PROJECT DESCRIPTION REPORT (PDR) for SCOPING

1.0 BASIC PROJECT INFORMATION

Table PD-1. Project Fact Sheet/PD Summary

ITEM	Project Information
Name of Project	**PROPOSED CAVITE RECLAMATION PROJECT**
Location	Along Coast of Manila By covering the Municipal Waters of Cavite City, Noveleta and Rosario, Province of Cavite
Nature of Project	Reclamation Project ECP in an ECA (Presidential Proclamation 2146 dated 14 December 1981)
Project Classification & Type	Major Reclamation Project ≥ 50 hectares
Project Classification Code	D.1.
Size/Scale	1,331 hectares reclamation area
Status of ECC	Being Applied For

Table PD-2. Project Proponent/EIA Preparer

ITEM	Project Information
Project Proponent	**Cavite Provincial Government**
Proponent Address	Provincial Capitol Compound, Provincial Capitol Building, Trece Martires City
Telephone Number	**Office of the Provincial Governor:** (046) 419-1919
EIA Preparer	Technotrix Consultancy Services, Inc.
Contact Person	**Edgardo G. Alabastro, Ph.D.**
Address	Unit 305 FMSG Building, Balete Dr. QC 1101
Contact Numbers	(632) 416.4625; 0917.8255203
Email address	technotrixinc@gmail.com

2.0 PROJECT DESCRIPTION

The proposed reclamation project covers 1,331 hectares involving five (5) islands with areas of **(1) 313 hectares; (2) 222 hectares; (3) 205 hectares; (4) 268 hectares; and (5) 323 hectares,** respectively. Consistent with the protocol of the Revised Procedural Manual (RPM), the Environmental Compliance Certificate (ECC) application being applied for involves only the horizontal development phase. The operations phase will be subject to the applicable requirements of the Philippine EIS System (PEISS).

Project Area, Location and Accessibility

- **Location and Political Boundaries**

The project, broken down into 5-islands, is located within Manila Bay and Bacoor Bay, within the municipal water areas of Cavite City and the municipalities of Noveleta and Rosario, all in the Province of Cavite. It will occupy a total reclaimed land area of 1,330 hectares and will be adjacent to the Proposed Cavite Logistic Hub, which shall involve the development of Sangley Point into an international logistic hub with container port and airport complex and also include the reclamation of about 2,000 hectares around Sangley Point.

The 33 impact barangays for the Proposed Project, as it spans 3 towns, See table below. These barangays fronting the site and hosting onshore establishments are considered DIAs for socio-economic aspects and perhaps for environmental/risks aspects as well, principally regarding flooding and storm surges.

CITY/MUNICIPALITY	BARANGAY
	1. Barangay 8 (Manuel S. Rojas)

CITY/MUNICIPALITY	BARANGAY
CAVITE CITY- MANILA BAY SIDE	2. Barangay 11 (Lawin)
	3. Barangay 13 (Aguila);
	4. Barangay 14 (Loro)
CAVITE CITY - BACOOR BAY SIDE	5. Barangay 5 (Hen E. Evangelista)
	6. Barangay 6 (Diego Silang)
	7. Barangay 7 (Kapitan Kong)
	8. Barangay 10-M (Kingfisher)
	9. Barangay 10-A (Kingfisher A)
	10. Barangay 10-B (Kingfisher B)
	11. Barangay 22-A (Leo A)
	12. Barangay 27 (Sagitarius)
	13. Barangay 28 (Taurus)
	14. Barangay 57 (Repolyo)
	15. Barangay 58 (Patola)
	16. Barangay 58-A (Patola A)
	17. Barangay 58-M (Patola M)
	18. Barangay 61 (Talong; Poblacion)
	19. Barangay 61-A (Talong A; Poblacion)
	20. Barangay 62 (Kangkong; Poblacion)
	21. Barangay 62-A (Kangkong A; Poblacion)
MUNICIPALITY OF NOVELETA	22. San Rafael 2
	23. San Rafael 3
	24. San Rafael 4
MUNICIPALITY OF ROSARIO	25. Bagbag II
	26. Kanluran
	27. Ligtong I
	28. Muzon II
	29. Sapa II
	30. Sapa III
	31. Wawa I
	32. Wawa II
	33. Wawa III.

- **Geographic Coordinates (Shape File Data) of Project Area**

The coordinates are vital for (a) identifying the Scope of the ECC that is being applied for, (b) providing the footprints from which evaluations may be made, e.g. water circulation, bathymetry; geotechnical investigation and marine surveys and for (c) ascertaining that the site is indeed within the political boundaries of Cavite City and municipalities of Noveleta and Rosario, Cavite Province. These coordinates are provided for each of the 5 islands in the table below.

Table PD-3. Geographic Coordinates (Shape File Data) of Project Area

CORNER	LONGITUDE	LATITUDE
ISLAND A (313has)		
1	120° 54' 53.5091" E	14° 27' 50.2052" N
2	120° 54' 37.9138" E	14° 27' 36.3666" N
3	120° 53' 41.2977" E	14° 27' 36.5108" N
4	120° 53' 36.5671" E	14° 27' 53.1950" N
5	120° 54' 20.8244" E	14° 28' 32.3518" N
6	120° 54' 54.8597" E	14° 28' 30.7029" N
7	120° 55' 00.4052" E	14° 28' 26.4869" N
ISLAND B (222has)		
1	120° 52' 26.1919" E	14° 27' 31.1126" N
2	120° 52' 18.2353" E	14° 27' 29.4246" N

CORNER	LONGITUDE	LATITUDE
3	120° 51' 57.1066" E	14° 27' 42.5734" N
4	120° 51' 53.0270" E	14° 27' 53.3303" N
5	120° 52' 15.1691" E	14° 28' 31.7593" N
6	120° 52' 26.3390" E	14° 28' 35.4057" N
7	120° 52' 51.4360" E	14° 28' 27.1570" N
8	120° 52' 52.8383" E	14° 28' 19.0474" N
ISLAND C (205has)		
1	120° 52' 14.2761" E	14° 26' 43.2135" N
2	120° 52' 00.7759" E	14° 26' 38.2896" N
3	120° 51' 33.0421" E	14° 26' 51.7782" N
4	120° 51' 25.1700" E	14° 27' 02.4198" N
5	120° 51' 41.6110" E	14° 27' 33.3327" N
6	120° 51' 58.3151" E	14° 27' 32.9654" N
7	120° 52' 19.7722" E	14° 27' 18.9656" N
8	120° 52' 25.3471" E	14° 27' 06.9851" N
ISLAND D (268 has)		
1	120° 51' 36.2344" E	14° 25' 50.7075" N
2	120° 51' 22.7066" E	14° 25' 50.6928" N
3	120° 50' 52.0701" E	14° 26' 10.0747" N
4	120° 50' 48.8697" E	14° 26' 28.0708" N
5	120° 51' 16.3934" E	14° 26' 47.8042" N
6	120° 51' 28.7479" E	14° 26' 45.6971" N
7	120° 52' 00.4339" E	14° 26' 30.3667" N
8	120° 52' 03.7365" E	14° 26' 20.5834" N
9	120° 51' 53.5284" E	14° 26' 01.8486" N
ISLAND E (323 has)		
1	120° 50' 26.9598" E	14° 25' 03.7576" N
2	120° 50' 11.0499" E	14° 25' 03.5575" N
3	120° 49' 52.4998" E	14° 25' 35.9603" N
4	120° 49' 52.0357" E	14° 25' 51.5921" N
5	120° 50' 23.2676" E	14° 26' 12.1576" N
6	120° 50' 40.2939" E	14° 26' 08.3767" N
7	120° 51' 22.5526" E	14° 25' 42.5894" N
8	120° 51' 20.6584" E	14° 25' 39.2179" N
9	120° 51' 09.4047" E	14° 25' 30.6094" N
10	120° 50' 51.9191" E	14° 25' 31.6063" N
11	120° 50' 39.4649" E	14° 25' 21.9813" N

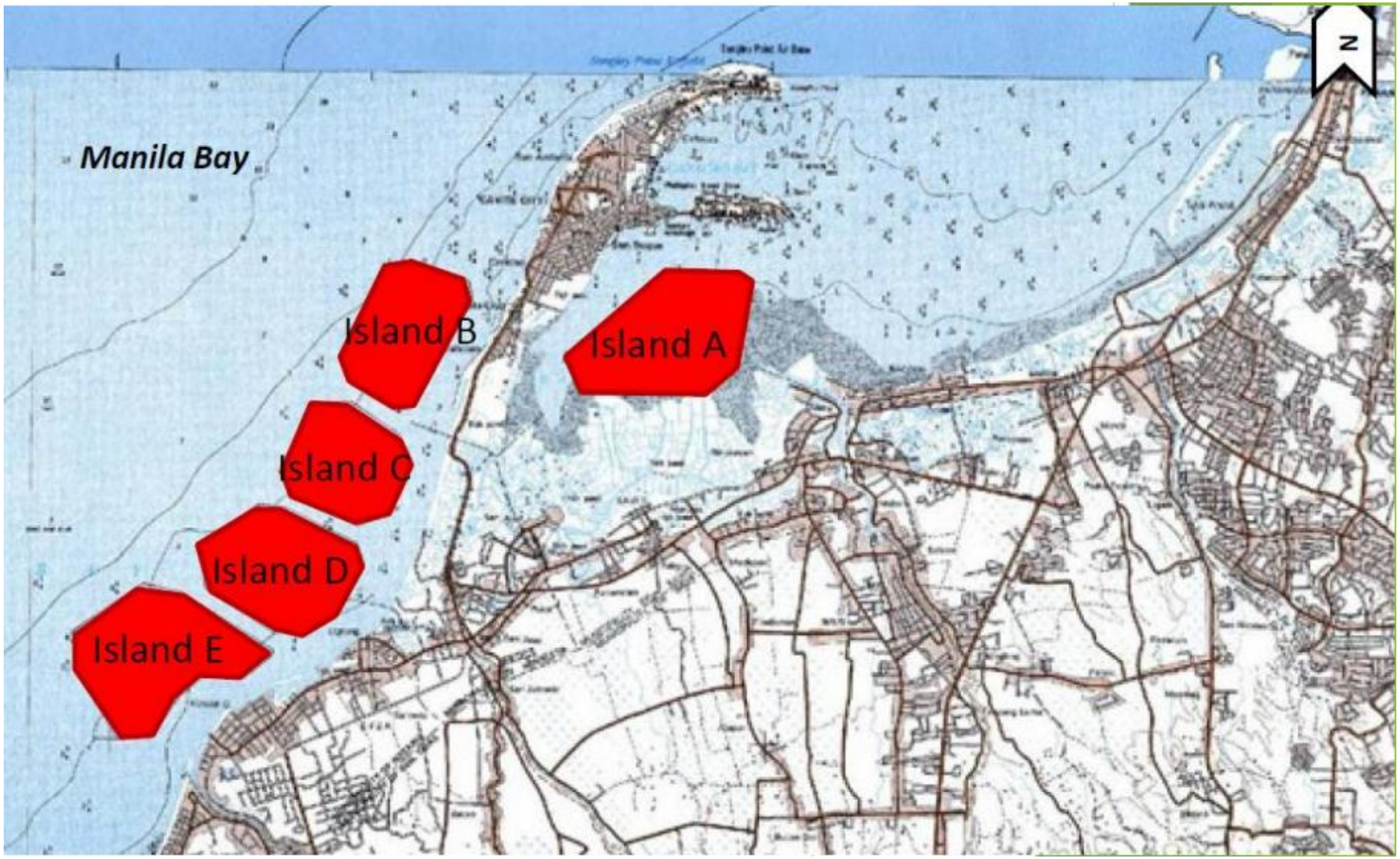


Figure PD-1. Location Map of Proposed Project

Accessibility

There are a number of major thoroughfares in the region. The nearest existing major road to the proposed project site on the Manila Bay side of Cavite City and Noveleta is the Manila-Cavite Road, approximately located at a range of 600 meters to 800 meters straight distance from the nearest corner of Islands B to D**.** This coastal road connects Noveleta and Cavite City to the Magdiwang Highway and Gen. Antonio Highway in Noveleta. Going southwest to Noveleta and Rosario area, the nearest existing road to Island E is the Marseilla Road, which is the southwestern extension of the Magdiwang Highway. This is approximately 1 km from Island E. On the side of Bacoor Bay, the Manila-Cavite Road is still the nearest existing major road with approximate straight distance of 800 meters from Island A, with an arterial road (P. Burgos Ave.) dissecting Cavite City northeastwards to the general direction of Trece Martires, which is about 800 meters from the proposed island. These roads are shown in **Figure PD-2.**

Cavite enjoys strategic access to Manila. Its proximity to the urban centers as well as the international gateways of the country has made it accessible through 12 major entry and exit points. It is located at Region IV-A or the CALABARZON Region. (www.cavite.gov.ph)

These access points are currently being expanded and re-developed to further ease the burden of reaching Manila and its neighboring cities. (www.cavite.gov.ph). The roads important to the project are:

- Manila-Cavite Coastal Road via Talaba, Bacoor City
- Cavite Toll Expressway (CAVITEX) or R-1 Expressway Extension

There is a project in the pipeline for the Manila-Cavite Expressway, also known as Coastal Road/ CAVITEx, (a tollway linking Manila to Cavite Province) to be extended northwards from the Imus Interchange to Sangley Point. This road shall pass over the waters of Bacoor Bay, and is seen as an opportunity for linkage to Island A.

The Access Ways

Preliminary design works are underway for the link from shore to the reclaimed land. In any case, the initial plan is for access ways/viaducts to be linked to the Manila-Cavite Road for islands A, B and C, and from the Marseilla Road to Island E. These are shown in **Figure PD-2.**

Inter-island Connectivity

Inter-island bridges will be built to connecting Islands 1 and 2 will be built. Furthermore, the access ways to islands A and B shall be interconnected, and will pass over land.

- **Inter-City Connectivity**

The proposed viaduct system could have spur lines that can connect Cavite City, Noveleta and Rosario, as well as all of their adjoining LGUs

- **Inter-Regional Connectivity**

The proposed viaduct system that can connect the Cavite reclamation islands can also effectively interconnect the Project with the southern NCR/ MMA cities of Pasay, Parañaque, and Las Piñas. To effectively connect the Project with the NCR/ MMA, additional or separate linkages to existing, ongoing and planned transit systems and to tollway systems have to be planned.

- **Extra-Regional Connectivity**

Aside from the planned and existing surface linkages, extra- regional travel (over straight-line distances of from 60 to more than 100 kilometers/km) may already require other forms of non-overland transport i.e. ships, ferries, private boats/yachts, helicopters, and the like. The marina/s that may be later proposed for the Project may effectively host water-borne traffic while the transportation and utility blocks can host heliports and helistops atop the multi-modals/ intermodals/ parking structures; should express (or high speed) railway services become available in the near future. It is also hoped that the viaduct can host this level of service. In such an event, the inter-reclamation island viaduct alignment shall have 4 separate services i.e. water, drainage and wastewater lines at sub-grade level, surface traffic at grade, a commuter rail (express) service cum utility alignments i.e. fiber optic/ telecommunications, power, gas/ fuel, etc. at the 2nd level, a light rail service at the 3rd level, a tollway service at the 4th level and possibly even a Project-wide cable car or monorail service at the 5th level.

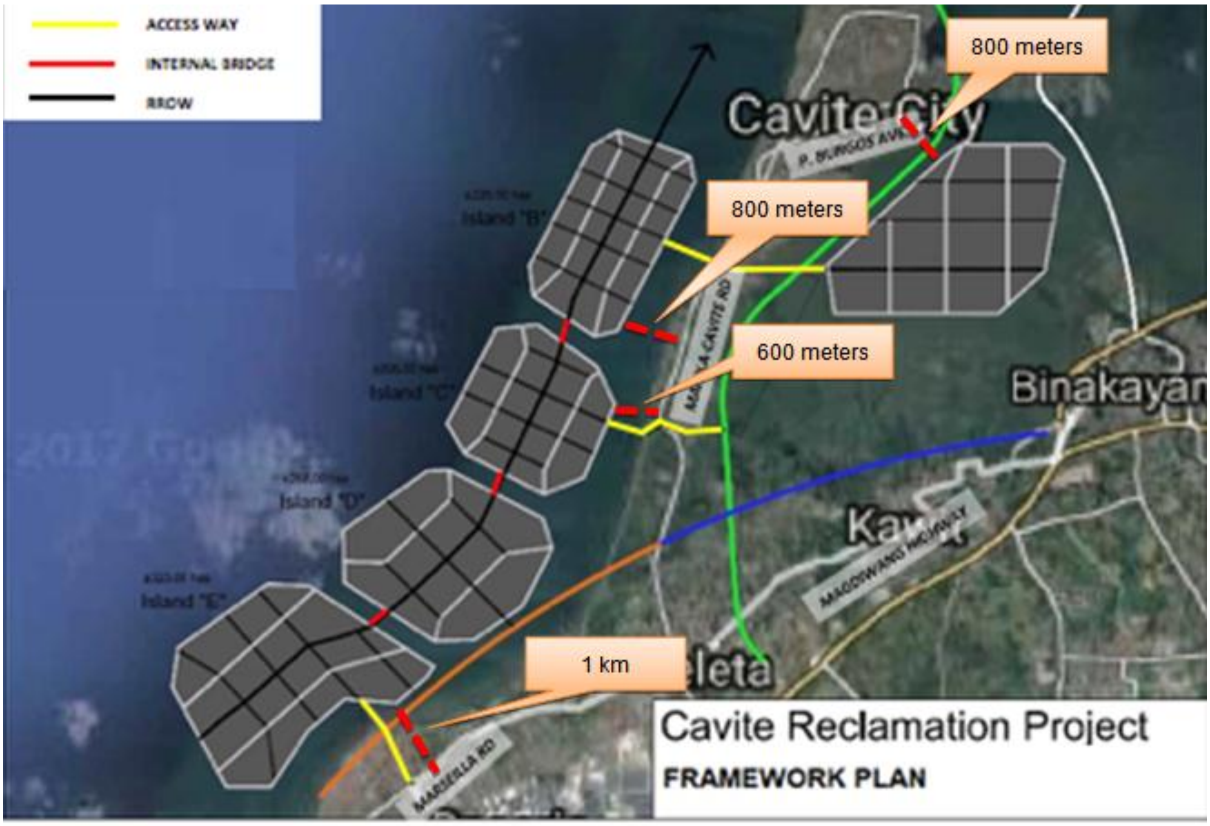


Figure PD-2. Preliminary Conceptual Access Ways, Internal Bridges and Development Layout of the 5 Islands of the Proposed Cavite Reclamation Project.

- **Vicinity Map and Adjacent Landmarks**

The vicinity map is shown in **Figures PD-3** and **PD-4** wherein may be seen the following adjacent proposed reclamation projects. To date, none of these projects have been implemented since the Notices to Proceed (NTPs) from the PRA have not been issued yet.

Important landmarks adjacent to the project site include:

- Trece Martires Centennial Plaza
- Cavite National High School
- Fort San Felipe-Naval Station Pascual Ledesma
- Cavite State University
- Cavite Medical Center
- Cavite Economic Zone II
- Cavite Export Processing Zone

There are also some important **historical sites** in the vicinity, which includes:

- Cavite City Hall - located in pre- World War ll site of Dreamland Cabaret and the "Pantalan de Yangco"
- Sangley Point - used by the Chinese pirate Limahong in 1574 as his refuge when he ran away after a failed attempt to take Manila. Sangley point was also used as a military base by the American and Japanese troops. It is now occupied by the Philippine Navy for ship repair and dry docking known as Danilo Atienza Airbase.
- Julian Felipe Monument - a monument stands for the composer of the Philippine National Anthem
- Don Ladislao Diwa Shrine - well remembered as the co-founder of the KKK. The National Historical Institute (NHI) declared his ancestral home as a national shrine.
- Cañacao Bay - was port to both the Spanish galleons and the Pan Am Clipper seaplanes
- Noveleta Tribunal or Town Hall - the place where Gen. Emilio Aguinaldo wrestled with two guardia civils on duty on August 31, 1896.
- Tejeros Convention Site in Rosario - this was the place where the Filipino Revolutionaries held their 115th convention on March 22, 1897 and approved the establishment of a Revolutionary Government headed by Gen. Emilio Aguinaldo.

The adjacent other proposed reclamation project in Cavite City is:

- The 1,700-Hectare Sangley Point Reclamation-Enabling International Airport Project

Figure PD-3. Vicinity Map of the Proposed Project showing Landmarks and Cities/Municipalities

Figure PD-4. Map Showing other and adjacent Proposed Reclamation Projects in the vicinity of the Cavite Reclamation Project

2.2 Project Rationale

The Province of Cavite has the advantage of being near/adjacent to major urban centers in Metro Manila. As such, it enjoys strategic access to Manila. Cavite is committed to becoming a major international gateway and a preferred hub for global companies. Presently, it hosts several industrial/economic productivity zones that continue to persuade investors to choose Cavite.

The increase in businesses also results to population growth. In addition, the areas of Cavite nearest to Metro Manila are increasingly becoming a popular choice for residential areas because of its easy access to work places/business centers, schools, and commercial areas.

The overwhelming congestion in Metro Manila has led urban planners to seek areas for expansion, and what better options are there but for adjacent provinces such as Cavite. In fact, the Sangley Point has been shown to be the most feasible area for the airport-seaport complex with enabling reclamation component. With this, it is necessary for Cavite to provide large parcels of land to accommodate envisioned developmental growth.

The proposed Cavite land reclamation project along the coast of Manila Bayand Bacoor Bay, near the Sangley Point, can produce some 13,300,000 square meters of additional buildable/developable space. This could be translated into about 9,310,000 square meters of building gross floor area, based on the existing 70% buildable vis-à-vis to 30% open space/public area ratio. The additional 9,310,000 square meters of building gross floor area can be allocated for tourism, office, residential, commercial, and other non-industrial mixed uses in a master planned community.

2.3 Project Components

The Master Plan will undergo iterative process prior to finalization. Among the decision parameters are : (a) project cost (b) timetable (c) market considerations (d) long term vision of the Province and (e) environmental considerations.

The Final Master Development Plan will cover a long term period of at least twenty five (25) years noting that it may take long period before the reclaimed land is fully utilized by the prospective locators.

The components of the expansion projects are:

- Island 1
- Island 2
- Island 3
- Island 4
- Island 5
- Internal Bridges Linking the 5 Islands
- Internal Road Network
- Drainage System
- Storm Surge Protection
- Access way/s – Viaducts
- Power Lines
- Water Distribution
- Waste Water Treatment Facilities
- Pollution Control Devices
- Support Facilities (transport, utilities, etc.)
- Open Spaces

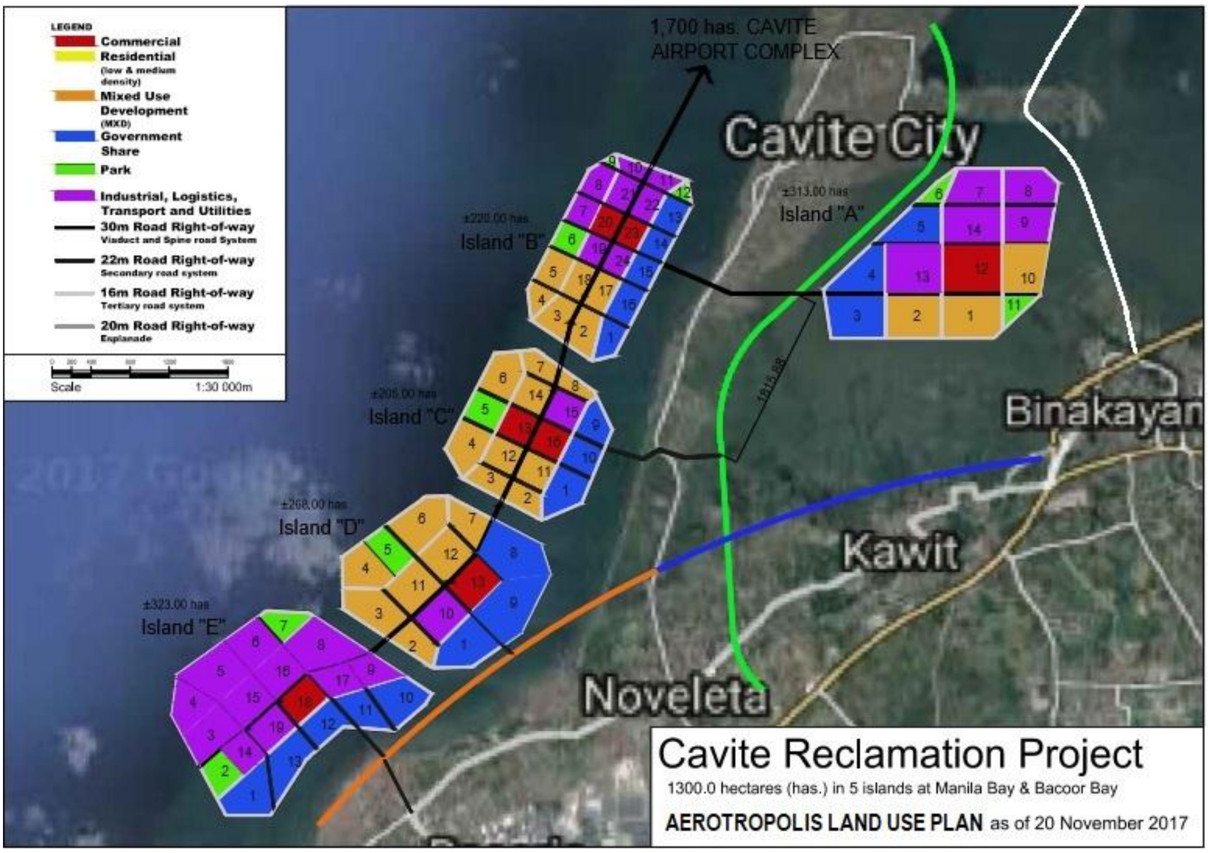


Figure PD-4. Preliminary Master Development Plan

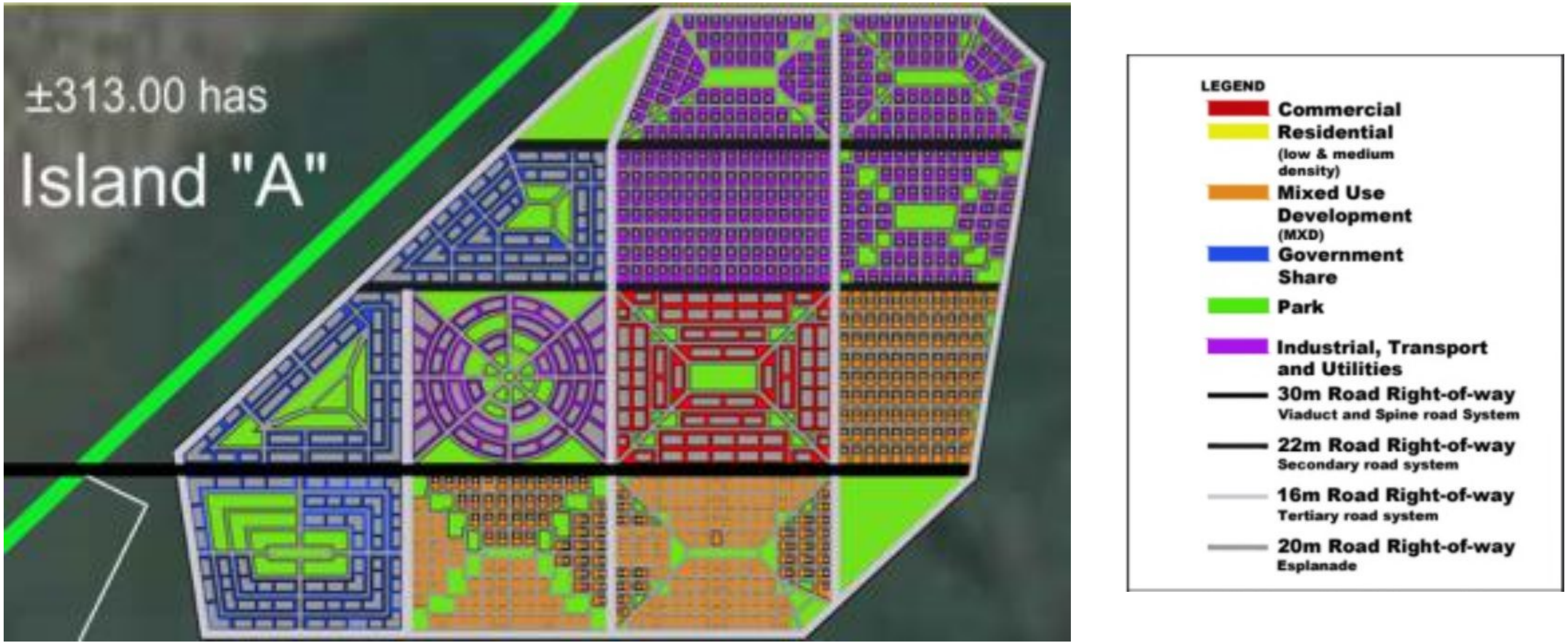


Figure PD-4a. Preliminary Master Development Plan for Island A

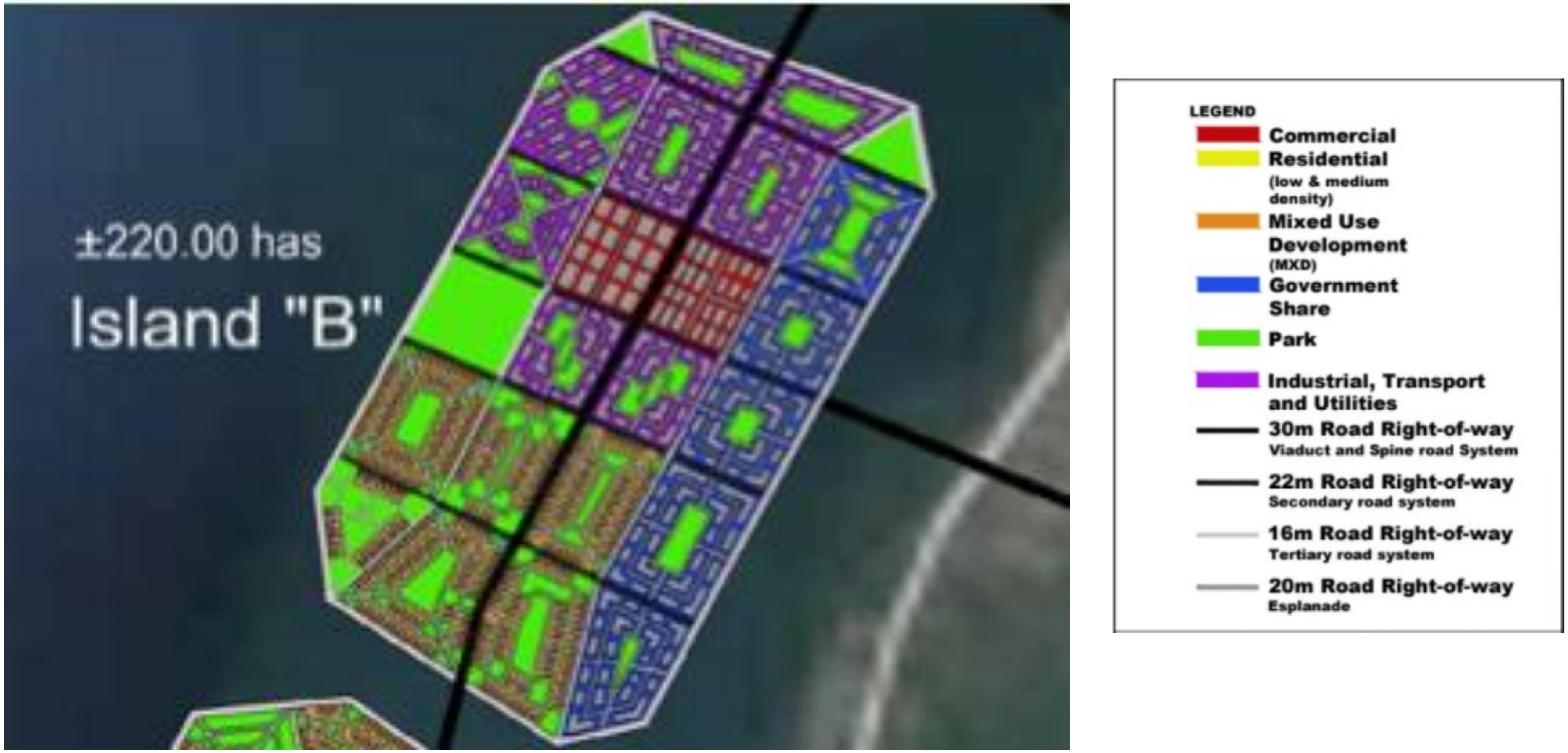


Figure PD-4b. Preliminary Master Development Plan for Island B

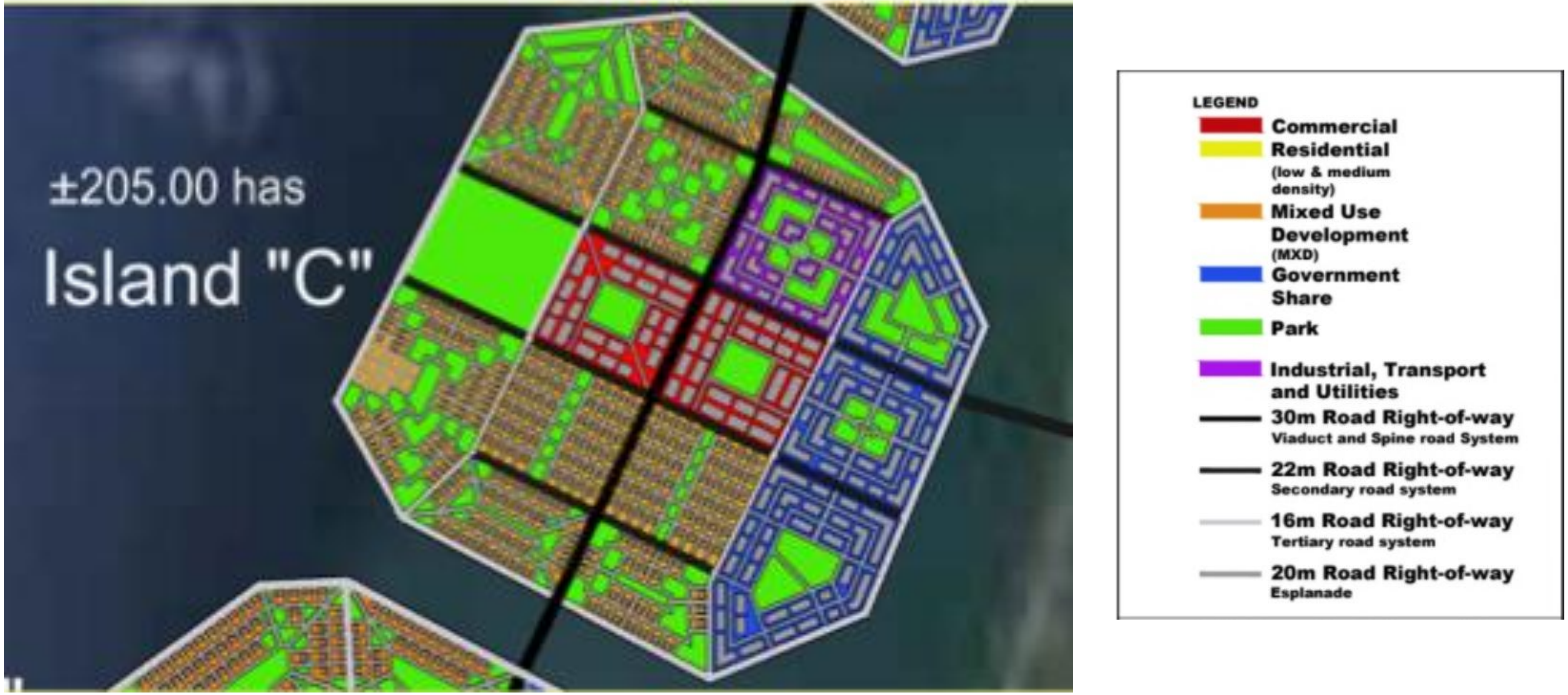


Figure PD-4c. Preliminary Master Development Plan for Island C

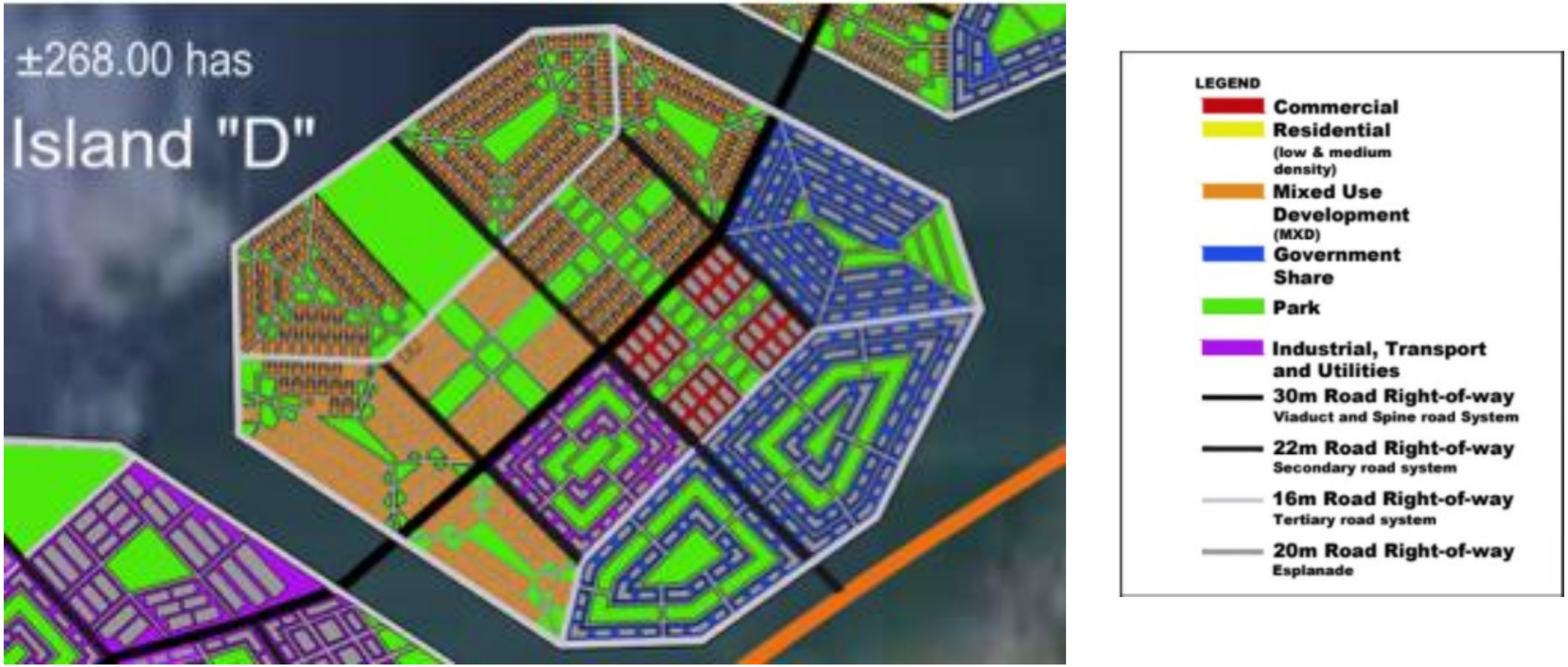


Figure PD-4d. Preliminary Master Development Plan for Island D

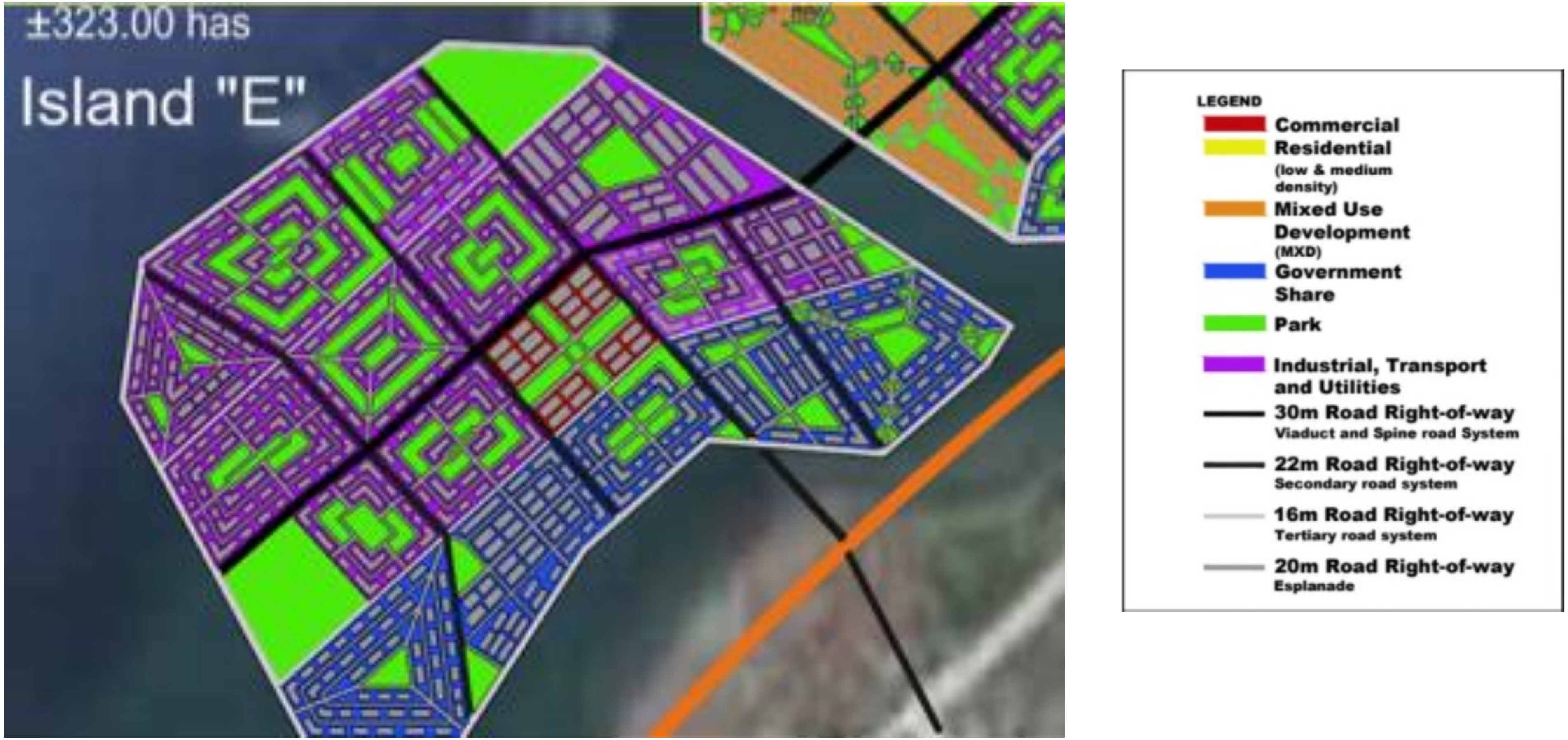


Figure PD-4e. Preliminary Master Development Plan for Island E

2.4 Project Alternatives

Options Considered on Methods of Reclamation that Will Be Considered in the Project

The various reclamation methods relate to the types of equipment to be used.

The determining factors in the choice of the methodology are:

- The most environmentally sound filling method such as by direct discharge from the TSHD without the need for using temporary storage (rehandling pit) of fill materials before discharging by high pressure pumps. Another method which is "rainbowing" illustrated at the right plate could result in significant silt dispersal.

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

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

- The geotechnical aspects which will dictate the type and amount of containment structure, i.e. whether made of rocks or steel piles or a combination.

Resources: Alternative sources of power, water, raw materials and other resources needed including factors significant to the selection such as supply sustainability and climate change projections

Raw Materials

The *"raw materials"* needed for reclamation are the fill materials and rocks. There will be no wastes or recycle streams when using these raw materials.

General Specifications for the Fill Materials (Preliminary)

- All materials used for fill shall be free of rock boulders, wood, scrap materials, and refuse.
- These should not have high organic content.
- Not more than 10 percent (10%) by weight shall pass the No. 200 sieve (75 microns). Maximum particle size shall not exceed to100 mm diameter.
- Maximum particle size shall not exceed 75 mm.
- Shall be capable of being compacted in the manner and to the density of not less than 95 %.
- Shall have a plasticity index of not more than 6 as determined by AASHTO T 90.
- Shall have a soaked CBR value of not less than 25 % as determined by AASHTO T 193.

Estimated Requirements

These will be estimated after full completion of the geotechnical investigation and in consultation with the prospective Reclamation/Dredging Contractor.

With respect to the potential sources following are the options identified at this time:

- **San Nicholas Shoal (SNS)**
  - Since materials also coming from Manila Bay characteristics relatively similar to the seabed at project site, minimizing introduction of foreign materials.
  - Closest to project site
  - Cost considerations
  - Dredging at SNS already covered by an EIS by PRA, ECC under processing. Other sites to be yet studied and apply for ECC.

Additional alternatives to be considered are:

- **"Lahar" from Mt. Pinatubo**
  - Suitability with respect to quality still to be evaluated
  - Transport considerations.
  - Cost considerations.
  - Permitting/Clearances consideration still to be established.

- **Others**
  - e.g. Dredging of river in Pampanga.
  - To be evaluated

Supply sustainability will not be an issue since this will be contracted out prior to the start of the reclamation works.

General Specifications for Rocks (Preliminary)

- Rocks should be angular, hard, durable and not likely to disintegrate in seawater,
- Minimum unit weight is 2,650 kg/cu.m. on dry basis
- Rocks of the primary cover layer should be sound durable and hard and should be fee from laminations, weak cleavages and undesirable weathering.
- Following test designations should be complied with
  Apparent Specific Gravity ASTM C-127
  Abrasion ASTM C-131

The various options are to be evaluated and the appropriate selection will also depend partly on:

(a) The requirements based on the final engineering works;
(b) Cost;
(c) Transport consideration; and
(d) Permitting/clearances requirements.

Power and Water Supply

- **Power**- During the dredging/reclamation works, electrical power that will be required by sea craft and auxiliary equipment (e.g. pumps) will be sourced on-board these sea vessels.

  During soil consolidation, which may take approximately 1 to 2 years, the minimal power requirements of the maintenance crew and for lighting on the reclaimed land will be sourced through MERALCO.

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

Summary comparison of environmental impacts of each alternative for facility siting, development design, process/technology selection and resource utilization

A comparison of environmental impacts is shown below in the case of soil stabilization.

Table PD-4. Summary of Comparison of Impacts of Various Stabilization Methods

Methodology	Key Feature(s)	Environmental Aspect(s)
Embankment or Surcharge	About 5 years to complete	No significant problems
Sand Drain Piles Plus Surcharge	Susceptible to Shear Failure	No significant problems
Sand Composer Piles + Surcharge	Same as in above; clogging with fine material within soil	No significant problems
Well Point System Plus Sand Drain Piles	Presence of soil-laden water with high salinity	No significant problems

Methodology	Key Feature(s)	Environmental Aspect(s)
Dynamic Compaction	Huge and heavy equipment	Noise problem
Vertical Drains Plus Surcharge	High breaking strength of vertical drains, reinforced soil in tension, light equipment	Minimum noise problem Acceptable stabilization time

Discussion of the consequences of not proceeding with the project on a " No project option"

Under this scenario:

- The vision of the Province of Cavite for development will be impaired because of the absence of land. Lands onshore are not easy to consolidate into a single area for development.
- The Province of Cavite will lose the opportunity to have developed land at no cost. It will therefore have to find land onshore and pay from its financial resources.
- Taxes to be paid during the reclamation works will be denied the Province of Cavite.
- The economic benefits during the operations phase including employment and livelihood opportunities will be lost.

2.5 Process Technology (Methods of Reclamation and Dredging)

The Reclamation Methodology/Technology

The specific methodology to be applied will depend on major factors such as:

- The Contractor to be selected noting that each Contractor may possess different equipment.
- The result of the geotechnical and soil investigations which will be undertaken as part of `the Design and Engineering Details (DED) post ECC.
- The source and properties of the filling materials

For illustrative purposes, the "process" involved in reclamation works is shown in **Figure PD-5.**

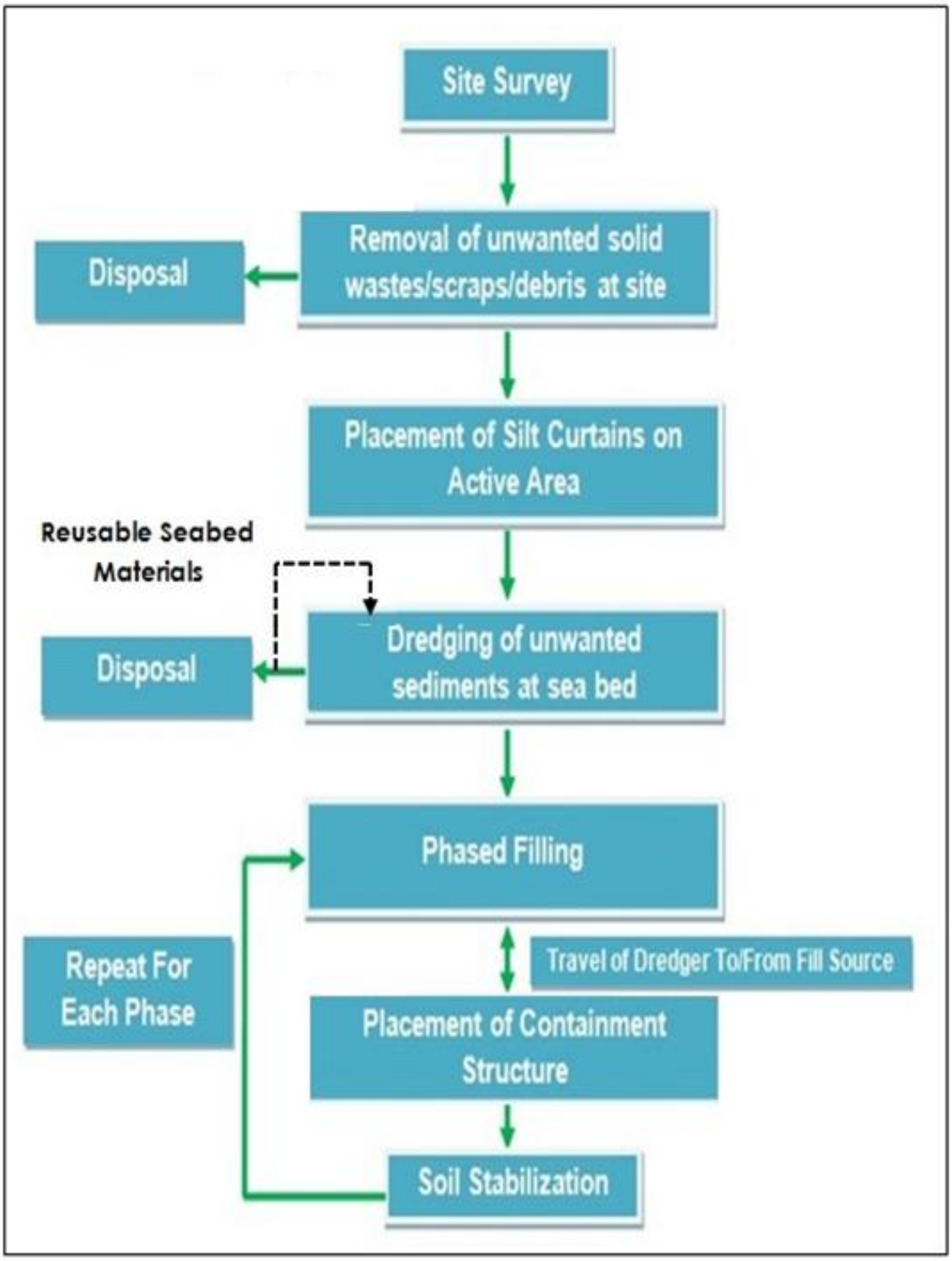


Figure PD-5. An Illustration of the Reclamation "Process"

Mandatory Requirements

The implementation of Reclamation Projects, i.e. the start of the **Construction Phase** can only be undertaken upon the securing of a Notice to Proceed (NTP) from the PRA. Some of the major prerequisites for an NTP are: an Environmental Compliance Certificate (ECC); (b) Letters of No Objections (LONO) from concerned government entities; and (c) approved final Design and Engineering Details (DED), which are undertaken post ECC.

The entities that will grant the LONO will necessarily impose their own requirements that will ultimately influence the reclamation methodology and the final master planning. The DPWH, for example, will closely evaluate the Project in respect of the Department's master flood control plan for Metro Manila. As experienced in the case of another Manila Bay Reclamation Project, the DPWH - *in consultation* *with the JICA* - may potentially require changes in the configuration of the reclaimed area without changes in the project area. These changes will influence the reclamation methodology and master planning.

The PRA may also likely impose its own and updated requirements, which will also influence the master planning and methodology such as:

- The final platform elevation (4.0 m above MWLL)
- The buffer zone from the edge of the reclamation to the shore line (presently assumed at 200 meter minimum and the distances between islands currently assumed at 60 m.)

Reclamation Methodology

The technology/methodology will be specific to the selected Contractor. To illustrate, certain Reclamation Contractors may possess special technologies for the reuse of unwanted seabed materials instead of disposal outside of the project site. The mixing of these materials with the SNS sand followed by compaction and the use of rock mounds could bring about desired quality of the land that will be created. The reuse will also minimize the requirements from the SNS. The use of sand bags is employed effectively by other Contractors, which effectively mitigate siltation problems.

Upon the determination of the reclamation/dredging contractor, details of the design and engineering will be discussed with them.

More specifically, the reclamation works/methodologies will most likely involve the following:

Survey works at seabed; disposal of scraps and wastes

To prepare the seabed for subsequent activities, this is first cleared of scraps and wastes, which are disposed by third party TSD facility onshore.

Placement of containment boom and silt curtains.

By its term, these are literally curtains that serve as physical barriers for the migration of silt to the water body by containing them within the contained or curtained area. These are made of geotextile materials placed **around portions of the reclamation work area wherein fugitive dredged materials/silts may be generated.** Silt curtains are a common and well-established method for containing and minimizing sediment plume spread, and when properly deployed, are an effective measure for mitigating adverse impacts due to release and transport of suspended solids.

The two layered (inner and outer layer separated at 30 meters) containment boom and silt curtain will utilize fine mesh sized material to filter fine and very fine sands to prevent transport across the block boundary. The containment boom and silt curtain will control suspended solids and turbidity in the water column generated by dredging and unloading of the dredged materials. Type II silt and turbidity curtain and containment boom will be installed at the unloading site where the water swell is up to 36 inches. The Type III silt and turbidity curtains will be used at the dredging site to keep turbidity and silt contained. This type of material is built specifically for moving water in conditions where there are rough waves, fast moving waters or harsh tidal conditions (cited in the EIS for SNS Project - www.erosionpollution.com. Erosion Control and Water Pollution Prevention Products)

The curtain extends to the bottom of the seawater so as to trap the heavier particles, which may tend to settle down the water column.

Plate PD-1 illustrates a typical installation of silt curtains.
Plate PD-2 illustrates a typical cross section of a silt curtain.

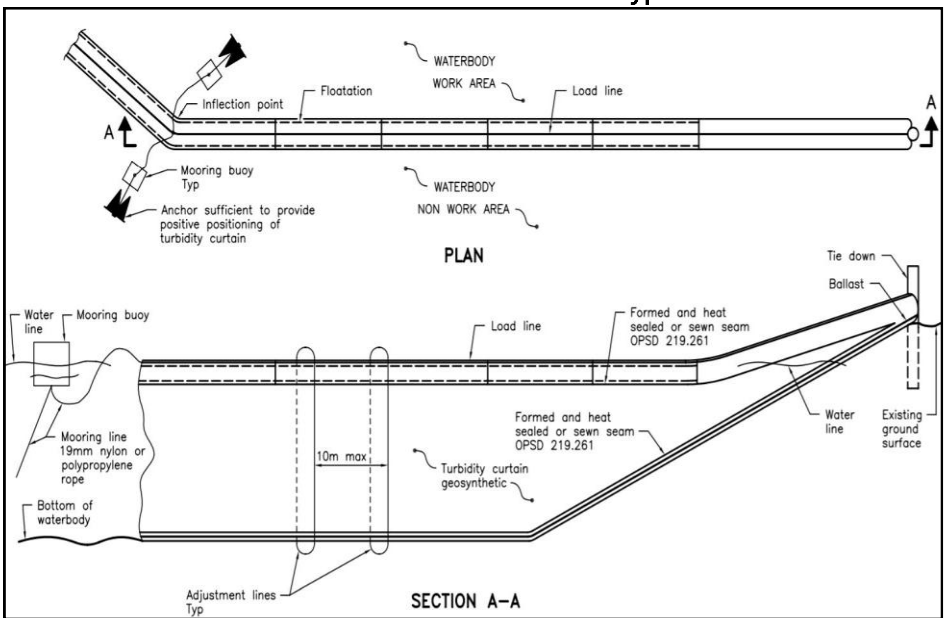
Locations of the Silt Curtains

Inasmuch as the function of the silt curtains is to prevent dispersal of silts from dredging and filling activities these are to be located to enclose the active work areas and thus the locations are variable.

Plate PD-1. Typical Silt Curtain Installation

SOURCE: Terrafix Geosynthetics Inc. Silt Curtains. Retrieved from http://terrafixgeo.com/products/silt-curtains/

Plate PD-2. Cross Sectional View of a Typical Silt Curtain



Removal of Unwanted Seabed Materials at the Reclamation Site employing dredging

Dredging Method: General description of dredging methods

- The methods are defined by the equipment used. A dredger is a piece of equipment, which can dig, transport and dump a certain amount of underwater laying soil in a certain time.
- Dredgers can dig hydraulically or mechanically. Hydraulic digging makes use of the erosive working of a water flow. The water flow pressure generated by a dredge pump is lead via suction mouth over a sand bed. The flow will erode the sand bed and forms a sand-water mixture before it enters the suction pipe.
- Mechanical digging uses knives, teeth or cutting edges of dredging equipment which is applied to cohesive soils to break these down to sizes that can be collected mechanically.

- It is expected that the Contractor to be selected for the reclamation works will use mechanical dredgers of which there are several types.
- The Grab and Bucket Dredgers This is illustrated in **Plate PD-5.**
- The Trailer Suction Header Dredger. This is illustrated in **Plate PD-6.**
- A method similar to the dredging at SNS in respect to the removal of loose clay at the seabed. Rather than transporting, however, the bulk of the dredged materials will be stored in the vessel temporarily on-site, while the seabed is replaced first by armor rocks before it is **refilled back** by the clay in combination with sands from SNS. One option is to use sand bags, hence, it may be assumed that all the dredged materials will essentially be reused and no spoils will be generated, except for dumped trash/garbage.
- The unwanted materials including wastes, debris, or scrap at the site will be disposed by a third party disposal entity accredited with the DENR/EMB at a site onshore to be pre-approved by the EMB. Seabed soils may also be disposed at portions of the Manila Bay with depths of 20 meters or more based on experiences by an international dredging/reclamation Contractor, which has undertaken projects in Manila Bay. Such disposal will be subject to prior approval by the LGU, the Philippine Coast Guard and the DENR/EMB and/or other concerned agencies.

SCOPE or RESTRICTIONS

Environmental measures to be adopted in the disposal of unwanted dredged materials

The most environmentally sound and cost effective method is to minimize the volume of the dredged materials to be disposed. One method adopted by several reclamation contractor is to reuse the dredged materials in combination with sands/fills from external sources.

If materials need to be disposed, laboratory tests shall be done on these materials for further checking of trace elements/metal content. If found to have contents beyond the Dutch standards and disposal site is offshore, treatment/intervention shall be done before final disposal.

If disposal is to be made at sea, the Authority to grant clearances/permits is the Philippine Coast Guard. It is known that in past experiences, disposal at sea was allowed but only at specific sites to be approved. Such sites must be in deep waters. Moreover, during the dumping operations, the area of the sea on which materials are to be dumped must first be enclosed by silt curtains.

Placement of Containment Structures

The containment structure is basically a wall around the perimeter of the reclamation area to prevent the dredge fill from being eroded back to the sea and to protect the reclamation area from strong waves and storm surges.

There are several types of containment walls. It can be vertical, rubble-type, or earth mounds depending on the availability and cost of materials. The method of construction and installation of the containment system will also depend on the chosen type. Rubble-type containment are usually placed first before filling in of the dredge fill; vertical type such as sheet piles are installed when the reclamation area is already above water.

The phasing of reclamation works will have to be decided prior to the placement of the structures.

The major activities or aspects of the reclamation works involved requiring specific technologies are:

1. **Dredging at the Reclamation Site to remove unwanted seabed materials and prepare the seabed for filling, i.e. reclamation**

The proposed project involves land reclamation of 1,331 hectares. The reclamation of the project will be accomplished through a combination of **hydraulic dredging** from burrow pit areas offshore of the project site is filling with burrow materials.

The said dredging can be undertaken either hydraulically or mechanically but as mentioned, the proposed project will use hydraulically type of dredging. Hydraulic dredging is a floating dredge or pump by which water and soil, sediment, or seabed are pumped, either onboard for sifting, as for clams or oysters before they are discharged overboard, or through a series of floating pipes for discharge onshore.

Hydraulic digging makes use of the erosive working of a water flow. For instance, a water flow generated by a dredge pump is lead via suction mouth over a sand bed. The flow will erode the sand bed and forms a sand-water mixture before it enters the suction pipe. Hydraulic digging is mostly done in cohesionless soils such as silt, sand and gravel.

Plate PD-3.TYPICAL HYDRAULIC DREDGER

The transport of the dredged soil can be done by hydraulically or mechanically too, ether continuously or discontinuously. Continuous transport can be undertaken through a pipeline or conveyor belts while discontinuous transport can be done via grab, ship or vehicles.

Deposition of soil can be done in simple ways by opening the grab, turning the bucket or opening the bottom doors in a ship. Hydraulic deposition happens when the mixture is flowing over the reclamation area. The sand will settle while the water flows back to sea or river.

Dredging equipment can have these functions integrated or separated.

The choice of the dredger for executing a dredging operation depends not only on the above mentioned functions but also from other conditions such as the accessibility to the site, weather and wave conditions, anchoring conditions, required accuracy and other consideration such as economics.

2. **Operation of the Trailer Suction Hopper Dredger - Main Reclamation Equipment Filling with suitable materials to the finished platform elevation.**

The reclamation methodology will be specific to the selected contractor and perceived to involve the following activities during the on-site dredging and reclamation works.

- **Placement of silt curtains.**
- **Placement of Containment Structures**
- **Securing/Sourcing of the Burrows/Fill Materials**

Plate PD-4. Typical Trailer Suction Hopper Dredger

It is considered that a Trailing Suction Hopper Dredger (TSHD) will be one the major equipment that will be used in the project. The TSHD has the capacity to extract the sand at the source, transport said sand to the reclamation area and place it directly to the reclamation area or a re-handling pit. If a re-handling pit is used, a cutter-suction dredger (CSD) will be necessary to pump the sand from the re-handling pit to the reclamation area through a much shorter pipeline.

The dredging vessel(s) will be making trips to the source (e.g. SNS). On return from the source to the reclamation area, all of the filling materials will be placed at the reclamation site**.**

The filling of the reclamation site may be done in two (2) ways.

- The dredging vessel to directly upload to the site
- The filling materials will instead be uploaded in a re-handler area immediately adjacent to the site wherein a cutter dredging vessel will take these materials and upload to the site.

3. Transport of the Dredging Vessel to/from Source of Fill Materials.

Dredge-fill materials abound in the PRA offshore burrow area at the San Nicolas Shoal (SNS), which reportedly has a vast deposit and which replenishes on its own through time***.*** *EGA Info is from PRA EIS…* Let us use this but with qualifications. We cannot however mention we got info from PRA EIS because this is confidential

As may be needed, alternate sources to the SNS will be studied; these include the lahar deposits in Pampanga and Zambales, which can be transported to the proposed site by barges. Other sources for evaluation may be dredged materials from the Pampanga River within Manila Bay.

The SNS is only approximately one hour of sea travel time to the project site while the Pampanga and Zambales areas may take some 3 hours to haul the lahar materials to the project site

4. Disposal of Dredged Materials and of Seabed Wastes

The perceived relevant wastes for the proposed project are silts, which are the solid wastes from the dredging of undesired seabed materials. Silt curtains will be used as the waste management mitigation facility to contain the dispersal of these materials.

The options for the disposal or management of the unwanted seabed materials or silts are:

- In-situ compaction and mixing with fill materials, thus, avoiding disposal outside the site

- Disposal at a designated and approved site onshore subject to approval and clearances from authorities including the Environmental Management Bureau.

The various options will be decided post ECC engineering studies; and the choice will depend on:

- Amount of dredged materials, which will be determinable after soil and geotechnical investigation
- Analysis of the silts/seabed materials particularly in respect of metals and hazardous wastes
- The dredging technology, which will be dependent on the dredging/reclamation contractor to be selected.

Other types of wastes (principally domestic garbage) are deemed not applicable for this type of project since no appreciable amount of garbage or solid wastes will be generated from the reclamation activities. Garbage are generated by construction crew personnel who are mostly located at the dredging vessels or sea crafts.

During the dredging of the site to remove the unwanted materials, solid wastes currently present at the reclamation site, which may include debris, plastics, scraps or even ordinances will be disposed of by a third party disposal entity accredited with the DENR/EMB at a site to be approved by the EMB.

Securing/Sourcing of the Burrows/Fill Materials from the San Nicholas Shoal

The initially identified burrow area for this project is the SNS. The quarrying in SNS for the fill materials needed for the Project is covered by an EIS Report and an ECC application by the 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. The Project recognizes the environmental concerns at the SNS and **commits to faithfully comply with the requirements of the PRA**. 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.

The ensuing discussions are derived from the EIS Report for the SNS Quarry Project, for which the securing of said information was cleared with the PRA.

Basic Information on the SNS

The following basic information relates to the Reclamation Project.

Project Name:	**PRA Seabed Quarry Project**
Location:	San Nicolas Shoal (SNS) along coastal towns and the offshore areas of the barangays of Ternate, Naic, Tanza and Rosario of Cavite
Type of Project:	Offshore Quarrying Project
Project Size:	20,000 hectares

The expressed intention by PRA for the SNS Quarry Project is to provide the various reclamation projects in Manila Bay with most suitable fill materials.

The water environment is the most important component of the resources. The EIS Report for the SNS stated the abssence of major marine species and that there are essentially no coral covers except for approximately 2-4% coral cover for the Municipality of Ternate while the rest of the quarry area has no coral community.

Volume of SNS Reserves and Volume of Fill Materials Required for the Project

Based on the PRA EIS Report, the volume of reserve at the SNS totals to **2,009,336,597 m^3**. It may therefore be concluded that the Project can well be provided by SNS with the required fill materials (of approximately **90 M m^3**.)

Heavy Metal Content of the SNS Sands

Any and all materials that will be introduced to the reclamation area will be subject to pre-screening to ensure that the reclamation site will not be contaminated with undesirable elements or substances. It is notable that based on the information for SNS fills shown hereunder, the metallic elements are present in minimal concentrations.

Table PD-5. Concentrations of Selected Heavy Metals in the PRA GSQP

Sample	Cr, mg/Kg	Cd, mg/Kg	As, mg/Kg	Pb, mg/Kg	Hg, mg/Kg
1	4.50	4.65	36.84	9.10	<.004
2	12	6.08	75.28	10.09	<0.004
3	2	6.88	54.84	3.75	<0.004
4	1.5	5	17.92	22.28	<0.004
5	3.75	4.55	15.38	18.9	<0.004
6	4	6.53	47.76	7.73	<0.004
Dutch Intervention Values	380	12	55	530	10
Dutch Target Values	100	0.8	29	85	0.3

Soil remediation intervention values (Ref: email communications with LLDA)

From the table it can be deduced that

- **The SNS fills will not contaminate the reclamation project area**
- **There is no need for any intervention related to the quality of the fill materials.**

The materials encountered in two borings conducted south of San Nicholas Shoals (between Timalan and Maragondon Pt.) in connection with other Manila Bay Land Reclamation Projects are of a rather similar character. Materials with the actual grain size distribution are prone to liquefaction if not densified by means of relevant techniques.

Requirement for Dredge-fill and Number of Dredgers

Assumptions:

- Grab Dredger Productivity: 1975.05 m^3 /hour (computed using T_{cycle} [cycle time] formula, 50 m^3 dredger bucket at 90% fill factor)
- Cycle time, T_{cycle} = 2 (swing angle x swing speed) + grab time + empty time + fall velocity (depth + height of barge) + lift velocity (depth + height of barge)
- Operating Hours: Two eight-hour shifts per day, 365 days per year
- Target completion of dredging is 2 years

Table PD-6. Summary of Dredge fill and Number of Dredgers Requirement

Volume to be Dredged (m3)	90,000,000
Grab Dredger Productivity/hr (m3)	1,975.05
Work Hours/day	16.00
Productivity/dredger/day (m3)	31,600.80
Productivity/dredger/Year (m3)	11,534,292
Needed Volume/Year (m3)	45,000,000
Number of Dredgers Required/Year	4

The above computation shows that 4 grab dredgers will be needed to complete the quarrying of 90M m^3 of dredge fill materials required for the reclamation in 2 years.

Planned Quarry/dredging Methodology

Since the seabed is made up of loose materials, quarrying is the most suitable method to extract material from the seabed. Quarrying will be conducted in parcels within the quarry area. The grab dredgers operate within these parcels while the bottom dump barge transport ferries the sand fill materials to the reclamation projects. The navigation routes are illustrated as white broken lines.

a. At the material source site, one Grab Dredger will extract material with two clamshell buckets, up to a depth of 50m. The clamshell buckets will load the material directly onto one Bottom Dump Barge which when full, will transport it directly to the reclamation site. This entire area will be enclosed by silt curtains made of geotextiles, covering the length from water level down to the sea floor and supported by poles driven 4m into the seabed. This is meant to prevent dispersal of material outward. There will also be an oil spill boom trap around the whole area, to contain small leaks and discharges that naturally occur in the operation of heavy equipment.

b. In the event of large amounts of unusable material (overburden) lying on top of dredge fill, the unusable material will be removed first and deposited in the pit left by previously dredged sections.

c. This procedure of quarrying shall continue until the required filling elevation has been achieved.

Equipment Requirements

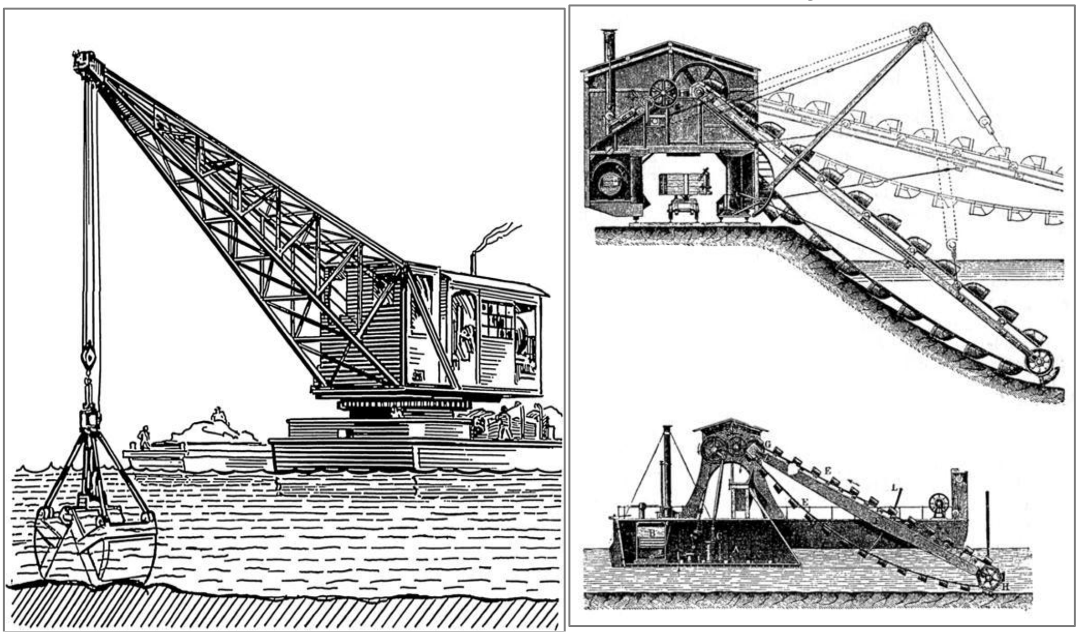
Grab dredgers will be the prescribed primary quarrying equipment since it can operate with higher efficiency at deeper portions of the marine burrow area up to 50m depth with a grab capacity of up to 200 cubic meter using 2 clam shell buckets. Note that the seabed at the burrow area is -30 meters and below. The buckets will load the material onto the dredger's hold, which is connected to one **Bottom Dump Barge** via a floating pipeline. When full, the Bottom Dump Barge will transport the material directly to the reclamation site while the Grab Dredger continually extracts and loads onto its hold.

The Grab Dredger will be equipped with anti-turbidity mechanisms for sediment control, the bucket must be water tight to minimize sediment release. There will also be an oil spill boom trap around the whole area, to contain small leaks and discharges that naturally occur in the operation of heavy equipment.

The main causes of sediment release from grab dredgers are:

- Impact of the Grab on the Bed;
- Disturbance of the Bed During Closing and Initial Removal from the Bed;
- Spillage from the Grab and Erosion of Exposed Soil During Hoisting (especially with Open, Non-Watertight Grabs);
- Material Washed from the Outer Surface of the Grab During Hoisting;
- Leakage During Slewing to the Barge; and
- Washing of Residual Adhering Material During Lowering.

Plate PD-5. Grab and Bucket Dredger



Excavated material will be dropped onto the hold of the grab dredger, which will be connected via a floating pipeline to a bottom dump barge. A tugboat pulls the barge off the quarry site and tows it offshore to the reclamation site. While one barge is being filled, another is being towed to the reclamation site. Numerous barges will be used so work can proceed continuously. Navigational route should be free from obstruction. As such, coordination with coast guard and other concerned agencies concerning the navigational route will be regularly communicated.

In the quarrying activities and loading of the dredge materials, spillage will be reduced through minimizing the height from which the bucket releases its load. Dredge operators will place the bucket as close as possible to the cargo compartment before releasing the load from the bucket. To ensure this, certified and licensed operators who have undergone sufficient training shall conduct these activities, which shall be communicated through the contractor.

Barges will be loaded with quarry material evenly to avoid tilting or overturning during transport to the reclamation site. It is important not to overfill the barge to avoid risk of spillage during transport especially when moving through rough waters. Spillage while in motion can also be prevented by placing removable cover over the barge. Barge hulls will be inspected to ensure that they are completely sealed before transporting the dredged materials to the reclamation site. Barges shall have silt curtain and spill boom in case of oil spill, equipped with horns and warning lights to be visible at night.

During unloading of the dredged materials, the barge will stop alongside the stationary suction dredger at the reclamation site. It will unload the material directly onto the seafloor, which will be suctioned and pumped onto the reclamation area by the suction dredger.

Transport of Fill Materials to Reclamation Site

Self-propelled bottom dump barge shall be used to transport the excavated materials from the seabed quarry to the disposal area. The shortest navigational route will be predetermined so as to minimize potential impacts within the route. These vessels will travel approximately 40 km, from the GSQP area to their respective sand winning areas within the GSQP coverage. The entire area will be enclosed by silt curtains made of geotextiles, as well as an oil spill boom.

Operation of all sea vessels shall strictly comply with sea transport safety rules. Weather conditions will be monitored at all times and there will be no operations for storm levels that the Coast Guard deems unsafe for sea travel.

Discharging/Filling Operation

The filling operations will be synchronized with the dredging of the materials from SNS. Discharge of the soil is sucked by the pipeline from the barge directly sprayed to the reclamation area.

Equipment consideration on the reclamation area is the use of suction dredger that would suck the material dumped by the bottom barges and blown out to the reclamation site.

Surcharging may be done in stages of 3 to 4 meters until the final height is attained. This way, the immediate settlements for the sand layers and consolidation of the layers are allowed to take place, thus, improving the strength of the soils in the upper portion of the seabed. Rapid construction may trigger base failure or induce cracks or zones of weakness within the fill.

In Manila Bay, the settlement of the reclaimed platform is mainly depending on the subsoil and on the fill materials. There are available process engineered solutions such as vertical drains and surcharge to speed up the settlement and stabilization. The time needed for consolidation depends on the technique used, but it is safe to say that 90% of primary consolidation will be reached after 1-2 years.

For greater stability of tall and heavy structures, current plans are to place these on piles.

Placement of armour rocks

These are specialty hard rocks, which render structural/foundation integrity to the reclaimed land.

Pile driving

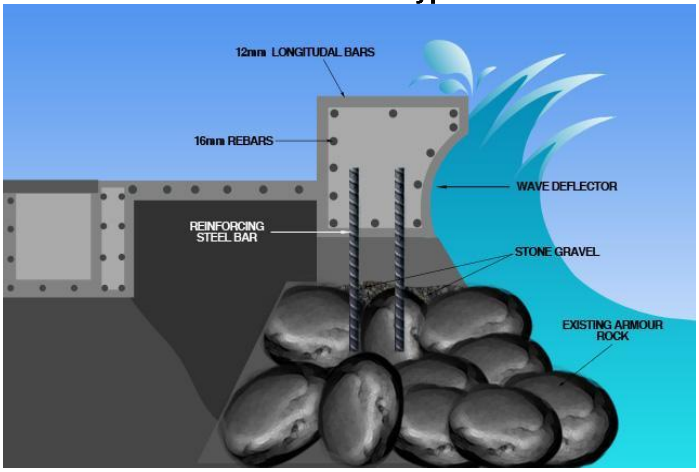
This will be undertaken at points in the reclaimed land at which heavy structures will be constructed, and thus, stronger foundation needed.

Installation of wave deflectors

The main functions of the wave deflectors are: (a) to redirect the flow of storm surge so that the onshore land will not be flooded; and (b) to dissipate the energy of storm surges.

The materials specification for the wave deflector will be of steel with reinforcing bars and stone/rock construction.

Plate PD-6. Illustration of a Typical Wave Deflector



Soil Stabilization

The newly reclaimed area needs to be compacted and consolidated to certain strength so that it can support the roads, infrastructure, utilities, and buildings.

Several stabilization methods are available but the most common is the paper wick drain with surcharge method. This method can accomplish the compaction process within a year or less.

Following are the acceptable methods, with comparative evaluation discussed per method:

1. **Embankment or Surcharge Methods**

   A volume of soil is placed over the reclaimed land to be improved. The weight of the surcharge will force out the escape of the entrapped water within the voids of the saturated underground soft soil thereby inducing settlement at an accelerated rate.

   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 taking into account yet 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**

   This method involves the construction of vertical sand piles at certain spacing down to the bottom of the soft soil layer in question to allow the drainage of pore waters when the weight of the surcharge is imposed over the subject area. With the accelerated escape of the water from the voids within the soils, settlement is induced at a very much faster rate that if surcharge is used only without providing vertical drainage pathways. The subject area can therefore be made usable at a very much earlier date.

   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 available yet 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**

   This method functions very much similar to the sand drains except that the composer piles can also serve later as vertical columns that will allow the stabilized land to support bigger loads. In the construction process, the sand composer piles are compacted vertically and laterally. Because of the later compaction that will be induced on the adjacent soft soils, pore water pressures will be increased accordingly. When the surcharge is finally placed over the subject area, the pore waters will be forced out to escape through the voids of the sand composer piles thus accelerating the settlement very much faster than the natural consolidation process.

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 Plus Sand Drain Piles**

This is the use of well point equipment to dewater the soil down to the desired depths. The series of riser pipes are installed down to the reach of the pipes around the perimeter of the area to be stabilized. These risers are then connected to the horizontal head piles attached to a powerful pump that will drain out all the water within the soil. Continuous pumping is required to maintain the drawdown of the underground water level. For very impervious soils, the provision of sand drain piles is also necessary to shorten the time of area is no longer necessary since the dried soil serves as the surcharge for the underlying soft soil layers.

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**

This method involves the use of huge weights to be dropped by a crane over the area to be improved. The impact transmitted to the underlying soft soils builds up the pore water pressures within them and thus forces out the escape of the pore water to the surface.

The equipment required is 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**

This method functions exactly the same as the Sand Drains Plus Surcharge Method. The only difference is that with this system, the sand drain piles are replaced with the vertical drains which are manufactured for the purpose in the form of wicks or strips and made of non-degradable materials. The core consists of ducts where water can flow upwards and wrapped around with very porous sheeting through which water can enter the core. The wick comes in various trademarks and designs but more or less uniform in the overall dimensions. For ease in handling and installation, the wick comes in coils.

All the above-described methods are to be first evaluated on the basis of technical considerations such as applicability to the project area with the type of soils as to be determined during the final geotechnical investigation, available equipment required, particularly the type and capacity and the characteristics of the newly reclaimed land as to load carrying capacity prior to stabilization. Cost evaluation will necessarily be considered also.

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

Removal of water in the Interstices of the Fills

Trapped water could weaken the integrity of the reclaimed land and therefore should be removed. An acceptable method for removal of water is by the use of wick drains.

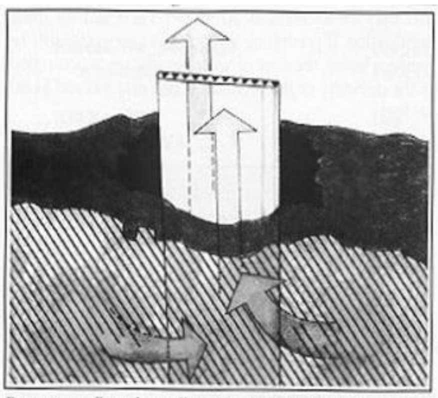
Wick Drains

In order to accelerate the consolidation of the underlying strata at the platform, and hence the use of the reclaimed areas for final structures in a short period of time, it is foreseen to install vertical wick drains over the total area.

Wick Drains are artificial drainage paths consisting of central core which functions as a free-draining water channel, surround by geosynthetics filter jacket. With the drainage of water consolidation of soils is expedited and long-term settlement is limited.

Plate PD-7 is an illustration of the concept of wick drains.

Plate PD-7. Illustration of the Principle of Wick Drains



Pore water flows laterally to the wick drains and is carried vertically up to the ground surface.

SOURCE: US Wick Drain. *Wick Drain*. Retrieved from http://www.uswickdrain.com/faqs.htm. Retrieved on July 2017

Continuous Monitoring of Soil Stabilization/Settlement

The Contractor who will undertake the installation of the wick drains as well as surcharging is also expected to provide for continuous monitoring. Instruments such as inclinometers, piezometers, strain gauges, settlement plates and surcharge slope indicators have to be installed by them. An extensive soil investigation will also have to be undertaken by them. This will be a combination of some actual soil boring and the Dutch cone penetrometer test. Laboratory tests to determine vertical and horizontal consolidation properties of the soil as well as permeability will also have to be undertaken by them for final evaluation by the consultants.

Installation or construction of supporting components of the reclaimed land

These include among others the following:

- **Connecting Bridges**
- **Drainage System**
- **Internal Road Network**
- **Access link to the shore**

2.6 The Direct and Indirect Impact Areas

The delineation of the EIA Study Areas is based on the Direct Impact Area (DIA) and the Indirect Impact Area (IIA). These study areas are identified in the discussions of the specific modules, i.e. Land, Water, Air and People.

THE PRE-EIS IMPACT AREAS FOR THE CONSTRUCTION PHASE UP THROUGH THE FORMATION OF LAND

The guidelines provided by the Revised Procedural Manual for the DENR Administrative Order 2003-30 relevant to this project are used for the delineation of the DIA and IIA, to wit:

a. **Direct impact area (DIA)** is … the area where ALL project facilities are proposed to be constructed/situated and where all operations are proposed to be undertaken. For most projects, the DIA is equivalent to the total area applied for an ECC.

For the proposed project, the DIA are:

- The reclamation area itself wherein the construction activities will be undertaken. This area is currently the body of water covered by the planned landform. There are no structures or fishing activities and settlers at the DIA.

- The 33 impact barangays for the Proposed Project, as it spans 3 towns, as below. These barangays fronting the site and hosting onshore establishments are considered DIAs for socio-economic aspects and perhaps for environmental/risks aspects as well, principally regarding flooding and storm surges

Cavite City - Manila Bay side

1. Barangay 8 (Manuel S. Rojas);
2. Barangay 11 (Lawin);
3. Barangay 13 (Aguila);
4. Barangay 14 (Loro)

Cavite City - Bacoor Bay side

5. Barangay 5 (Hen. E. Evangelista);
6. Barangay 6 (Diego Silang);
7. Barangay 7 (Kapitan Kong);
8. Barangay 10-M (Kingfisher);
9. Barangay 10-A (Kingfisher A);
10. Barangay 10-B (Kingfisher B);
11. Barangay 22-A (Leo A);
12. Barangay 27 (Sagitarius);
13. Barangay 28 (Taurus);
14. Barangay 57 (Repolyo);
15. Barangay 58 (Patola);
16. Barangay 58-A (Patola A);
17. Barangay 58-M (Patola M);
18. Barangay 61 (Talong; Poblacion);
19. Barangay 61-A (Talong A; Poblacion);
20. Barangay 62 (Kangkong; Poblacion);
21. Barangay 62-A (Kangkong A; Poblacion).

Municipality of Noveleta:

22. San Rafael 2;
23. San Rafael 3;
24. San Rafael 4.

Municipality of Roasrio:

25. Bagbag II;
26. Kanluran;
27. Ligtong I;
28. Muzon II;
29. Sapa II;
30. Sapa III;
31. Wawa I;
32. Wawa II; and
33. Wawa III.

- The other establishments and buildings that are much more distant than those identified as within the DIA, e.g. the Danilo Atienza Airbase, Naval Station, Trece Martires Centennial Plaza, Cavite National High School, Cavite State University, Cavite Medical Center, Cavite Economic Zone II, and Cavite Export Processing Zone

- Dredging – noise, sediment plumes, release of nutrients or contaminants from dredged sediments, dissolved oxygen depletion, habitat destruction and ecological impacts.

- Marine burrow works–the same as those due to dredging works with the addition of the possibility of reduction or removal of the natural supply of sand to existing beaches.

- Land burrow works – noise, dust and smoke generation, and visual impact.

- Mud disposal–release of nutrients or contaminants from deposited sediments; other impacts similar to those due to dredging works.

- Fill delivery– noise and dust generation.

- Fill placement– noise, dust and smoke generation, and water quality impact.

- Final land form–interference in tidal flow, wave and sediment transport patterns, siltation, scour and reduced dispersion or dilution of discharges, water quality and ecological impact, elevation of ground water levels uphill, and possibility of causing erosion of the shoreline of existing beaches.

- Potential Pollution and Soil Erosion During Construction Phase

b. Indirect Impact Area (IIA) …an IIA can be the stretch of the river/s OUTSIDE the project area but draining the project site, which can potentially transport Total Suspended Solids and other discharges from the project towards downstream communities.

For the proposed project, the IIA are:

- Navigation lane of dredging vessel.

- The other adjacent proposed reclamation project is the 1,700 - Hectare Sangley Point Reclamation Project, which is still being planned and being worked out by the **PRA/NEDA**

Table PD-7. Impact Areas

RATIONALE	MAJOR IMPACTS	SITES/IMPACT AREAS
DIRECT IMPACT AREAS		
Land	Perception of Floods	Establishments fronting site
	Extraction of Filling Materials	Source of Fill Materials - possibly the nearby San Nicholas Shoal

RATIONALE	MAJOR IMPACTS	SITES/IMPACT AREAS
	Visual Impact (Construction Works at the bay)	At and vicinity of site
Water	Marine Ecology	At and vicinity of site
	Change in water circulation	1,330 hectare reclaimed land and immediate vicinities including identified proposed other reclamation projects
	Potential for silt dispersal	Within and immediate vicinity of the project site
	Change in seabed topography	Seabed of reclamation islands
	Accretion/erosion	Seabed of reclamation islands
Air	Increase of Ambient Noise	At and vicinity of site
	Impacts on Existing Air Quality	At and vicinity of site
People	Positive impacts on employment and livelihood	Cavite City, Noveleta and Rosario especially the impact barangays
	Positive impacts on economic uplift of Cavite City, Noveleta, Rosario and the provincial government of Cavite	Cavite City, Noveleta and Rosario
INDIRECT IMPACT AREAS		
Domain impacted by changes in circulation	Transport of particles	Body of water potentially affected by changes of circulation
Navigation of Dredging Vessel	Oil Spills	Along the navigational lane to San Nicholas Shoal
	Potential Damage to fish cages	Fish lifts/sapras within Bacoor Bay

Direct and Indirect Impact Map is provided in **Figure PD-10.**

Further refinements on the delineation of the DIA and IIA will be made after (a) the continuing Stakeholder Consultation and the evaluations of (b) the EIA Management Division of the DENR and the Review Committee.

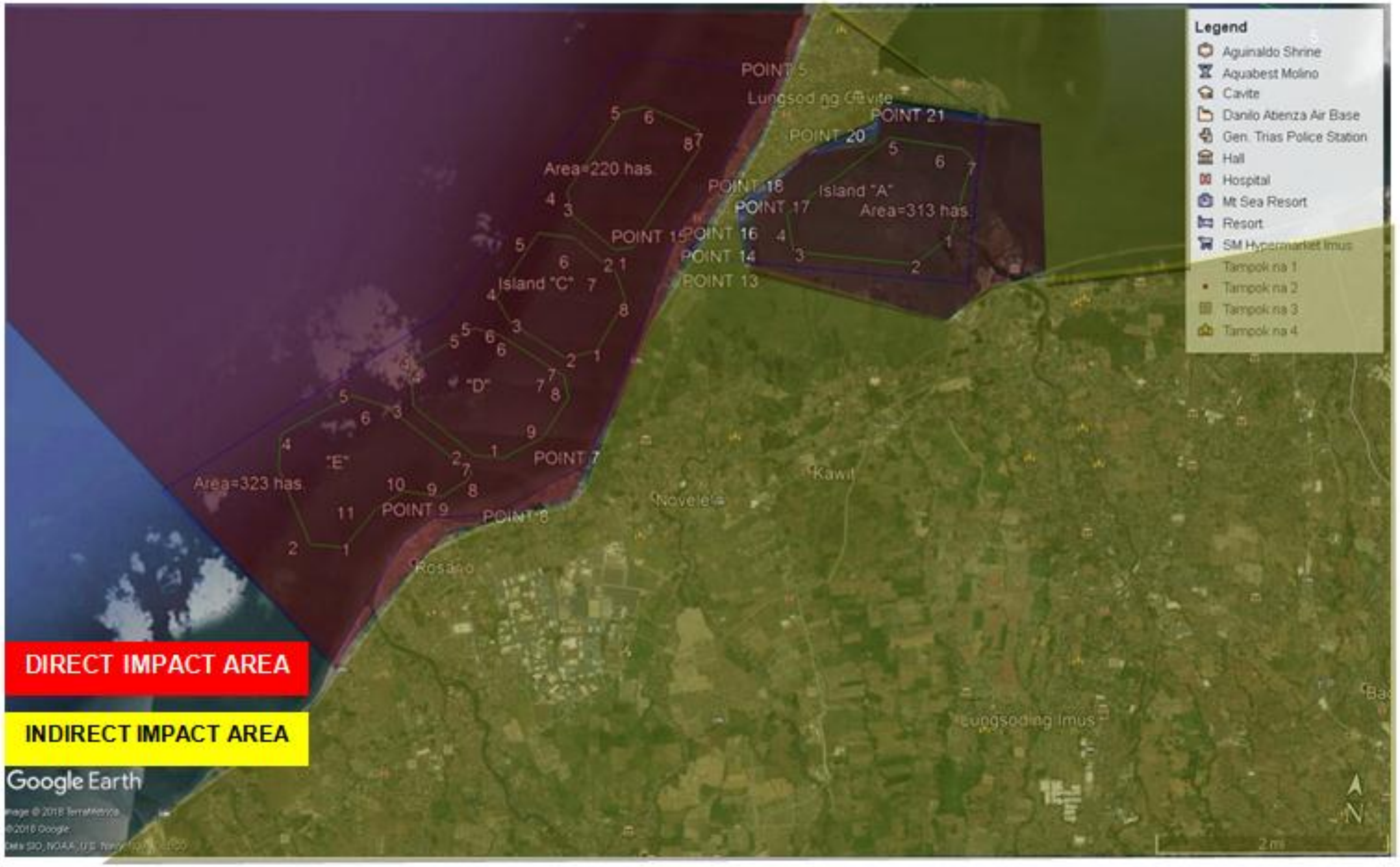


Figure PD-6. Pre-EIA Direct and Indirect Impact Areas (Google Earth)

2.7 Development Phases. Development Phases in terms of specific activities (with special attention on those with significant environmental impacts as well as climate change adaptation options relevant to the project and project activities) and corresponding projected implementation timeframes:

- **Pre-construction** (e.g. planning, acquisition of rights to use land, etc.)

There are no activities during this phase that will result in significant environmental impacts.

- **Construction** (e.g. land/site clearing, temporary housing, transport of materials, health and other services for the workforce)

The various dredging and reclamation activities described are summarized in **Table PD-8** with focus on potential environmental impacts.

Table PD-8. Summary of Various Reclamation Activities THEIDI COMMENTS

Major Activities	Environmental Impact
Dredging	Noise, sediment plumes, release of nutrients or contaminants from dredged sediments, dissolved oxygen depletion, habitat destruction and ecological impacts.
Marine burrow works	The same as those due to dredging works with the addition of the possibility of reduction or removal of the natural supply of sand to existing beaches.
Land burrow works	Noise, dust and smoke generation, and visual impact.
Mud disposal	Release of nutrients or contaminants from deposited sediments; other impacts similar to those due to dredging works.
Fill delivery	Noise and dust generation.
Fill placement	Noise, dust and smoke generation, and water quality impact.
Final land form	Interference in tidal flow, wave and sediment transport patterns, siltation, scour and reduced dispersion or dilution of discharges, water quality and ecological impact, elevation of ground water levels uphill, and possibility of causing erosion of the shoreline of existing beaches.

Operation (projected period of start-up/commissioning/full operation of various project components) include discussion on the operation of various components (as identified above) in terms of raw materials and fuel requirements, infrastructure requirements (transport—road/rail/ship, power, water supply and storage, storm water drainage, sewerage, telecommunications, accommodation and other

The operations phase involves the construction of buildings and structures by various locators and the operation of their activities, e.g. food stores, convention centers, movie houses, etc. This phase is not included in the scope of this EIS and in the application for an ECC.

Decommissioning Phase

- This refers to the permanent cessation of all activities involved through the formation of stable land forms.
- Under this scenario, all the construction vessels and equipment shall be returned to the contractor. The Province of Cavite and the members of the Project Consortium will decide on how the reclaimed land will be used.
- Remediation of the site will not be relevant.

2.8 Project Size

Table PD-8. Project Size

Island	Size (ha)
A	313
B	222
C	205
D	268
E	323
Total	1,331 hectares