the Human environment

14.1 Project Activities

The Project activities discussed within this section covers pre-reclamation, dredging and reclamation works, and topside development. Nevertheless, the discussion of impacts herewith is done from the overall perspective of the phases related to construction, i.e. pre-construction and construction. Potential socio-economic impacts anticipated out of these activities would relate to the local fishermen and their fishing activities, project contractors, labour force in terms of economic gains or otherwise, socio-cultural impacts and safety.

14.2 Pre-construction Phase

14.2.1 Potential Impact on Location and Site

A major part of the proposed Project is to be developed in the waters of Management Unit 3-9 (MU 3-9) of the Shoreline Management Plan for Iskandar Malaysia. It is designated to protect Merambong Island and the seagrass bed of Merambong Shoal. The nature of the proposed Project is one which will result in high impact development from high-density commercial and residential components of the development plan. Although mitigations could be sought to reduce the damage that may accrue, the area has to be degazetted from being a protected area.

Mitigation Measures

- a) The process of degazetting the protected zone of the Management Unit 3-9 of the Shoreline Management Plan for Iskandar Malaysia in which the proposed Project is to be located has to be sought from the planning authority of Iskandar Malaysia.

14.3 Construction Phase

14.3.1 Potential Impact on Labour

The manpower requirements for reclamation will be in the range of 5,000 workers during the peak of the reclamation works. The workforce will comprise engineers, skilled workers and semi-skilled workers. The requirements of several hundred workers will boost the local labour market or employment. This will lead to a boost in the local economy, thus improving the economic standing of the locals as they are generally from the relatively low-income group.

Although employment of foreign workers is expected during the reclamation phase, engaging totally foreigners would forfeit this advantage to the locals. Furthermore, increased employment opportunities for the local population, which was perceived by some 17% of the locals as one of the advantages of the Project, was also used as one of the reasons for supporting the Project.

The activities would also require the deployment of contractors and the mobilization of vehicles and equipment. These would again boost local participation and the economy. Nevertheless, the immediate locals should be given priority in contracting works that they could participate in, as voiced by them in the Focus Group Discussions and Public Dialogue organised to get feedbacks about the proposed Project during the course of the study.

Mitigation Measures

- a) The boost in local employment would only be effective if a portion of the labour required is recruited from within the local area.
- b) Recruitment of labour from among the locals would be most beneficial if taken from the unemployed source or new entrants to the labour market and not pinching from other employments.
- c) It should also be similarly applied to employing local contractors and sub-contractors who should be given priority in the selection process.

14.3.2 Potential Impact on Livelihood

Although the setting up of the Project would entail the creation of numerous economic opportunities, it would also pose inconveniences to the local fishermen, especially in disrupting their activities, affecting local marine life (although temporarily) and damaging their fishing gears. The newly-formed islands would reduce the size of the local fishing ground. This had been iterated in our survey findings when the local fishermen perceived that they would lose their work and livelihood as well as being displaced from their normal fishing ground.

The deployment of 5,000 workers would push up the current population size of the study area. Increased population size would bring about increased demand in basic goods and services.

Mitigation Measures

- a) The installation of the silt curtain.
- b) The boundary of the reclamation activities and sand barges' route should be marked with buoy markings.
- c) Compensation ought to be based on several considerations, such as claims from genuine cases, the types of inconveniences faced and the duration affected etc. in order to arrive at the quantum of the compensation. Other aspects of payment

- such as its nature (in cash or kind), frequency (one-off or over a period of time) and the paying agency such as UPEN should also be considered.
- d) Concerted arrangements should be made to involve the locals.

14.3.3 Potential Impact on Safety

Safety issues are also a major consideration in any stage of the construction. Industrial accidents may have the potential to occur if the workers were not properly supervised and managed. Safety is not only a consideration at the construction site but also on the road. The additional traffic loads from the transportation of machineries and construction materials would make the traffic condition in the area stressful and hazardous.

Mitigation Measures

- a) *"Safety first"* should always be stressed upon.
- b) Transport operators should be more considerate and always observe safe driving at all times.
- c) Stress on the existing road system during the transportation of machineries and construction materials could be minimized if a proper traffic-flow system is designed by the contractor to streamline the movement.
- d) Transportation of materials to and from the construction sites should be carried out during non-peak hours.

14.3.4 Potential Impact on Tranquillity and Aesthetics

The natural panorama of the sea view fronting the Tanjung Kupang coasts would be lost forever. But in its stead, four built-up islands would be put in place in the near future. They may have their own charms and the aesthetic value of the sea front would be in the eyes of the beholders.

14.3.5 Impacts on Construction and Operation of Workers' Camps

Workers' camps is a potential source of health and safety hazards and are also not without their socio-cultural implications. During occupation of the accommodation provided, crowding may occur not only on a per-room basis but the overall arrangement of the lodging blocks may also tend to be close to one another.

Accommodating and putting foreign workers or workers from other states of Malaysia together under the same roof or within the same workers' camp complex may have its repercussions. The presence of foreign workers, probably numbering up to several hundreds and coexisting alongside the locals, could disrupt the cultural and racial balance of the area, thus transforming the social makeup of the area into a more

cosmopolitan entity. Physical conflicts could easily develop as a result of the differences in culture and subculture, values, attitude and tolerance level among the different ethnics and races.

Other associated problems are those of social and health which were also voiced by one-fifth of the respondents when their views were sought regarding the future influx of foreign workers into their area. Such views are normally based on the alleged increase in crimes and diseases previously unknown to the country or the reappearance of those which had long since been eradicated such as malaria and tuberculosis

Mitigation Measures

- a) The condition of the base or workers camps would have to fit into certain decent living standards that provide well-ventilated space, basic amenities, proper sanitation and non-crowding.
- b) The implication of social and cultural problems arising from accommodating foreign workers within one complex could be avoided if workers of different cultural backgrounds would be housed separately but sharing common facilities to promote social integration.
- c) Racial clashes and other social problems could be avoided if workers' interest could be looked after, cordial relationship maintained and cultural understanding and tolerance inculcated.
- d) The emergence and rise of new strains of diseases, which have often been associated with foreign workers, could be checked and overcome by having proper recruitment procedures and health screening before permission to work is granted.

14.4 Development on Newly-reclaimed Land

14.4.1 Potential Impact on Employment

At the peak of the development of the newly reclaimed land a labour force of 5,000 is expected to be employed. Meanwhile, during the operational phase, an estimated 62,200 employment opportunities will be created. The impact on employment could be significant depending on the ratio of those labour recruited from the local area. The impact of the external labour would be different depending on the number moving or not moving into the locality and those who move with or without family.

Mitigation Measures

- a) The proposed Project should strive to have some local recruitment ratio for it to be relevant in the development of the area.

14.4.2 Potential Impact on Income and Revenue

Direct employment render direct income earned from the salary paid. This is a definite positive remuneration and contribution to additional local earnings and from those spent locally would contribute to additional local income. However, the additional contribution would very much dependent on the amount or proportion of earnings spent locally by the outside workers who may or may not move into the local area either bringing in or not bringing in family as mentioned above.

The capital investment in the proposed Project will be significant to other related agencies. If the percentage of total expenditure on goods and services (excluding labour) that would be spent in the local area in purchasing local goods and services is significant then the local economy would thrive.

There are also rates such as assessment rates, quit rent, fees and royalties to be paid and this would create net change in local authority receipts pointing to surpluses or higher returns. Other utilities and services providers for water supply and electricity would also tend to benefit from rate collections.

14.4.3 Potential Impact on the Wider Multiplier Effects

The workforce, which may be substantial (and well paid), can generate considerable retail expenditure in the locality, on a whole range of goods and services. This may be a considerable boost for the local retail economy. The proposed Project itself requires supplies ranging from components from local engineering firms, to provisions for the canteen. Such demands create employment, additional to that directly created by the proposed Project. The additional workforce may demand other services locally such as health, education, and housing, which may generate additional construction. These demands will create additional employment. Such wider economic impacts are considered as beneficial and long-term in nature.

14.4.4 Potential Impact on Demography, Housing and Other Services

The employees recruited from beyond daily commuting distance can be expected to move into the development area permanently during operation. Some of these employees will bring families into the area. In-migrant workers and their families will have several effects on the locality. They will result in an increase in the population of the area and possibly changing the age and sex structure of the nearby local population. They also will require accommodation or housing and place additional demands on a range of local services, including schools, health and recreational facilities, police and emergency services.

Mitigation Measures

- a) If population increase is to be checked, the most basic mitigation would be to encourage the maximum recruitment of labour from within daily commuting distance of the Project site, thereby reducing the number of workers and families from moving into the impact zone.
- b) Local accommodation impacts can be mitigated by either providing additional accommodation for the workforce or to encourage the use of unoccupied or under occupied accommodation into the impact zone, depending on condition of local housing and accommodation market.

14.4.5 Potential Socio-Cultural Impacts

With an estimated population size of 300,000 people living in the newly created islands, the magnitude of the social impacts would be enormous. Social and cultural conflicts and frictions may become the order of the day if measures for cordial and harmonious living are not promoted.

Mitigation Measures

- a) Problems of integration and clash of lifestyles may lead to failure and disappointment. These could be avoided if the residential areas created would not be exclusively enclave; equal opportunities are open to all to participate in the everyday doings and regular happenings in the local area or impact zone.
- b) The role of the local authority and management body is crucial in seeing to the implementation of the events by involving all in whatever amenities provided and functions organised for the area. The creation of the feeling of oneness is important in determining that all members of the public would feel that they belonged.
- c) With regards to the marginalization of the locals, it could be mitigated by identifying deserving local manpower to be recruited and trained for specific skills required by the multifaceted development in the area.
- d) Alienation could also be overcome by ensuring the integration of the surrounding population with the new development through the provision of proper access, infrastructures, and high level of connectivity to and from the area.

15.0 Residual Impact

15.1 Introduction

This chapter details the potential residual impacts of the proposed Project. Residual impacts are defined as impacts which may remain even after the mitigating measures

are adopted into the design and construction management of the Project. These include the following:

- a) Decline in marine water quality;
- b) Disruption to the sensitive ecosystems;
- c) Sedimentation and erosion;
- d) Increase in land traffic;
- e) Increase in marine traffic;
- f) Loss of fishing ground;
- g) Foreign influx;
- h) Impacts on socio-economy; and
- i) Changes in viewscape.

15.2 Decline in Marine Water Quality

Considering the proposed development is surrounded completely by sea, the occurrence of marine water pollution may happen if solid waste, sewage and sullage are not properly managed. For sewage, even if it is treated to Standard A, the discharge from the outfall will introduce additional loading to the surrounding area, which host a number of sensitive ecosystem namely seagrass, corals and mangroves.

15.3 Disruption to the Sensitive Ecosystems

The creation of four new islands will upset the interconnectivity of seagrass, mangroves and corals, which will cause disruption to these sensitive ecosystems. In addition, should degradation of water quality occurs, these sensitive ecosystems would be affected.

15.4 Sedimentation and Erosion

The development primarily affects the area within the direct vicinity of the Project site. There is insignificant impact to bed level change at the ESAs due to the full development. However, sedimentation is expected at the Sungei Buloh wetland and erosion at the mangrove area of Sungai Melayu with the presence of other committed developments. Sedimentation of about 0.1 m/yr is detected at Singapore's coastline in front of Pantai Lido for full development (Scenario 4). However, erosion of up to about 0.6 m/yr is experienced at Singapore's coastline fronting Lido Boulevard reclamation for full development with the presence of other committed development (Scenario 5).

15.5 Increase in Land Traffic

There will be a substantial increase in land traffic on the surrounding area due to the additional commercial activities and population living on the reclaimed islands. Unless the proposed upgrade on major road and intersection networks connecting to the Project site is implemented, there will be a considerable disruption on the traffic flow caused by trip generated by the several hundred thousands of new residents, workers and visitors.

15.6 Disruption to Marine Traffic

The Project location is originally busy with various marine traffic plying through such as ferries, barges, yachts and fishermen boats. With a high number of vessels sharing the same space, disruption may occur.

15.7 Loss of Fishing Ground

The land reclamation will cause permanent loss of fishing ground as the local fishermen can no longer fish there. The Project area has traditionally been the usual fishing ground for the local fishermen as it is very rich in marine resources. Not only that, the proposed development is also expected to cause considerable impacts on important ESAs namely seagrass meadows and mangroves which are very important to the fishes.

15.8 Foreign Influx

Considering the fact that the majority of the new residents will be outsiders, the magnitude of the social impacts would be enormous. The impacts could be further exacerbated if a large number of this new population is made up of foreigners. A large number of people living together with different social, economic and cultural backgrounds may cause social and cultural conflicts and friction.

15.9 Impacts on Socio-economy

This significant boost in employment opportunities can be beneficial to the locals if they are given priority during the recruitment process. Direct employment of the locals will render direct income being earned from the salaries paid, which will then contribute to the improvement of the communities' economic standing. A significant boost in the population number will generate additional retail expenditure in the locality, on a whole range of goods and services. This will be a considerable improvement for the local retail economy.

However, there is a possibility for the locals to be left out from reaping the benefits of this development. If this happens, the local communities will feel marginalized and alienated. The bitter feelings can be further aggravated considering that the new residents coming in will have better economic standing than the locals.

15.10 Changes in Viewscape

Seaward view facing the reclaimed island will be changed. In terms of aesthetic, the view provided by the new islands is a subjective one. However, with a well-planned and landscaped development, the island will offer a new panorama where the sea is still prominent, complementing the current viewscales.

16.0 Economic Valuations of Environmental Impacts

Only incremental environmental costs and benefits are considered in the analysis. Considering only “incremental costs and benefits” means that only marginal costs and benefits that arise as a result of choosing the “with Project” option (instead of “without Project”) is included in the study.

16.1 Valuation of Cost and Benefits

Of the six components listed in *Table 16.1*, four are significant enough to be considered for evaluation. These are i) the loss in mudflat/muddy seabed due to reclamation, ii) the removal of mudflat/muddy seabed due to dredging work, iii) degradation in seagrass bed, and iv) loss of fishing ground. The proposed Project is expected to reduce the environmental services obtainable from the affected area.

16.2 Overall Assessment

After discounting at the rate of 8%, the total present value of the stream annual loss amounts to RM116.0 million over a 50-year period. At 6 and 4% discount rates, the corresponding value are RM145.6 million and RM193.2 million respectively. This study notes that the sum should not be construed as indicating Project feasibility. They rather provide some indication of the magnitude, in monetary terms, of the reduction in the flow of environmental services as a result of the implementation of the Project over the evaluation period.

17.0 Environmental Management Plan

A summary of the proposed monitoring programme is as per *Table ES17.1*.

18.0 Conclusion

From the overall assessment, it can be concluded that the proposed development is expected to cause various degree of negative and positive impacts on the environment, social as well as surrounding land use. Huge commitment is needed from the Proponent in implementing all mitigation measures proposed so that this development will be beneficial not only to the Proponent, but also to the local communities and the State of Johor.

Table ES17.1
Proposed Monitoring Programme

Item	Parameter	Monitoring Stations	Sampling Frequency	Environmental Quality Criteria	Reporting Requirement
Water Quality	Temperature, Salinity, pH, Conductivity, Turbidity, DO, BOD, COD, TOC, TSS, and Oil and Grease, AN, Phosphate, Nitrate, Heavy Metals, Faecal Coliform, <i>E.coli</i> , <i>Enterococci</i>	As per Table 7.11, Chapter 7—Existing Physical Environment	Monthly	Results will be compared to the baseline and Malaysia Marine Water Quality Criteria and Standard (MWQCS) and Malaysia-Singapore Joint Committee on the Environment (MSJCE) Protocol.	Report to be submitted to DOE monthly and quarterly.
	Total Suspended Solids and Turbidity	Merambong Shoal and Merambong Island	Daily	Results will be compared to the baseline and Malaysia Marine Water Quality Criteria and Standard (MWQCS).	-
Sediment Quality	Nitrogen, Phosphorus, Arsenic, Cadmium, Chromium, Copper, Lead, Zinc, Mercury and Nickel	As per Table 7.15, Chapter 7—Existing Physical Environment	Once every month during dredging period	Results will be compared to the baseline and US EPA Standard.	Report to be submitted to DOE monthly during dredging period.
Air Quality	TSP, NO ₂ , SO ₂ and CO	As per Table 7.19, Chapter 7—Existing Physical Environment	Once every 3 months	Results will be compared to the baseline and Recommended Malaysian Air Quality Guidelines (RMAQG).	Report to be submitted to DOE quarterly.
Noise	(L _{Aeq} , L _{A5} , L _{A10} , L _{A50} , L _{A90} and L _{A95}); and (L _{Amax})	As per Table 7.22, Chapter 7—Existing Physical Environment	Once every 3 months	Results will be compared to the baseline and DOE's Interim Guidelines for Maximum Permissible Sound Levels by Receiving Land Use (Schedule 1 and 2).	Report to be submitted to DOE quarterly.

Table ES17.1 (*cont'd*)

Item	Parameter	Monitoring Stations	Sampling Frequency	Environmental Quality Criteria	Reporting Requirement
Bathymetric Survey	Nearshore and Bed Level Change	As per <i>Figure 17.2</i>	Once every 3 months (during reclamation phase) Once every 6 months (post-reclamation)	Results will be compared to the baseline condition.	Report to be submitted to DID not later than 3 months after the completion of each survey.
Sedimentation Monitoring	Settled Suspended Sediment	Merambong Shoal and Merambong Island	Every 2 weeks	Results will be compared to the proposed Impact Severity Matrix for each ESA.	Report to be submitted to DOE monthly.
Ecological	Health and condition of the ESA	Merambong Island, Tanjung Adang Shoal and Merambong Shoal	Once every 3 months	The ESA condition should be compared to a control site and/or the initial condition before the start of dredging and reclamation activities.	Report to be submitted to DOE quarterly.
Environmental Audits	To audit the compliances with the EIA approval conditions and the relevant environmental regulations and guidelines.	The whole project's implementation and its activities	Monthly	Environmental Audits should be carried out by a third party Environmental Auditor (registered with DOE).	Report to be submitted to DOE monthly.