EXECUTIVE SUMMARY

PROJECT FACT SHEET

Table ES-1. Project Fact Sheet

Name of Project	**HORIZON MANILA RECLAMATION PROJECT**
Location	Along Coast of Manila Bay in the territorial jurisdiction of the City of Manila
Project Category per EMB Memorandum Circular 2014-005	Category A: Environmentally Critical Project (ECP)
Project Classification per EMB Memorandum Circular 2014-005	3.3 Reclamation and other land restoration project
Scope of Project	Horizontal development only (Note: Separate ECCs will be applied for the vertical development and source of reclamation materials)
Authority over the project area	Memorandum of Understanding (MOU) between Philippine Reclamation Authority (PRA) and City Government of Manila dated 02 June 2017
Project size	419 hectares reclamation area
Project cost	Php 60 Billion
Project Components	• Island 1 (140 has) • Island 2 (140 has) • Island 3 (139 has) • Containment Structures • Drainage System • Internal Roads • Internal Bridges connecting the Islands • Electrical Distribution • Water Distribution • Wave Deflector • Pollution Control Devices • Support Facilities • Viaduct
Project Proponent	**CITY OF MANILA GOVERNMENT** Office of the Mayor Padre Burgos Ave, Ermita, Manila, Metro Manila Telephone No.: (02) 527-0907 Authorized Representative: **Secretary Edward Serapio** Office of the Mayor
EIA Preparer/Consultant	**TECHNOTRIX CONSULTANCY SERVICES, INC.** Unit 305 FMSG Building, Balete Dr. QC 1101 Telephone No.: (02) 416-4625 Cellular No.: 09178255203 E-mail address: technotrixinc@gmail.com Contact Person: **Edgardo G. Alabastro, Ph.D.**

PROCESS DOCUMENTATION

- **DOCUMENTATION OF THE EIS**

The screening **per EMB Memorandum Circular 2014-005** showed that the proposed project falls under "Category A: Environmentally Critical Project (ECP)" and classified as "3.3 Reclamation and other land restoration project".

The content of the EIS report was established during the conduct of Technical Scoping on 17 July 2017. (**See Annex 1).** As prescribed by the EMB/DENR under the Revised Procedural Manual (RPM) protocol, the appropriate type of documentation for this project is the Environmental Impact Statement (EIS) considering that the project is a "new single project". A Programmatic Environmental Impact Statement (PEISS) is not applicable because there is only a single activity involved which is creation of land; the various activities of the locators to be undertaken in the reclaimed land are not included in the application for an ECC. These activities will be included in the "Operations Phase" and will be covered separately by the applicable provisions of the PEISS.

The project does not fall into the "Programmatic Type" Type of EIS Documentation.

- **EIS AS A PLANNING TOOL AND NOT A PERMIT**

The Proposed Reclamation Project has been prepared in compliance with the basic principle of the Philippine EIS System (PEISS), i.e. that **an EIA/ECC is a planning tool and not a permit**.

Moreover, the details of a project are established post-ECC, as stipulated in **page 10 of the Revised Procedural Manual**, quoted verbatim below:

> *iii) During the project's **Detailed Engineering Design (DED)** stage, which is post-ECC, the generic measures identified during the EIA study at the FS stage will now be detailed based on the project facility design and operational specifications. Additional baseline monitoring may also be required prior to construction or implementation of the project to provide a more substantive basis for defining the environmental management and monitoring plans.*

- **The Public Scoping Process as stipulated in DAO 2017-15**

This DAO was to be effective fifteen (15) days from June 06, 2017 while the process for the Public Scoping was undertaken before the effectivity of this regulation. Nevertheless, the applicable aspects of the said DAO were complied with, such as:

9.1 Stakeholders in the community were considered as the key informants in baseline data gathering for the proposed project. The specific involvement of includes

- Participation in rapid appraisals for the identification of the affected communities, for the general rating of the level of development in terms of economic, status of each population categories (farmers, fisherfolks, laborers, etc.) for assessing the affected population's need or demand for the project, to assess absorptive capacity and in the conduct of perception survey.

- As source of information on the biophysical environment and could provide environmental indicators for the assessment of changes/trends in their own environment (ex. Occurrence of flooding, reduced river flows, decline in fishery production, etc.,), presence of disappearance of wild animals or birds and other ethnobiological information.

- Participation in community validation meetings or workshops to check the accuracy of the results obtained from the survey and to gather additional issues and concerns.

9.2 Participatory methods such as consultations, focused group discussions, group meetings among others may be used. The participation of identified stakeholders shall be the priority but shall also be open to relevant concerns from the general public.

9.3 Information gathered from the public including stakeholder inputs in the assessment of project alternatives shall be properly documented and shall be integrated into the appropriate modules of the EIS.

11.3 The identified stakeholders shall be invited to be actively involved in review through the following:

- Participating in the public hearing/s
- Providing relevant written comments that the EIARC should consider in the review of the EIA Report through online feedback or submitting hard copy to the EMB within the set timeframe.

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) TEAM

The composition of the EIA Team with compliance with EMB MC 2011-005 is shown in **Table ES-2**. Resource Persons/Expert Companies were also engaged and are also listed hereunder.

Table ES-2. The EIA Preparer Team

Team Member	Module	Registration No.
EIA Preparer		
1. Edgardo G. Alabastro, Ph.D.	Team Leader	IPCO-257
2. Nadia P. Conde	Project Coordinator	IPCO-102
3. Benjamin Francisco	Marine and Fresh Water Ecology (Team Leader)	IPCO-038
4. Susan Cruz	Sociology	IPCO-253
5. Maria. Catherine R\tos	Technical Assistant	IPCO-037
6. Angelie Faye Nicolas	Research	IPCO-259
7. Kathlene Andrea Efe	Research	IPCO-258

Resource Persons:

1. Virgilio Pantaleon — Marine Ecology
2. Engr. Jeramee Dimapilis — Hydrodynamics/Modeling
3. Gary Benico — Marine Ecology
4. Jose Rene Villegas — Marine Ecology
5. Ernie Fontamillas — Marine Ecology
6. Michael Francisco — Fisheries/Water Quality
7. Nazario Sabello — Air Quality/Dispersion Modeling
8. Jean Ravelo — Geology
9. Dr. Salvador Reyes — Geotechnical

Proponent's External Expertises

10. AMH Philippines,Inc. - Oceanography, Hydrology and Geotechnical.
11. Manuel L. Berenia, Jr. - Reclamation Technology /Traffic Management
12. Arch Armand Alli - Master Planning/Traffic Management
13. FDC Engineering (Eng'r Ric Yuson) - Traffic Management

As may be gleaned above, several individual expertise and engineering companies were consulted regarding traffic management. Moreover, consultations were also made with the MMDA through Traffic Engineering Center headed by Noemi Recio.

EIA STUDY SCHEDULE

The following are the activities that were conducted for this study:

Table ES-3. The EIA Study Schedule

STUDY SCHEDULE	
ACTIVITY	**DATE**
▪ Secondary Data Researches	March to August 2017
▪ Discussions with Reclamation Experts of Impacts and Methodology (Summit on Reclamation)	April 2017
▪ Secondary Baseline data for Air	March 2017
▪ Primary Baseline Data for Noise	April 2017
▪ Baseline data for Water	April 2017
▪ Marine Study	April 2017
▪ Bathymetric Survey	April 2017
▪ Ocular Survey for Migratory Birds	June 2017
▪ Geotechnical Survey	August to October 2017
SOCIAL PREPARATION UNDERTAKEN	
ACTIVITY	**DATE**
Preliminary Key Informant Interview, Preliminary Pre IEC and Perception Survey (Public Participation Documentation provided in **Annex 2)**	
• Supplemental Pre-Scoping and Information, Education And Communication (IEC) with Barangay Officials of Barangay 701	17-May-2017; 9am
▪ Supplemental Pre-Scoping and Information, Education And Communication (IEC) with Barangay Officials of Barangay 719	17-May- 2017; 2pm
▪ Courtesy Call with the Manila Barangay Bureau -Mr. Arsenio Lacson Jr., Head of Manila Barangay Bureau	15-May-2017, 9am
▪ Supplemental Focus Group Discussion (FGD) and Pre-Scoping IEC with Barangay Officials and resident of Barangay 719	15-May-2017, 10am
▪ Supplemental Focus Group Discussion (FGD) and Pre-Scoping IEC with Barangay Officials and resident of Barangay 701	15-May-2017, 3pm
▪ Supplemental Focus Group Discussion (FGD) and Pre-Scoping IEC with Barangay Chairman Felibus C. Papa Jr.	15-May-2017, 1pm
▪ Initial survey with the community along Roxas Boulevard fronting the project site	15-May-2017 (See Public Participation on page **ES-8**)
▪ Initial survey with the establishments near the proposed project site	17-May-2017 (See Public Participation on page **ES-8**)
▪ Initial survey with the taxi drivers in Roxas Blvd.	17-May-2017 (See Public Participation on page **ES-8**)
▪ Initial perception survey along Roxas Boulevard fronting the project site	31-March-2017 (See Public Participation on page **ES-8**)
▪ Public Scoping	23-June- 2017 (See **Annex 2a)**
▪ Technical Scoping	17-July-2017 (Technical Scoping Checklist provided in **Annex 1**)
▪ First Procedural Screening	25 September 2017
▪ Perception Survey -Barangay 701 -Barangay 720 -Barangay 719 -Barangay 721	27-30 June 2017

EIA STUDY AREA

The EIA study area includes the coastal areas of the City of Manila and Manila Bay in the project site, and its vicinities. The study areas in general are the primary and secondary impact areas. The

primary impact areas of the project are the adjacent barangays, including reclamation areas and establishments along Roxas Boulevard.

For the Land Module, area coverage include Manila Bay, the coastal lowlands in Manila and adjacent cities, regional geologic structures and lithology, and nearest rivers/waterways. For Marine Water Biology, the study area encompasses a stretch of coastal waters more than 6 kilometers long from the coastline reference point to the farthest corners and areas adjacent to the proposed project site. For the People Module, surveys covered the 4 nearby barangays namely (1) Brgy. 701 (2) Brgy. 719 (3) Brgy. 720 and (4) Brgy. 721.

San Nicholas Shoal (SNS) as a study area

On the other hand, the quarrying in San Nicholas Shoal for the fill materials needed by the Project is covered by an EIS Report and an ECC application by the Philippine Reclamation Authority (PRA). The environmental concerns and mitigation and legal responsibilities therefore fall on the PRA. When the reclamation contractor undertakes dredging at the SNS, it will have to observe the rules of PRA in respect of environmental concerns. As one requirement to secure permit from the PRA the Contractor will need to submit an Environmental Protection and Enhancement Plan (EPEP) approved by the MGB.

EIA METHODOLOGIES

The following methodologies were considered in establishing the baseline information of the areas that will be impacted by this project:

Table ES-4. EIA Methodologies

Resource	Methodology
LAND	
• Land Use Classification	**Secondary data:** The CLUP. Assessment of compatibility of the proposed project in the land use classification, Manila Bay Coastal Strategy, Boulevard 2000 Plan, Consistency with the PRA Implementing Rules and Regulations, Relation to the PRA Master Plan for Manila Bay, **Secondary data:** Relevance of the Continuing Supreme Court Mandamus on Manila Bay
• Geology	**Secondary data:** Geologic, seismic, liquefaction, slope hazard maps and evaluation based on government data and maps. **Primary data:** Borehole drilling with Geotechnical and Coastal Engineering studies (also used in Pedology)
• Pedology	**Primary data:** Geotechnical Investigation Standard Methods for Sediments Sampling Parameters Considered ▪ Cadmium ▪ Lead ▪ Mercury ▪ Cr + 6
WATER	
• Hydrology / Hydrogeology	Assessment of project impact on changes in drainage morphology/local drainage resulting effects of flooding pattern on the project
• Marine Water Quality	**Primary data:** Standard Methods for Water Quality Sampling and Monitoring. **Water Body Classification:** DENR Class SB **Parameters Considered** • Arsenic • Mercury • Cadmium • Lead

Resource	Methodology
	• pH • Dissolved Oxygen • Total Suspended Solids • Oil & Grease • Chloride • Hexavalent Chromium • Fecal coliform • Nitrate • Phosphate
• Oceanography	**Primary data:** Numerical Modeling for assessment of impacts Bathymetric map; Predicted tides; 24-hour tidal cycles; Surface current system
• Freshwater Ecology	**Primary data:** Delineation of Fresh water bodies and if in impact areas, assessment of project impact in terms of threats to existence/and or loss species, abundance frequency and distribution species and overall impact to freshwater ecology.
• Marine	**Primary data:** Transect, manta tow and spot dives surveys, marine resource characterization (e.g. city/municipal and commercial fisheries data), Key informant interview. **Primary data:** Survey focused on the impact areas. Updated survey of significant fish population at the DIA.
AIR	
• Ambient Air	**Primary data:** Ambient air quality sampling and testing being undertaken by CRL Corporation **Secondary data:** Standard Methods for Ambient Air Quality Sampling and Monitoring **DENR Classification Ambient Air and Noise Classification:** Class B – Commercial Area **Parameters Considered** • TSP • PM10 • SO2 • NOx • Ambient Noise level
• Noise	**Primary data:** Noise Meter
PEOPLE	
• Demographic Profile / Baseline	**Primary data**: Conduct of Public Perception Survey, Public Scoping **Secondary data:** 2005-2020 Manila Comprehensive Land Use and Zoning (MCUPZO). Philippine Statistics Authority, 2015 Census of Population (2015).
ERA	
• Physical and Natural Environment	**Annex 2_7**.e of the Revised Procedural Manual

PUBLIC PARTICIPATION

1. Pre-Information Education Communication (PRE-IEC) Activity

- **PRE-IEC AND FGD WITH THE OFFICIALS OF BARANGAY 701 AND 719**

Pre-IEC activities were conducted with the Officials of Barangay 701 and 719, which were identified as the primary impact barangays during that time. In general, the Barangay Officials are in support with the Proposed Reclamation Project. They perceived that their barangays will be benefited by the livelihood and employment opportunities that will be generated by the proposed project. Moreover, the

barangay officials appreciated the IEC as the chance to raise issues and feedback. The presentation gave background and understanding on the proposed project as well as the potential impacts that could arise. Provided below are the top key issues raised during Pre-IEC and FGD conducted.

Top Key Issues and Concerns raised during Pre-IEC and FGD conducted:

- When to conduct Public Scoping
- Project Details: Exact location of the proposed project
- Economic: Positive impacts in the barangay

- **INITIAL SURVEY WITH THE COMMUNITY ALONG ROXAS BOULEVARD FRONTING THE PROJECT SITE, ESTABLISHMENTS NEAR THE PROJECT SITE AND TAXI DRIVERS**

The results of the initial surveys covering the community along Roxas Boulevard/fronting project site, establishments near the project site and taxi drivers are presented in **Annex 2.0B**. The said surveys were conducted as part of the Pre-Information, Education and Communication (Pre-IEC).

Most of the respondents were taxi drivers, vendors and policemen. Traffic congestion during peak hours was mentioned as a concern. There is inadequate knowledge of the project, which is understandable because the Pre-IEC is intended at "information and education" and was undertaken prior and a prerequisite to Public Scoping.

Thus, it is perceived that Continuing IEC activities throughout the proposed project will be undertaken. Moreover, a Public Hearing will be conducted were they will also be invited.

2. Public Scoping Activity

The Public Scoping conducted on 16 June 2017 was attended by participants from different sectors. The concerned stakeholders, especially those known to have opposing views on reclamation projects, as well as those located in the Impact Areas were invited to participate. Among those invited were LGU Officials, Government Offices, Non-Government Organizations (NGO) / People's Organization (PO), and others. Out of the 76 stakeholders invited, 53.94% of the invitees were able to attend the said event while 46.05% did not attend. On the other hand, there were also participants that are not included in the official list of invitees but attended the said scoping. Summary of Participants during the Public Scoping provided in **Annex 2.0A.**

It is noted that sufficient lead time was provided the invitees. For whatever the individual reasons maybe for their inability to attend, the stakeholders continued to be consulted to date for their concerns, if any. Letters of No Objection (LONO) have in fact been secured from certain agencies as shown below.

a. The Bureau of Fisheries, whose mandate includes the protection of the marine ecology, provided the attached letter **(provided in Annex 3.0)** after individual consultation.
b. The DPWH, whose mandate includes flood controls, provided the letter shown in **Annex 3.0.**
c. The DOT, another key stakeholder to reclamation projects, also sent the LONO provided in **Annex 3.0.**
d. The Philippine Ports Authority (PPA), whose mandate includes the management of navigational lanes, conducted a Public Hearing on reclamation projects in Manila Bay on 08 September 2017 at the Manila South Harbor. In so far as Horizon Manila Project is concerned there were no issues raised but only clarification on the alignment of the project relative to other proposed projects for which ECC application has not been submitted yet for processing.

Summary of Issues and Concerns Raised during Public Scoping Activity

The objective of the conducted Public Scoping Activity and other continuing IEC to be conducted is to ensure that the Environmental Impact Assessment (EIA) will address the relevant issues and

concerns of the stakeholders and that it will be consistent with the Philippine Environmental Impact Statement System (PEISS).

In fact, the result of the conducted Public Scoping is vital to the proposed project. The oppositions to the project due to perceived environmental impacts and other concerns as well as support, especially from the Barangay 719 Captain, were freely expressed during the Public Scoping.

Among the major issues are: (a) the identification of the Project Developer; and (b) Impacts on the San Nicholas Shoal, the expected source of the sands/filling materials. A bullet list of the top Issues and Concerns raised during the Public Scoping Activity is provided below.

Top Key Issues and Concerns Raised during Public Scoping Activity

- **Issues Not Directly Related to Environmental Concerns and/or to Project**

  - Source of Filling Materials and Impacts on San Nicholas Shoal
  - Impacts on Fisherfolks at/near the San Nicholas Shoal
  - Identification of the developer or partner of the City of Manila and of project financier
  - Type of EIS Report Documentation, i.e., Why not a Programmatic EIS

- **Issues Directly Related to Environmental Concerns**

  -- During the Construction/Reclamation Phase

  - Impact areas / barangays Identification
  - Impacts on Water Circulation
  - Miscellaneous Concerns:
    - ✓ Erosion
    - ✓ Subsidence
    - ✓ Storm Surge
    - ✓ Sea Level Rise
    - ✓ Climate Change
  - Solid Waste
  - Impacts on the Sailors of Manila Yacht Club

  -- During the Operations Phase

  - Traffic Problem
  - Increase Congestion in Metro Manila
  - Effect on Indigent Manileños
  - Displacement of Vendors in Roxas Boulevard

  -- Others

  - Consistency with the Operational Plan of Manila Bay per Supreme Court Mandamus
  - Project Alternatives
  - Basis of Reclamation Platform Elevation

The complete Public Scoping Report is provided in **Annex 2.0A.**

The Table of List of Issues and Concerns, Proponent's Response and Page discussed in the EIS is provided in **Section 2.4, Table 2.4-65 onwards.**

EIA SUMMARY: SUMMARY OF ALTERNATIVES AND ENVIRONMENTAL IMPACTS THEREOF

- **ALTERNATIVES IN SITING**

In terms of siting, a major consideration is compliance with the legal requirement that the site should be within the territorial jurisdiction of the City of Manila. The site has to have sufficient buffer zone from the (a) other reclamation projects such as the Manila Goldcoast Reclamation and the Pasay City Project, (b) the North and South Harbors and (c) the Manila Yacht Club. This is seen in **Figure ES-5.**

Providing buffer zone will impact on water circulation.

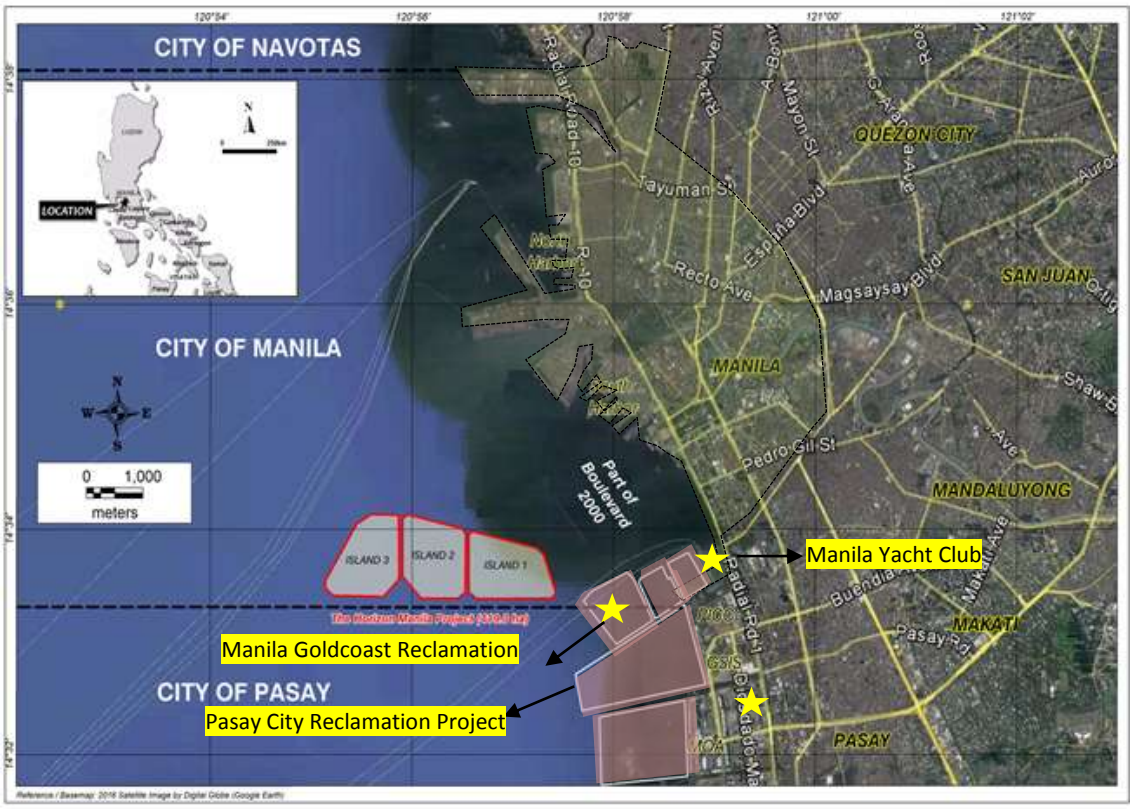

Figure ES-1. Proposed Project Site Relative to Other Landmarks

Moreover, the proposed project site must not be situated in very deep waters otherwise the reclamation methodology and the project cost may be adversely influenced. The other aspects such as ancestral domain and land classification are also considered.

The reclamation site considers the resources that may be impacted such as the marine ecology; that it is not within or in conflict with Environmentally Critical Areas (ECAs) or Protected Areas as declared in the NIPAS; and that there are no settlers nor fishing activities in the site.

- **ALTERNATIVES IN DESIGN**

The designed landform is divided into three (3) islands with individual areas of 139, 140 and 140 hectares, respectively instead of having only one big island to ensure minimal effects on water circulation pattern. The adjacent Manila Gold Coast Reclamation project of 148-hectares is also divided into three (3) islands. Moreover, the alignment is based on a configuration that does not conflict with the other reclamation projects and also with the requirements for the navigational lane of the PPA. A summary of criteria that led to a decision for the creation of three (3) islands instead of one (1) island is provided in the **Table 1-4 page 1-25.**

Based on the **Table 1-4**, the selection for the design of the proposed project is mostly independent of no. of islands but three (3) island reclamation project was preferred the most because of more effective water circulation and drainage system compared to having one island reclamation project.

- **CRITERIA CONSIDERED IN ESTABLISHING THE ALIGNMENT OF THE RECLAMATION**

Based on the forgoing, alignment is influenced by the distances to buildings, centers and structures of interest. Because of distances, the option for alignments is not influenced.

The configuration and alignment of the islands will be subject to final evaluation and approval by the PRA. Final Considered Design is provided in **Figure ES-2.**

Corner	Latitude	Longitude	Island
1	14°33'46.56"	120°57'18.32"	1
2	14°33'26.10"	120°57'25.74"	Area = 140 hectares
3	14°33'23.09"	120°57'23.39"	
4	14°33'23.02"	120°56'38.53"	
5	14°33'26.40"	120°56'33.87"	
6	14°33'57.42"	120°56'33.85"	
7	14°33'58.83"	120°56'36.19"	
8	14°33'50.02"	120°57'14.06"	

Corner	Latitude	Longitude	Island
9	14°33'26.40"	120°56'31.93"	2
10	14°33'23.11"	120°56'27.21"	Area = 140 hectares
11	14°33'23.14"	120°56'05.35"	
12	14°33'33.00"	120°55'54.32"	
13	14°34'05.75"	120°55'54.32"	
14	14°34'07.78"	120°55'57.44"	
15	14°34'00.44"	120°56'29.44"	
16	14°33'57.66"	120°56'31.93"	

Corner	Latitude	Longitude	Island
17	14°33'35.00"	120°55'52.38"	3
18	14°33'32.46"	120°55'51.42"	Area = 139 hectares
19	14°33'24.21"	120°55'42.87"	
20	14°33'24.74"	120°55'12.88"	
21	14°33'28.77"	120°55'08.37"	
22	14°33'32.49"	120°55'08.28"	
23	14°34'02.76"	120°55'26.92"	
24	14°34'07.95"	120°55'35.64"	
25	14°34'07.69"	120°55'51.31"	
26	14°34'07.04"	120°55'52.05"	

Figure ES-2. Final Considered Design for the Three (3) Islands

- **ALTERNATIVES IN TECHNOLOGY SELECTION / OPERATION PROCESS**

  - **Reclamation techniques / methods that are considered**

The reclamation techniques/methods will ultimately be determined by the Reclamation/Dredging Contractor and subject to approval by the Project Consortium. Strict compliances to the DENR regulations and its associated agencies including the Manila Bay Office, to the conditions of the ECC as well as to the international marine regulations, e.g. the MARPOL will by imposed by the Project Consortium. The process/technology are discussed hereunder in **Section 1.7**, including a discussion of the sources of water and power. Fuel for the sea vessels for propulsion and for power needed by the equipment will be directly sourced by the Contractor in compliance with the MARPOL.

  - **Reclamation Methodology to be employed and environmental impacts thereof**

The methodology will be specific to the selected Contractor. To illustrate, certain Reclamation Contractors may possess special technologies for the re use of unwanted sea bed materials instead of disposal outside of the project site. The mixing of these materials with sand followed by compaction and the use of rock mounds will bring about the desired quality of the land that will be created. Other determining factors in the choice of the methodology are:

1. The optimum method and choice of equipment by the Reclamation Contractor considering that each contractor has its own particular vessels and dredging equipment;

2. The required timetable to complete the project noting also that each contractor will have different timelines based on the equipment available; and

3. The containment structure, i.e., whether made of rocks or steel plates or a combination which will be dictated by the geotechnical aspects.

In respect of the soil stabilization methodology, a summary of the comparative is as follows.

1. **Embankment or Surcharge Method** – Preliminary estimations on approximately 5-meter high embankment indicated approximately 5 years to attain full consolidation. This is too long a period of time to wait for the utilization and disposal of buildable areas not yet taking into account the length of construction time required for the development of the site in terms of provision of roads, utilities, etc.

2. **Sand Drain Piles Plus Surcharge** – Under this method, the sand drain piles may not be continuous if improperly installed in addition to the fact that they are very much susceptible to shear failure during the planning of the surcharges. Further, the equipment required is usually heavy and require good construction surface which is not yet available on a newly reclaimed land. This was demonstrated by the experience of PNCC during the ground improvement of the Financial Center Area in MCCRRP.

3. **Sand Composer Piles Plus Surcharge** – The system is vulnerable to the same problems as the sand drain piles. In addition, during the process of compacting the piles vertically and laterally, they can easily be clogged with fine within the soil. Should this happen, resistance to flow of pore waters can become high, thus requiring higher surcharge or embankment.

4. **Well Point System Plus Sand Drain Piles** – In addition to having the same problems as the sand drain piles, the presence of soil-laden water with high salinity is a potential source of problem for maintenance of the equipment.

5. **Dynamic Compaction** – The equipment required are huge and heavy that the newly reclaimed unconsolidated ground may not be able to support. Provision of matting and grillages is costly and very inconvenient every time equipment position transfer is

executed. The methods are not very effective as proven by the test conducted by the PNCC for stabilization of the First Neighborhood Unit.

6. **Vertical Drains Plus Surcharge** – Under this method, the vertical drains have high breaking strength and reinforce the soil in tension. Various types of drains are commercially available that a specific type of drain can be chosen to be exactly consistent with the actual permeability of the soil. Equipment required to install the drain is very light and can easily be supported by the newly reclaimed land. The rate of flow within the drain is higher, thus less height of surcharge is required. From the economic viewpoint, the surcharge can be eliminated if good dredge fill materials are available. Upon completion of the reclamation, the dredge fill itself will function as the surcharge

- **Options considered for the source of water, power, fuel during the construction phase**

  - **Power and Water Supply**

Power- During the dredging/reclamation works, electrical power that will be required by sea craft and equipment (e.g., pumps) will be on board these sea vessels. During the period of soil consolidation which may take approximately one (1) two (2) years the minimal power requirements of the maintenance crew and for lighting on the reclaimed land will be sourced through connection with Meralco.

Water- Water supply by the vessel/barge crews will also be on board. Mobile water tanks most likely to be used by contractors. No underground water extraction. Internal sourcing by individual contractors or water can be tapped from the MWSS-designated concessionaire. The reclamation works are "dry" in nature.

Summary of Main Impacts

This is provided in the Summary **Table ES-5**.

Table ES-5. Matrix Summary of the Main Impacts and Residual Effects

EIA MODULE	Potential Impact)	Options for Prevention or Mitigation* or Enhancement	Residual Effects
CONSTRUCTION PHASE: LAND			
Geology / Soil	• Changes in seabed properties / subsurface geology	• Seabed actually enhanced by improving soil properties through replacement of unstable soil with rock mounds, sand fills and application of containment structure technology	Enhanced
Solid Waste	• Solid waste generation (debris and waste) during construction phase	• Compliance with RA 9003. No garbage disposal into Manila Bay. Disposal onshore through third party • Inventory of solid wastes, principally garbage through records of amount of garbage disposed onshore.	No residual effects.
	• Disposal of unwanted seabed soil	• Spent oil from maintenance or accidental spills by oil-water separator on board vessel. OWS built in the Bilge Management System on vessel. • "Wastes" are possible unwanted silts, which may be kept on site by reusing as fill or disposed outside in observance of rules of the Philippine Coast Guard and the EMB. Previous reclamation activities in Manila Bay was allowed disposal in deep portions of Manila Bay (>20m depth).	

EIA MODULE	Potential Impact)	Options for Prevention or Mitigation* or Enhancement	Residual Effects
Geology	• Erosion/sedimentation	• Engineering design to include mitigation of impacts water circulation changes on particle movements. • Containment structure technology to consider geotechnical studies. • In-depth study (including simulations) on prevailing and predicted sedimentation patterns, wave transformation, longshore currents, tidal currents, wind patterns, bay morphology and bottom topography, etc. • Some areas in the vicinity will be shielded from erosion because the project will serve as barrier against strong waves that can cause erosion. • Visual observation especially along the shorelines fronting the Project	No residual effects on Manila Bay.
Geology	• Storm surges/waves/tsunamis and flooding on land and impacts of the proposed project during typhoons	• Reclamation platform itself with structural defense gives sheltering effect. • Structural defense options are: seawalls at breakwaters, wave deflectors, other similar defenses such as revetment; angled bypass walls. Appropriate structure to be selected in the DED.	No residual effects expected on the reclaimed land.
		• May occur with or without project. • Reclaimed land can mitigate storm surges by acting as “breakwater”	
		• Design of platform to withstand wave force, provision of structures/drainage ways against water incursion • Layout of the land use and structures in the entire reclaimed land with provisions for easy “evacuation routes” in case of early and swift evacuation to elevated areas • Minimum height of completed platform at +4 MWWL	
Geology	• Subsidence/Settlement	• Subsidence is caused by underground water extraction and natural compaction. Groundwater extraction will not be undertaken by the Project • Buildings and structures to be constructed will be founded on the solid bedrock or dense layer and appropriate foundation design will be put in place • A settlement criterion shall be calculated and will include settlements that will develop in the natural subsoil and those that will develop in the reclamation fill from project handover to the end of project life • Use of containment structures • Soil compaction/densification, and to be advanced into the loose alluvial layer of the seabed through use of wick drains	No residual effects. Land will be stabilized before vertical development. Instrumentation to confirm absence of subsidence before vertical development

EIA MODULE	Potential Impact)	Options for Prevention or Mitigation* or Enhancement	Residual Effects
Geology	• Subsidence/Settlement	• Fill materials will be fully engineered and compacted/densified. The soil remediation process that will increase the N-value should be advanced to the to the bottom of pre-existing alluvium. • Monitoring of ground level will be done during the period of soil stabilization to determine quantitative surface movements with respect to both spatial and temporal rates. Known accurate measuring techniques include: InSAR satellite imagery - time-series techniques; GPS surveys; leveling surveys; optical leveling; LIDAR; and field observations	No residual effects. Land will be stabilized before vertical development. Instrumentation to confirm absence of subsidence before vertical development
Geology	• Ground shaking and liquefaction	• Engineering intervention: structural and engineering designs to withstand ground shaking and liquefaction. Use of armor rocks in containment structure • The computed "g" values of 0.592g will be utilized in the design of the structures and also serve as guide in the degree of soil remediation/compaction • Remediation measures to mitigate settlement/subisdence also apply for liquefaction • Philippine Standards and Codes • Use of Armor Rocks. • Recording of events	No residual effects expected based on experiences with present reclaimed land in the Manila-Pasay areas.
CONSTRUCTION PHASE: WATER			
Oceanography	• Impacts on water circulation in the project site • Impacts of water circulation on erosion, deposition and sedimentation. Impacts on the reclamation islands and adjacent areas • Loss of Water Body at Site	• Based on the mathematical modeling for the landform lay out • Design and alignment of landform • Creation of 3 islands to ensure circulation • Only adjacent areas granted NTP by the PRA are deemed relevant to this study	Minimal effect on water circulation patterns. Irreversible impacts on loss of water body at site
Marine Water Quality	• Silt dispersal to Bay due to dredging/filling operations	• Silt curtains and containment structures	Nil to Insignificant
Marine Water Quality	• Turbidity Increase	• Dredging/filling methodology; • Silt curtains and containment structures.	No residual effects. Silt dispersal will be contained.
Water Quality	• Potential contamination with substances in filling materials	• Pre-screening of filling materials; possible sourcing from Manila Bay	No residual effects. Fill materials will be sourced from Manila Bay itself.
Water Quality	• Disposal of unwanted dredged materials	• Strictly not wastes because source is Manila Bay sea bed itself • Maybe reused • If disposed outside of project area subject to appropriate clearances e.g., Phil Coast Guard, DENR, etc.	No residual effects on Manila Bay, fill materials are sourced from Manila Bay itself.

EIA MODULE	Potential Impact)	Options for Prevention or Mitigation* or Enhancement	Residual Effects
Water Quality	• Manila Bay Water contamination, e.g. oil leaks, domestic wastes from construction workers • Wastewater Discharges	• On-board vessel oil containment and recovery equipment • Own on-board vessel toilet facilities, Disposal on land by 3rd parties • Temporary portable toilets during soil stabilization • Bilge Water Management which includes oil-water separation units • Compliance with MARPOL	No residual effects. No intentional discharges to the Manila Bay.
Marine Environmental Risk Assessment	• Potential accidents and damages to marine ecosystems during transport of dredging vessel	• Sea worthy vessels • Navigational Devices • Proper training • Avoid transport during inclement weather • Compliance with PCG and International regulations	Nil to Minimal Residual Effects on Damage to fish lifts in the navigational lane in case of accidents.
CONSTRUCTION PHASE: AIR			
Air Quality	• Air Pollution	• Use of quality fuel • Compliance w MARPOL • Construction works distant from ESRs • Short term only • Sea is buffer zone itself • Proper maintenance of gensets	Residual Effects - Nil
Noise Quality	• Increase in Noise Level	• Construction works distant from ESRs • Short-term only • Sea is buffer zone itself	Residual Effects - Nil
CONSTRUCTION PHASE:PEOPLE			
People: Displacement of Settlers	• Displacement of fisher folks and displacement of indigent people residing in bay walk	• No settlers to be displaced because the project site is uninhabited	Residual Effect. Not Relevant
Generation of Local Benefits	• Perception of adverse impacts on small vendors	• Ambulant and indigent people at the Bay walk will not be displaced on account of the reclamation project • Livelihood and employment opportunity to Manileños particularly to indigent people of the City of Manila	Residual positive effects on employment and livelihood
Generation of Local Benefits	• Positive effects of the proposed project to Manileños particularly to indigent people of Manila		
OPERATIONS PHASE			
Land: Visual Aesthetics	• Aesthetics (Manila Bay sunset)	• Viewing spot in the master plan • Monitoring of Master Plan for provision for viewing spot(s)	Residual effects: Partial blockade of sunset view

EIA MODULE	Potential Impact)	Options for Prevention or Mitigation* or Enhancement	Residual Effects
Inducement of geological hazards	• All known geohazards in the area	• Public education, awareness and preparedness campaign to include each of the known hazards. This will include evacuation drills, placing of signages, and establishing alert systems. This will be done in coordination with agencies like NDRRMC, PHIVOLCS, PAGASA, Proj NOAH, etc. vis-a-vis the Disaster/Risk Reduction and Management Plan of the government • Implement community-based coastal tree planting and clean-ups in area/s to be chosen among the existing mangroves/coastal forests in Manila Bay. • In cases where deterioration is detected, retrofitting/repairs shall be done accordingly • Geohazards will be monitored throughout the operation phase. Buildings, roads, bridges, sewer, drainage, as well as the structural defences shall be checked for	No residual effects
Generation of Local Benefits	Social Concerns: • Social Equity in terms of target benefits of the project • Unemployment problem	• Socio-economic benefits from the project will trickle to the Manileños • Enhancement	Positive residual economic effects
Traffic Congestion	• Traffic problem	• Construction of links from Roxas Boulevard side and from the Cultural Center side • General Traffic Management Plan in coordination with MMDA and the other cities • The Project may in fact provide better alternative than location of the development plans onshore	No residual effects due to traffic management and construction of traffic infrastructures.
People	• Impacts to the sailors of Manila Yacht Club	The reclaimed land will not adversely affect the movement of the MYC sailors; their sea lanes will not be disturbed.	No residual effects