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 BACOOR RECLAMATION AND DEVELOPMENT PROJECT**
Location	Along Coast of Manila Bay in the territorial jurisdiction of the Bacoor City
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	320 Hectare
Status of ECC	Being Applied For

Table PD-2. Project Proponent/EIA Preparer

ITEM	Project Information
Project Proponent	**Bacoor City Government**
Proponent Address	Molino Boulevard, Bacoor, Cavite, Philippines
Telephone Number	**Office of the City Mayor:**
Responsible Officer	**The Honourable Mayor Lani Mercado Revilla**
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

Project Area, Location and Accessibility

Location and Political Boundaries- This proposed project forms part of a larger reclamation effort that is is divided into two Area A (Bacoor Reclamation and Development Project-BRDP) and Area B (Diamond Reclamation and Development Project DRDP). Area A covers a total of 320 hectares and Area B covers 100-hectare reclamation. This ECC application pertains only to Area A while the other area will be subject to a separate application.

The proposed project will include 5 reclaimed areas; 4 inland reclamation islands behind Manila-Cavite Expressway (CAVITEX) with an aggregate area of 90 hectares, and one outer island north of CAVITEX with an area of 230 hectares.

The impact barangay for the Proposed Project are Sinegueslasan, Alima, Campo Santo, Tabing Dagat, Digman, Kaingin, Maliksi III, Maliksi I, Talaba II, Talaba I and Zapote V.

Geographic Coordinates (Shape File Data) of Project Area

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

NAME / ID	LATITUDE PRS92 (Decimal)	LONGITUDE PRS92 (Decimal)	LTITUDE PRS92 (Deg Min Sec)	LONGITUDE PRS92 (Deg Min Sec)
INLAND 90 HECTARES				
I-01	120.9568620	14.4688300	120°57'25"	14°28'8"
I-02	120.9561790	14.4705860	120°57'22"	14°28'14"
I-03	120.9569460	14.4709000	120°57'25"	14°28'15"
I-04	120.9576200	14.4711410	120°57'27"	14°28'16"
I-05	120.9581930	14.4713450	120°57'29"	14°28'17"
I-06	120.9588680	14.4715770	120°57'32"	14°28'18"
I-07	120.9592200	14.4717060	120°57'33"	14°28'18"
I-08	120.9596920	14.4717640	120°57'35"	14°28'18"
I-09	120.9601850	14.4716240	120°57'37"	14°28'18"
I-10	120.9604750	14.4713830	120°57'38"	14°28'17"
I-11	120.9607840	14.4709970	120°57'39"	14°28'16"
I-12	120.9602780	14.4705860	120°57'37"	14°28'14"
I-13	120.9598820	14.4702750	120°57'36"	14°28'13"
I-14	120.9594300	14.4699370	120°57'34"	14°28'12"
I-15	120.9589790	14.4696170	120°57'32"	14°28'11"
I-16	120.9585180	14.4693050	120°57'31"	14°28'9"
I-17	120.9580760	14.4690210	120°57'29"	14°28'8"
I-18	120.9576240	14.4687550	120°57'27"	14°28'8"
I-19	120.9570240	14.4684160	120°57'25"	14°28'6"
I-20	120.9492490	14.4657190	120°56'57"	14°27'57"
I-21	120.9485410	14.4681520	120°56'55"	14°28'5"
I-22	120.9491700	14.4683110	120°56'57"	14°28'6"
I-23	120.9507420	14.4688040	120°57'3"	14°28'8"
I-24	120.9519720	14.4691310	120°57'7"	14°28'9"
I-25	120.9533410	14.4695950	120°57'12"	14°28'11"
I-26	120.9554760	14.4703450	120°57'20"	14°28'13"
I-27	120.9561880	14.4685080	120°57'22"	14°28'7"
I-28	120.9555320	14.4682310	120°57'20"	14°28'6"
I-29	120.9547100	14.4678990	120°57'17"	14°28'4"
I-30	120.9542390	14.4677230	120°57'15"	14°28'4"
I-31	120.9530280	14.4672700	120°57'11"	14°28'2"
I-32	120.9520580	14.4669000	120°57'7"	14°28'1"
I-33	120.9507740	14.4663550	120°57'3"	14°27'59"
I-34	120.9500160	14.4660320	120°57'0"	14°27'58"
I-35	120.9356640	14.4626270	120°56'8"	14°27'45"
I-36	120.9355370	14.4632760	120°56'8"	14°27'48"
I-37	120.9354120	14.4638360	120°56'7"	14°27'50"
I-38	120.9352680	14.4643850	120°56'7"	14°27'52"
I-39	120.9350290	14.4651330	120°56'6"	14°27'54"
I-40	120.9356210	14.4652920	120°56'8"	14°27'55"
I-41	120.9367590	14.4656180	120°56'12"	14°27'56"
I-42	120.9376000	14.4658430	120°56'15"	14°27'57"
I-43	120.9397850	14.4663140	120°56'23"	14°27'59"
I-44	120.9413950	14.4666530	120°56'29"	14°27'60"

NAME / ID	LATITUDE PRS92 (Decimal)	LONGITUDE PRS92 (Decimal)	LTITUDE PRS92 (Deg Min Sec)	LONGITUDE PRS92 (Deg Min Sec)
I-45	120.9439410	14.4671000	120°56'38"	14°28'2"
I-46	120.9461070	14.4675710	120°56'46"	14°28'3"
I-47	120.9478280	14.4679560	120°56'52"	14°28'5"
I-48	120.9483360	14.4662080	120°56'54"	14°27'58"
I-49	120.9485270	14.4655590	120°56'55"	14°27'56"
I-50	120.9475460	14.4653330	120°56'51"	14°27'55"
I-51	120.9465660	14.4651080	120°56'48"	14°27'54"
I-52	120.9452140	14.4648160	120°56'43"	14°27'53"
I-53	120.9438440	14.4645330	120°56'38"	14°27'52"
I-54	120.9424840	14.4642590	120°56'33"	14°27'51"
I-55	120.9415860	14.4640880	120°56'30"	14°27'51"
I-56	120.9408170	14.4639370	120°56'27"	14°27'50"
I-57	120.9400580	14.4637860	120°56'24"	14°27'50"
I-58	120.9387720	14.4634850	120°56'20"	14°27'49"
I-59	120.9377170	14.4632050	120°56'16"	14°27'48"
I-60	120.9368110	14.4629530	120°56'13"	14°27'47"
I-61	120.9262310	14.4618030	120°55'34"	14°27'42"
I-62	120.9275780	14.4625650	120°55'39"	14°27'45"
I-63	120.9291680	14.4631480	120°55'45"	14°27'47"
I-64	120.9308400	14.4638040	120°55'51"	14°27'50"
I-65	120.9322170	14.4642860	120°55'56"	14°27'51"
I-66	120.9337340	14.4647340	120°56'1"	14°27'53"
I-67	120.9343170	14.4649190	120°56'4"	14°27'54"
I-68	120.9344880	14.4643970	120°56'4"	14°27'52"
I-69	120.9346700	14.4637750	120°56'5"	14°27'50"
I-70	120.9347960	14.4632070	120°56'5"	14°27'48"
I-71	120.9349420	14.4624400	120°56'6"	14°27'45"
I-72	120.9340720	14.4622510	120°56'3"	14°27'44"
I-73	120.9330080	14.4619800	120°55'59"	14°27'43"
I-74	120.9323700	14.4617850	120°55'57"	14°27'42"
I-75	120.9315480	14.4614970	120°55'54"	14°27'41"
I-76	120.9311320	14.4613490	120°55'52"	14°27'41"
I-77	120.9305120	14.4611450	120°55'50"	14°27'40"
I-78	120.9298740	14.4609680	120°55'48"	14°27'39"
I-79	120.9294390	14.4608820	120°55'46"	14°27'39"
I-80	120.9288280	14.4607870	120°55'44"	14°27'39"
I-81	120.9283830	14.4608100	120°55'42"	14°27'39"
I-82	120.9278430	14.4609680	120°55'40"	14°27'39"
I-83	120.9272470	14.4612250	120°55'38"	14°27'40"
I-84	120.9267730	14.4614280	120°55'36"	14°27'41"
OUTER 230 HECTARES				
P-01	120.9647700	14.4783060	120°57'53"	14°28'42"
P-02	120.9655070	14.4778060	120°57'56"	14°28'40"
P-03	120.9660400	14.4774220	120°57'58"	14°28'39"
P-04	120.9662100	14.4770710	120°57'58"	14°28'37"
P-05	120.9662410	14.4766740	120°57'58"	14°28'36"
P-06	120.9661700	14.4763300	120°57'58"	14°28'35"
P-07	120.9659600	14.4759850	120°57'57"	14°28'34"

NAME / ID	LATITUDE PRS92 (Decimal)	LONGITUDE PRS92 (Decimal)	LTITUDE PRS92 (Deg Min Sec)	LONGITUDE PRS92 (Deg Min Sec)
P-08	120.9656380	14.4757110	120°57'56"	14°28'33"
P-09	120.9650660	14.4753440	120°57'54"	14°28'31"
P-10	120.9643650	14.4749500	120°57'52"	14°28'30"
P-11	120.9637930	14.4746550	120°57'50"	14°28'29"
P-12	120.9632560	14.4744700	120°57'48"	14°28'28"
P-13	120.9626170	14.4744100	120°57'45"	14°28'28"
P-14	120.9619570	14.4745850	120°57'43"	14°28'29"
P-15	120.9614450	14.4748430	120°57'41"	14°28'29"
P-16	120.9609430	14.4749200	120°57'39"	14°28'30"
P-17	120.9602670	14.4747610	120°57'37"	14°28'29"
P-18	120.9599080	14.4745040	120°57'36"	14°28'28"
P-19	120.9595700	14.4739770	120°57'34"	14°28'26"
P-20	120.9594720	14.4735160	120°57'34"	14°28'25"
P-21	120.9593840	14.4730270	120°57'34"	14°28'23"
P-22	120.9591270	14.4727540	120°57'33"	14°28'22"
P-23	120.9588780	14.4725800	120°57'32"	14°28'21"
P-24	120.9582580	14.4723570	120°57'30"	14°28'20"
P-25	120.9572510	14.4719780	120°57'26"	14°28'19"
P-26	120.9562620	14.4715900	120°57'23"	14°28'18"
P-27	120.9550610	14.4711370	120°57'18"	14°28'16"
P-28	120.9536460	14.4706280	120°57'13"	14°28'14"
P-29	120.9523430	14.4701820	120°57'8"	14°28'13"
P-30	120.9513440	14.4698480	120°57'5"	14°28'11"
P-31	120.9506040	14.4696340	120°57'2"	14°28'11"
P-32	120.9496880	14.4695000	120°56'59"	14°28'10"
P-33	120.9489080	14.4696010	120°56'56"	14°28'11"
P-34	120.9484610	14.4697960	120°56'54"	14°28'11"
P-35	120.9479740	14.4702800	120°56'53"	14°28'13"
P-36	120.9477760	14.4706580	120°56'52"	14°28'14"
P-37	120.9475590	14.4710720	120°56'51"	14°28'16"
P-38	120.9472110	14.4715750	120°56'50"	14°28'18"
P-39	120.9468450	14.4720050	120°56'49"	14°28'19"
P-40	120.9463870	14.4724710	120°56'47"	14°28'21"
P-41	120.9458810	14.4729460	120°56'45"	14°28'23"
P-42	120.9453860	14.4734110	120°56'43"	14°28'24"
P-43	120.9449080	14.4738950	120°56'42"	14°28'26"
P-44	120.9445330	14.4743340	120°56'40"	14°28'28"
P-45	120.9440260	14.4750620	120°56'38"	14°28'30"
P-46	120.9435640	14.4758350	120°56'37"	14°28'33"
P-47	120.9432430	14.4764200	120°56'36"	14°28'35"
P-48	120.9430830	14.4767250	120°56'35"	14°28'36"
P-49	120.9428190	14.4772110	120°56'34"	14°28'38"
P-50	120.9426680	14.4774810	120°56'34"	14°28'39"
P-51	120.9424970	14.4779220	120°56'33"	14°28'41"
P-52	120.9424450	14.4785360	120°56'33"	14°28'43"
P-53	120.9425970	14.4791340	120°56'33"	14°28'45"
P-54	120.9428530	14.4795610	120°56'34"	14°28'46"
P-55	120.9431650	14.4798890	120°56'35"	14°28'48"

NAME / ID	LATITUDE PRS92 (Decimal)	LONGITUDE PRS92 (Decimal)	LTITUDE PRS92 (Deg Min Sec)	LONGITUDE PRS92 (Deg Min Sec)
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P-57	120.9439390	14.4804200	120°56'38"	14°28'50"
P-58	120.9443730	14.4806220	120°56'40"	14°28'50"
P-59	120.9451960	14.4809550	120°56'43"	14°28'51"
P-60	120.9460180	14.4812510	120°56'46"	14°28'53"
P-61	120.9470070	14.4816030	120°56'49"	14°28'54"
P-62	120.9480890	14.4820100	120°56'53"	14°28'55"
P-63	120.9493360	14.4825000	120°56'58"	14°28'57"
P-64	120.9504730	14.4829440	120°57'2"	14°28'59"
P-65	120.9516100	14.4833970	120°57'6"	14°29'0"
P-66	120.9527930	14.4838230	120°57'10"	14°29'2"
P-67	120.9535970	14.4840830	120°57'13"	14°29'3"
P-68	120.9541990	14.4842500	120°57'15"	14°29'3"
P-69	120.9549030	14.4843290	120°57'18"	14°29'4"
P-70	120.9557110	14.4841910	120°57'21"	14°29'3"
P-71	120.9564010	14.4838450	120°57'23"	14°29'2"
P-72	120.9570070	14.4834530	120°57'25"	14°29'0"
P-73	120.9574390	14.4828870	120°57'27"	14°28'58"
P-74	120.9571710	14.4827040	120°57'26"	14°28'58"
P-75	120.9568310	14.4823760	120°57'25"	14°28'57"
P-76	120.9565750	14.4819940	120°57'24"	14°28'55"
P-77	120.9564030	14.4815680	120°57'23"	14°28'54"
P-78	120.9563160	14.4809340	120°57'23"	14°28'51"
P-79	120.9563570	14.4804470	120°57'23"	14°28'50"
P-80	120.9565010	14.4799510	120°57'23"	14°28'48"
P-81	120.9567280	14.4794740	120°57'24"	14°28'46"
P-82	120.9571690	14.4788900	120°57'26"	14°28'44"
P-83	120.9577210	14.4783890	120°57'28"	14°28'42"
P-84	120.9583740	14.4779970	120°57'30"	14°28'41"
P-85	120.9592580	14.4777070	120°57'33"	14°28'40"
P-86	120.9599720	14.4776410	120°57'36"	14°28'40"
P-87	120.9605000	14.4776900	120°57'38"	14°28'40"
P-88	120.9611380	14.4778950	120°57'40"	14°28'40"
P-89	120.9616830	14.4782340	120°57'42"	14°28'42"
P-90	120.9620960	14.4786980	120°57'44"	14°28'43"
P-91	120.9623690	14.4792520	120°57'45"	14°28'45"
P-92	120.9626630	14.4795530	120°57'46"	14°28'46"
P-93	120.9632210	14.4793220	120°57'48"	14°28'46"
P-94	120.9638750	14.4788850	120°57'50"	14°28'44"
B-01	120.9587050	14.4823200	120°57'31"	14°28'56"
B-02	120.9603940	14.4811960	120°57'37"	14°28'52"
B-03	120.9604330	14.4810420	120°57'38"	14°28'52"
B-04	120.9602660	14.4810140	120°57'37"	14°28'52"
B-05	120.9588570	14.4819500	120°57'32"	14°28'55"

Figure PD-1. Expanded Google Earth Map indicating the Proposed Project

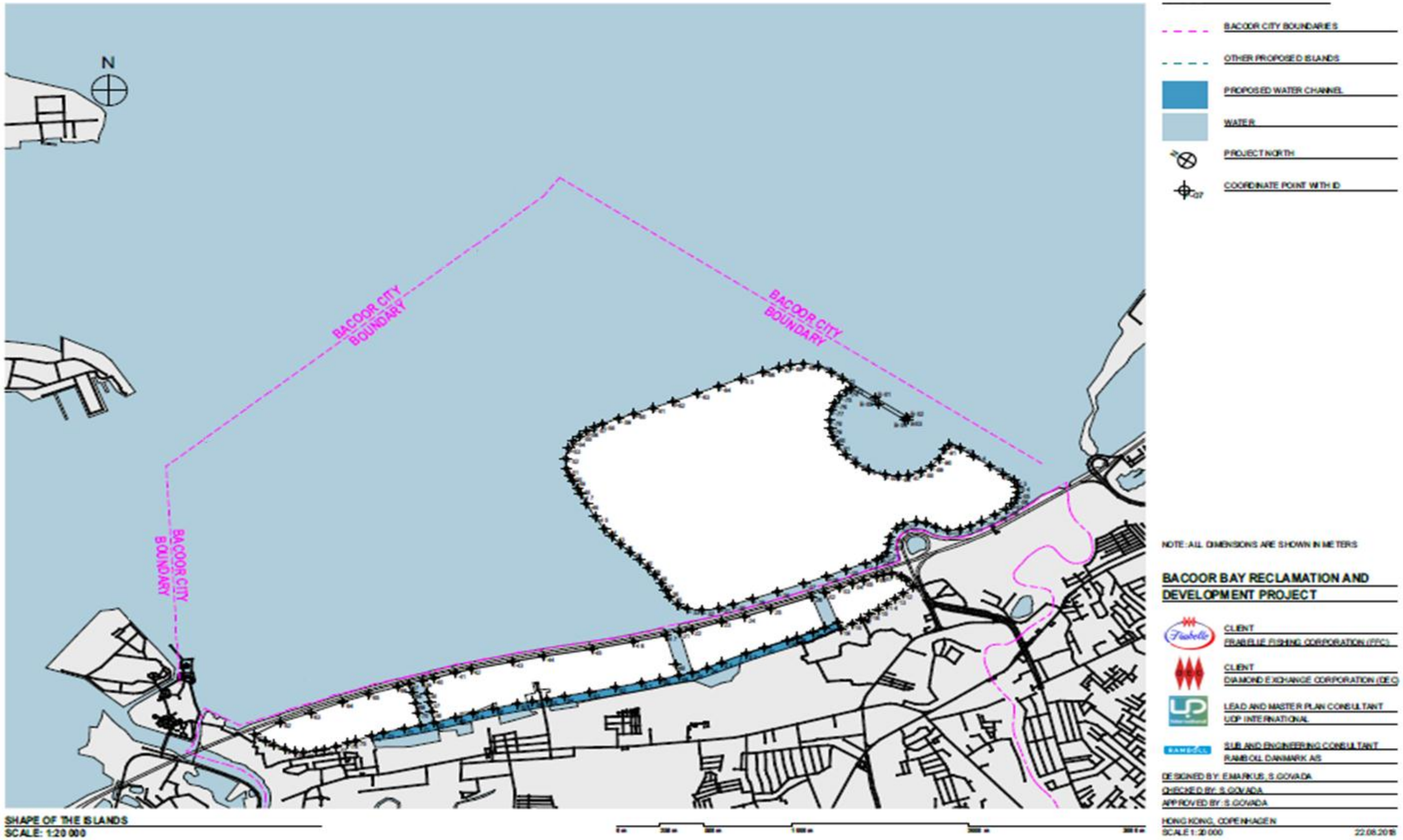


Figure PD-2. Proposed Project indicating its Geographical Points (NAMRIA Map)

Accessibility

The project site lies along both sides of CAVITEX. The access to the islands is key to the success for the development. In this case, there has to be at least 2 access points to the upper island and 2 access points to the lower island between the mainland and CAVITEX.

There will be two access points to secure sufficient capacity, to distribute traffic loads at a larger part of the transportation network and to secure accessibility even in a situation where an event of emergency occurs at one of the access points. In this case, there will always be another access option in case it will be congested.

The existing intersection on CAVITEX has to be supplemented with 'the second half' of the intersection providing access to the upper island. Based on traffic data collected, a study of the existing intersection will validate if this interchange can be expanded in a cost-efficiently way to provide sufficient capacity to all directions needed for the traffic flow between the project and Bacoor/Cavite/Manila.

At the western end of the BRDP island, it is proposed to secure an access to the other proposed "Diamond" island and subsequent to the BRDP Island from CAVITEX and from Bacoor Bypass Road. This can serve as access to the lower islands as well. In this case, two high capacity access points to the upper islands as well as to the lower islands are planned. The distance between the two interchanges is approximately 2.5 km.

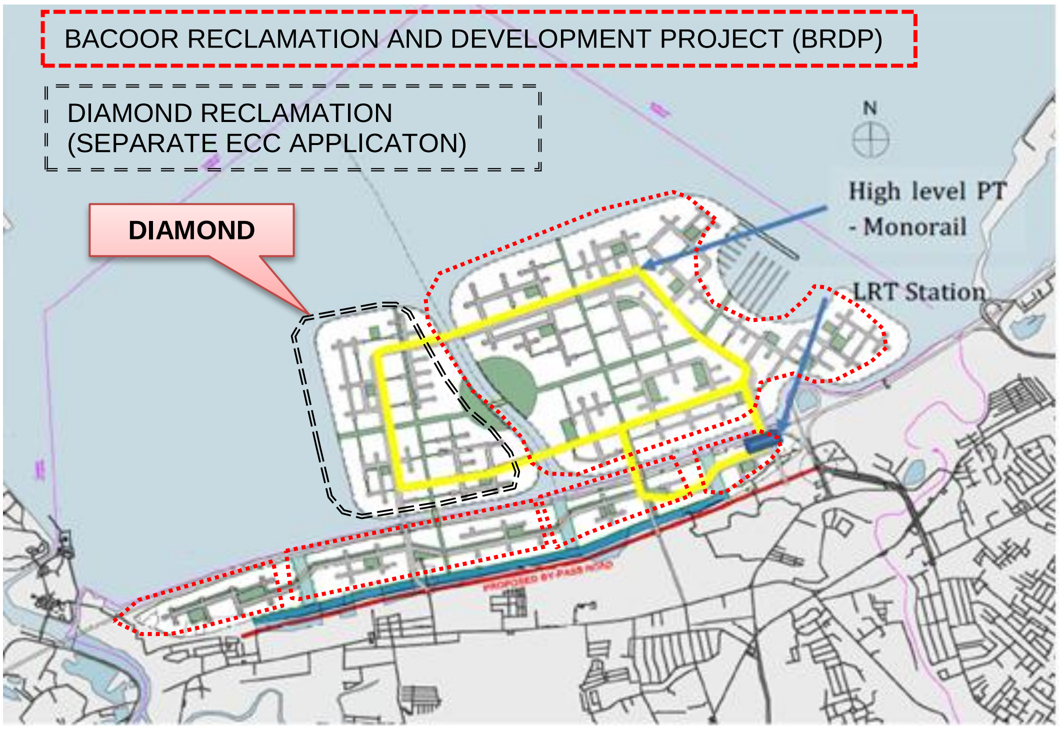


Figure PD-3. Proposed Access Ways

Vicinity Map and Adjacent landmarks

Important landmarks adjacent to the project site include: Muntinlupa-Cavite Expressway; Iglesia ni Cristo Bacoor Bay; Fish pens in Bacoor; St. Michael the Archangel Parish Church Bacoor; Cavite Post Office; Bacoor National High School Main; Digman Elementary School; Cavite Solas Training Site; Sineguelasan Elementary School; Imus River; and. Las Piñas – Parañaque Wetland Park. The vicinity map is shown in page **PD-4.**

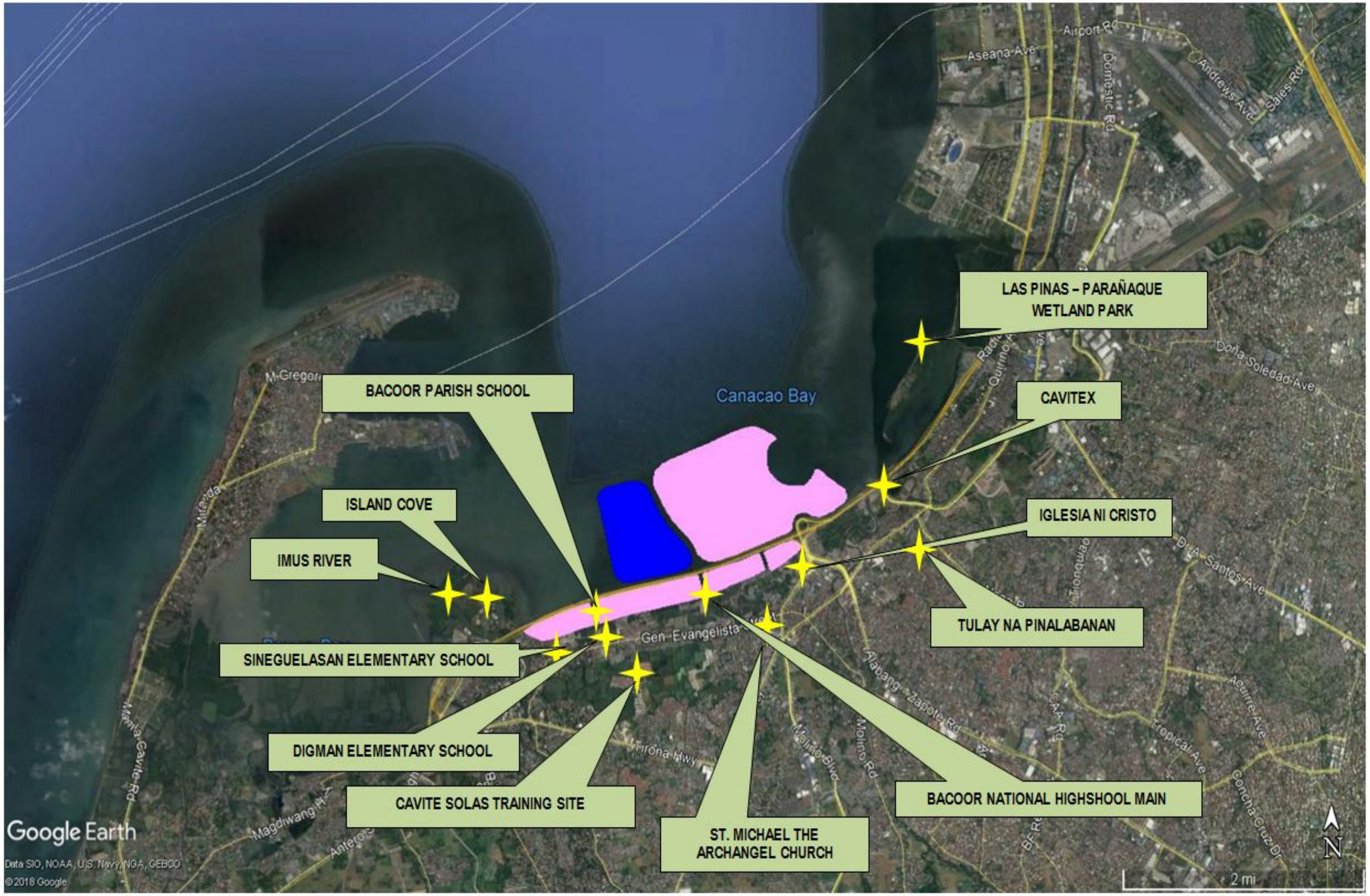


Table PD-4. Vicinity Map Showing the Important Landmarks

3.0 Project Rationale

Bacoor was once famous for its long established agri-fishery industry. However, being in close proximity to Metro Manila, Bacoor has converted from a historic town to a city in 2011. It is estimated that Bacoor's population will be doubled to 1 million in 2024. With such rapid growth, land developments are much needed to facilitate this expansion.

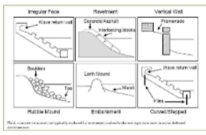
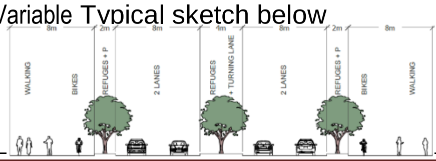
The City of Bacoor is known to be the gateway and a bedroom community of Metro Manila. To reposition the city's image and rise to new heights, this project aims to create a unique identity for Bacoor Reclamation and Development project with well-planned, integrated and mixed-use development characteristics. It will also address some of the city's need for extra residential and commercial land, as well as to provide much needed community, high quality landscape and public open space to the people of Bacoor.

The City of Bacoor primarily depends on income from trade, commerce and service sectors. Being a historic and coastal town, the city also developed its tourism based on heritage sites and seafood restaurants. Bacoor Bay has strong accessibility to Metro Manila especially as the mid and major access point from the Cavite province through the CAVITEX, which makes the city increasingly attractive to live given its proximity and lower cost of living. However, it is still dealing with informal settlements with lack of employment opportunities. Building a waterfront CBD of mixed-use developments will attract economic developments in the City of Bacoor by enhancing and creating new sectors as well as provide adequate housing to support the future growth of the city. Other than a CBD, the site also has a great potential for a Science Park with mixed-use developments including, retail, entertainment, cultural and historic preservation area. The project can help bring research and technology sector to the Bacoor Bay, especially from Manila where the institutes are overwhelmed.

In addition, the project allows the city to address the issue of public open space. Currently, there are no public green spaces and development that is large enough to become a tourist attraction. The City Government implemented policies to encourage urban forestry throughout Bacoor and has required developers trees to enhance the green and sustainable development of the city. Taking the opportunity, the project aims to create a "Green and Blue Network", which prioritizes public green space, to make this reclamation project an environmentally-friendly and pedestrian-oriented development. A Central Park is designed as a shape large enough to function as an urban forest and serve as a tourist attraction. The Marina is placed strategically facing Metro Manila to provide a city skyline. To complement the Central Park and Marina, a promenade will loop through the entire outer islands to make the whole waterfront an active open space. The Bacoor Reclamation and Development Project will create a smart, walkable, livable, and sustainable community.

4.0 Project Components

The initial project developmental concept is shown in page **PD-12.**

Component	General Description	Size / Capacity
Island 1: Bacoor Reclamation Outer Island	To be based on Final Design and Engineering Details (DED) especially the Containment Structures	230 hectares
Island 2: Bacoor Reclamation Inner Island		21.7 hectares
Island 3: Bacoor Reclamation Inner Island		39.7 hectares
Island 4: Bacoor Reclamation Inner Island		19.2 hectares
Island 5: Bacoor Reclamation Inner Island		9.4 hectares
Containment Structures	Based on Final Design and Engineering Details	Typical 
Internal Road Networks	To be based on Final Master Plan	Variable Typical sketch below 

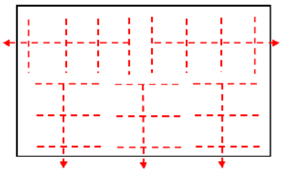
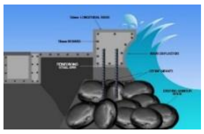
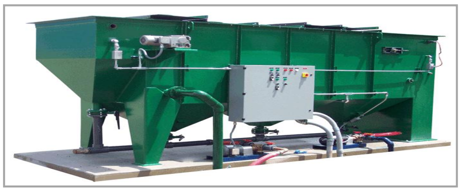
Component	General Description	Size / Capacity
Drainage System	Based on Final Master Plan	Typical 
Storm Surge Protection	Based Final Design	Typical 
Access ways	Based Final Master Plan	Initial Concept 
Pollution Control Devices		
Waste Water from Sea Vessels	Bilge Oily Water Treatment System	
Air Pollution Control System	Specification Marine Diesel Fuel	Not Applicable
Sedimentation Pond During Soil Stabilization	To be designed based on storm water flow	
Support Facilities (for Construction Works)		
• **Electricity (Stabilization Works)**	Meralco	As Needed Basis
• **Water**	To be Purchased	Stored in Water Tanks
• **Communication**	Radio; mobile phones	AS needed Basis

Figure PD-5. Preliminary Master Development Plan

5.0 Project Alternatives

Alternatives in Siting: Establishing the Location of the Proposed Project

The key to siting of the project is to determine the best option available that will not result in serious environmental and social impacts.

- **Territorial Jurisdiction**

The site should be legally within the jurisdiction of the LGU-Proponent, hence this project will be within the municipal waters (foreshore and offshore areas) of Bacoor City.

- **Distances from important landmarks**

Bacoor City is home to a lot of historical and cultural sites and important landmarks. This is the location of the Battle of Zapote Bridge (a.k.a. Tulay na Pinaglabanan), which happened in 1897 and 1899. Other historical landmarks in the city include: Bahay na Tisa (The First Malacañang); St Ezekiel Moreno Park; St. Michael The Archangel Church built in 1669; Prinza Dam built in the 18th century on the Zapote River found on the border between Barangay Talon Dos, Las Piñas and Barangay San Nicolas, Bacoor; and Molino Dam located in Brgy. Molino 3 which was constructed in the 18th century. Among these, the nearest important landmarks to the project site are Tulay na Pinaglabanan and St. Michael Church.

- **Must not be in or conflict with ECAs or Protected Areas as declared in the NIPAS, principally the LPP Wetland Park and mangrove communities**

The project site is not within the LPP Wetland Park nor does it infringe on the mangrove communities (see **page PD-10**). As the municipal waters of Bacoor City are all relatively near these ECAs, there is not much options left but to ensure they are at least at a safe distance, and potential impacts were evaluated by mathematical modeling.

In fact, the northeast side of the outer island had to be shaped/cut to ensure that the distance to the LPPCEA is at least 500m.

Furthermore, there is an area visited by migratory birds in the fishponds along Brgy. Habay 1, during November and December. This site is about 1 km south of the inner reclamation islands.

- **Must not be in or cause disturbance of significant marine resources**

Bacoor has long been known for its mussel and oyster farms. However, this industry has rapidly dwindled in recent years. The site behind CAVITEX shall be partly infringing on these farms, and hence, considerations on just compensation and provision of alternate livelihood should be factored in.

- **Must not conflict with existing settlers**

The "inland" landforms are close to onshore institutions such as public schools and churches as well as private properties. Moreover, there are numerous informal settlers and a few commercial establishments such as floating restaurant on the foreshore areas that fall within the project site.

As repeatedly declared by the Bacoor LGU in various IEC fora on this project, the informal settlers shall be provided with in-city relocation and just and fair compensation package.

- **With respect to the other possible reclamation projects in the future**

There is sufficient buffer zone between the site and these other projects.

Other factors considered were:

- Must not be in very deep waters otherwise dredging and reclamation costs would be prohibitive. Bacoor Bay is essentially shallow.
- Environmental impacts associated with the site must be minimal and/or readily manageable
- Site must be in conformance with the CLUP
- Site must be acceptable to other concerned government entities

Factors considered for the project components were:

The siting of the major components is largely determined by the master plan, which for the project involves mixed-used developmental structures/facilities and the allocations for the government and private sector.

The siting of the government offices will be determined by the government entities, i.e. the City Government of Bacoor and the Philippine Reclamation Authority (PRA).

The siting of the access way from the shore to the island is determined from the most feasible connecting points to the CAVITEX and the shortest feasible lengths.

Alternatives in Design: Establishing the Alignment of the Reclamation Layout

<u>The process of determining the of islands and shaping them</u>

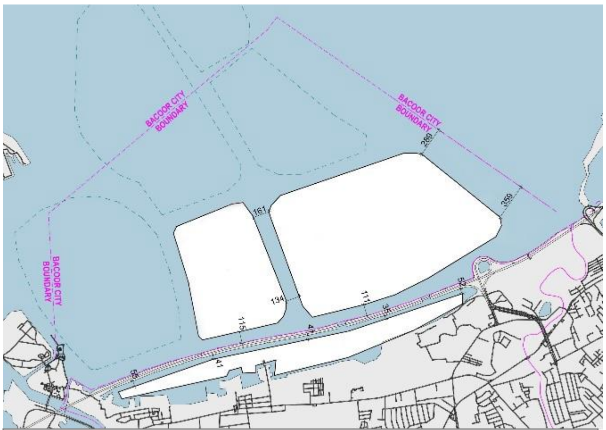
Note: this process was made with the combined two reclamation projects, Bacoor Reclamation and Development Project (BRDP) and Diamond Reclamation and Development Project (DRDP) to ensure compatibility and holistic approach.

Given the size of the project, the islands have been carefully shaped so that it would make the most sense in achieving high quality of the space while making it financially feasible. During the process of shaping the islands, concerns and issues have been considered to ensure the end result would be a win–win situation for everyone.

The initial coordinates for the two (2) projects were first taken as a starting point for preliminary concepts and ideas. Initially, the project envisioned a marina at the center of the island to serve as the main attraction and gathering point for the people. An "organic" approach was also taken to the design of road and pedestrian networks to bring vibrancy and character to the development, all in all, to bring significant value to the projects by enhancing the quality of life on the islands.

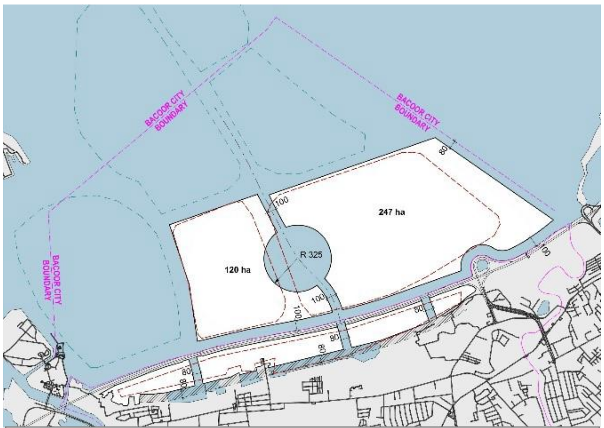
Through the ongoing discussion, concerns of existing flooding issues and feasibility of a center marina were identified. Finally, it was decided that it is better to add water canals to address the flooding issues, which will be in line with waterways of the existing traffic bridges and potential future reclamation projects. To better serve the expected high density of residential and working population, it was decided that moving the marina to the northeast side will be more suitable and replacing the designated location with a Central Park. The Central Park will give the development a unique identity and image while serving as a gathering point for the people. Meanwhile, the marina will be closer to the Bacoor City border with Las Piñas to give the flexibility to connect both reclaimed islands and grant the marina with a "front-row" view to the skyline of Metro Manila. Most importantly, the marina echoes Metro Manila’s developments and directly faces the Port Area, which allows the possibility of water transport connections to enhance connectivity in the future.

Below is a series of images that better illustrates the steps.



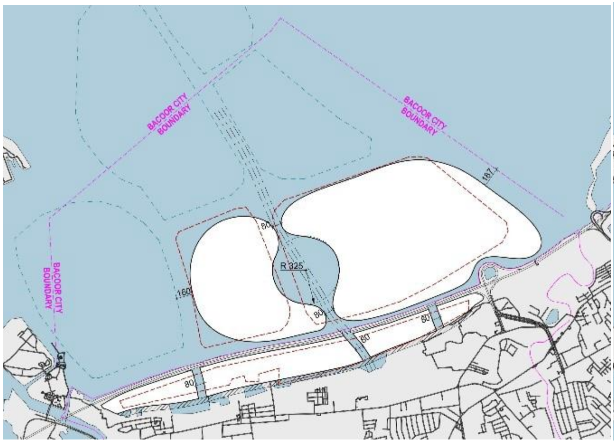
Step 1

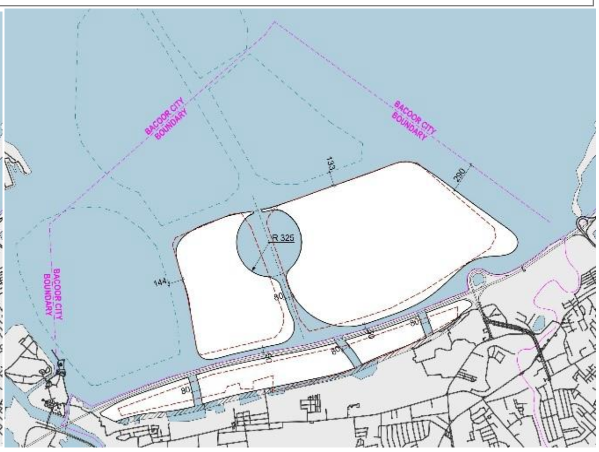
The provided coordinates for the BBRD development were first taken as a starting point for initial concepts and ideas. The two outer islands are two from total of 6 potential reclamation projects in the Bacoor Bay. There is an additional inner island between Cavitex and Bacoor City.



Step 2

It was envisioned that the marina can serve as the main attraction for the islands and a gathering point for the people. However, due to the flooding issue in Bacoor, it was decided it is better to create water channels which will also be in line with the next reclamation projects.





Step 3	**Step 4**
Having a more "organic" development was taken into consideration to generate more exciting road and pedestrian path street perspectives that would increase the quality of the neighborhoods.	The financial feasibility came into concern of additional dredging required for the previous location of the marina, therefore exploring an option of moving the marina to the north was done.

Figure PD-6. Alternative Shapes of Landform (Steps 1-4)

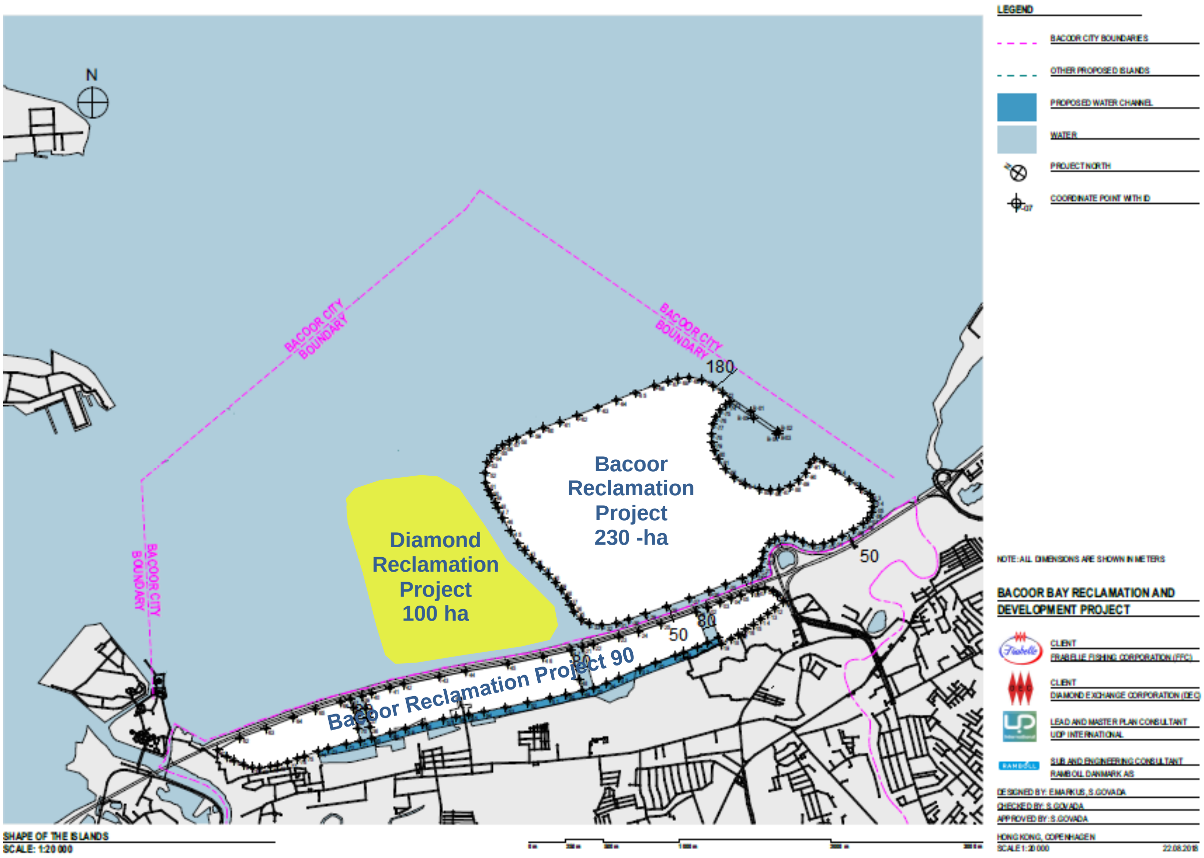


Figure PD-7. Final Shape of Landform (Step 5)

Taking into consideration that there might be around one million combined population of residents, visitors and working population, it was decided that moving the marina to the northeast side will be more suitable. By moving the marina closer to Bacoor 's border with Las Piñas gives more flexibility to connecting both of the islands with additional bridges if and when needed.

Technology Selection / Operation Processes

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 is 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 = **30 million cu.m.**

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/m^3 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 firm requirements for the quantity and specifications will be made after the final reclamation methodology and contractor shall have been selected. Initially, the alternatives considered for making the best source option is provided below.

Option 1: San Nicholas Shoal (SNS) Since materials are also coming from Manila Bay, the characteristics are relatively similar to the seabed at project site, minimizing introduction of foreign materials. Also, this is closest to project site. However, the securing of necessary permits by the PRA to extract the sand is currently nowhere near completion, hence, other options are being looked into.

Option 2: **Lahar" from Mt. Pinatubo** its suitability with respect to quality is still to be evaluated. There are also other considerations such as transport, costs and permitting requirements

Option 3: Pampanga River considerations the same as in option 2

Power and Water Supply

Power Supply

During the dredging/reclamation works, electrical power that will be required by sea craft and auxiliary equipment (e.g. pumps) will be sourced onboard 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 Supply

The reclamation works are "dry" in nature. Water supply by the vessel/barge crews will also be onboard. Mobile water tanks most likely to be used by contractors. Underground water extraction will not be undertaken. Internal sourcing by individual contractors or water can be tapped from the MWSS-designated concessionaire.

No other alternatives considered.

6.0 Process Technology (Methods of Reclamation and Dredging)

6.1 Choice of most suitable equipment for dredging and filling operation

The choice of the methodology and equipment will be largely dependent on the choice of the particular dredging and reclamation contractor for the project. Each contractor has its own particular vessels and dredging equipment. Among the criteria for the choice of the contractor are:

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.

A major factor is the technology/methodology choice that will minimize the need for the disposal of unwanted seabed materials at the reclamation site-- This is currently being discussed with the prospective reclamation/dredging contractor and the application of their proprietary technology that will meet this important criterion.

Moreover, the technology/methodology for soil stabilization must ensure integrity of the finished reclaimed area and the time duration by which to attain the desired stabilization.

Overall, the final option for the choice of the dredging/reclamation methodology will be reflected in the Terms of Reference (TOR) in the bidding for the Contractor with considerations of the above aspects and focus on:

- Timetable: Contractors will possess individual dredging and reclamation vessels and equipment but must comply with the required timeline for the Project.
- Minimal disposal of unwanted seabed materials
- Pollution abatement facilities onboard vessels
- Experience
- Cost consideration
- External financial resources for the Project which would also depend on the qualifications of the Contractor when it undergoes due diligence process by the financing entity

The choice of the most suitable equipment is closely intertwined with the choice of the methodology for dredging and that for the reclamation (the containment structure and the filling Process)

6.1.1 Dredging:

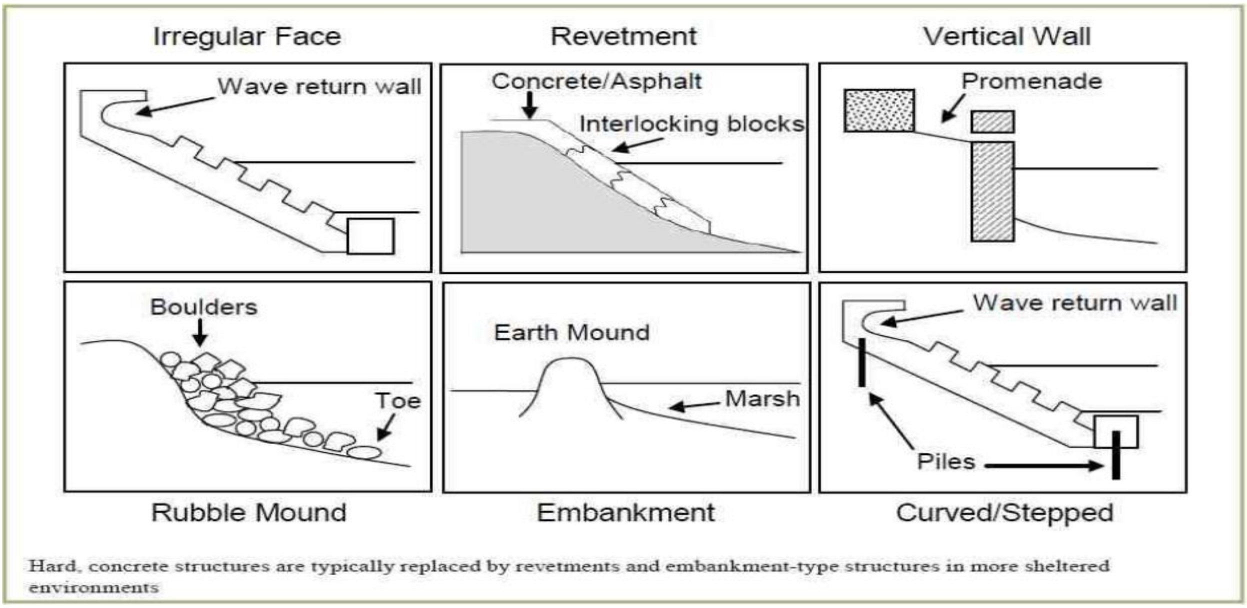
At the reclamation site, the sea bed will be dredged prior to the actual placement of the fill materials.

The extent of the dredging works will depend on the quality of the sea bed soil as determined during the geotechnical survey and investigation. Further, portion of the dredged sea bed which will not meets the specifications for filling materials will be disposed of (referred to as "unwanted" materials while the portion that meets the specifications will be used in mix with the filling materials that will be sourced from other locations/site.

At the source of the fill materials where dredging will be undertaken to extract the fills for transport to and use as the reclamation site.

6.1.2 The Containment Structures

The containment structures will be dependent on the result of the geotechnical investigation among others and also on the particular area in the landform. Containment structures could be different for that in the channels between the islands of the land form and that for portion of the landform that is directly facing the sea. **Figure PD-8** illustrates the various types.



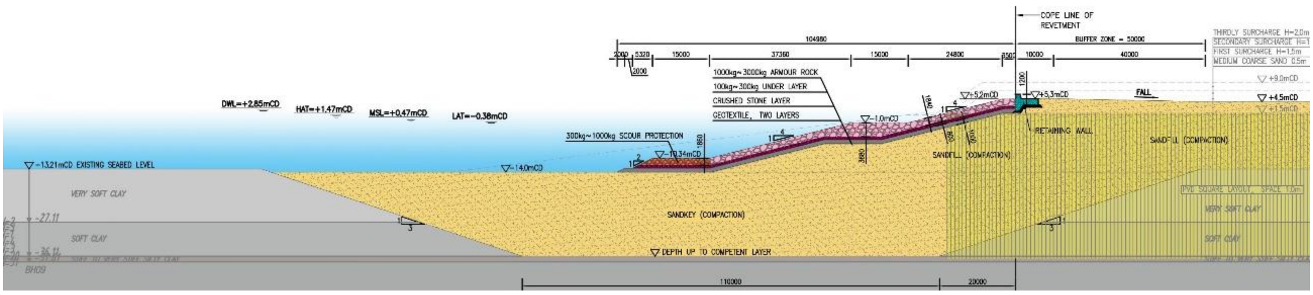


Figure PD-9. Illustration of a typical revetment below the water level.

As further explanation, containment may be done by reinforcing the rock bund into a rock revetment wall. Concurrently during the reclamation works, the rock bund is further strengthened into a rock revetment wall which makes the structure even stronger and more efficient in absorbing the force of storm waves.

The core layer (inner layer) of the structure is made using the perimeter bund that was constructed earlier to contain the fill material in the early reclamation stage.

There are different solutions to creating a boundary for the containment of the reclaimed areas. Viable methods are a revetment, an anchored sheet pile wall or a caisson wall.

Revetments

Revetments constructed as boulder embankments are recommended around the perimeter of the development to contain the reclamation areas. This type of construction behaves in a ductile manner during seismic loads, allowing the structure to deform without losing its ability to retain the reclamation. A typical cross section of a rock revetment at a concept design level is shown below. The revetment might be supplemented by a wave-breaking structure, such as a concrete barrier or an elevated crest as indicated in the figure below. The effects of the wave action may also be mitigated by the construction of an elevated area, extending as far inland as the waves are anticipated to reach during extreme weather situations. Optimum ground level is to be determined through hydraulic / flood analyses.

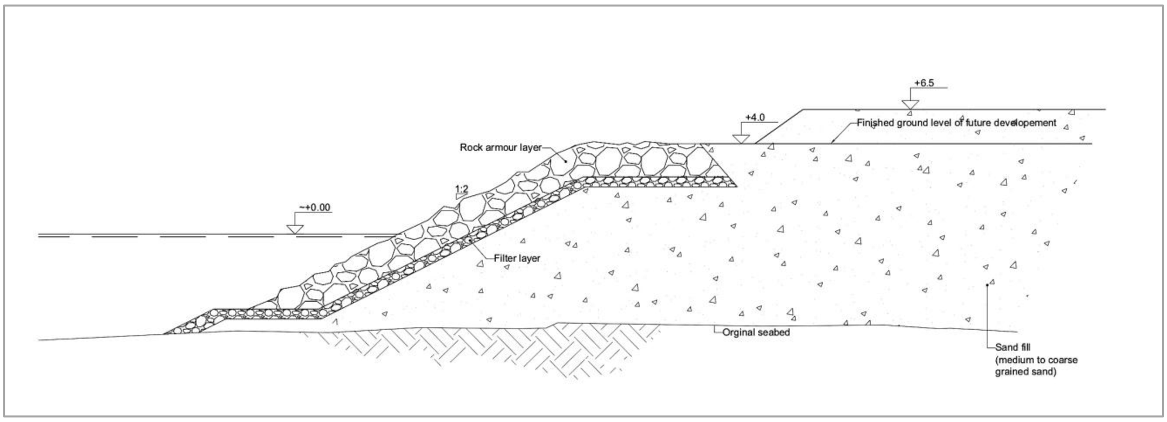


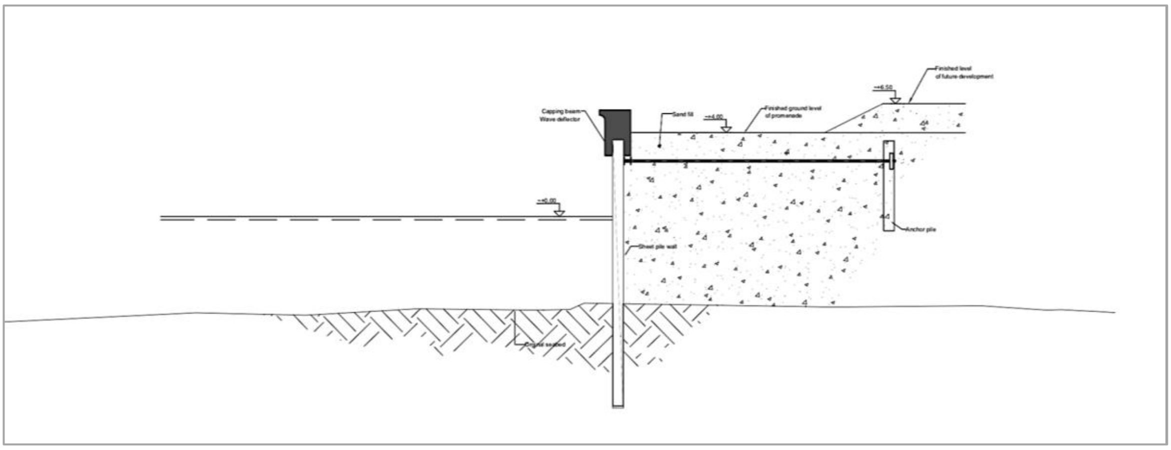
Figure PD-10. Typical Cross Section of Rock Armored Revetment

Anchored sheet pile wall

As an alternative to the revetment, the outer perimeter of the islands can be constructed as anchored sheet pile. This allows for a vertical island boundary. The construction is likely to be more expensive than the revetment and is less robust under seismic loading due to the anchor system. The anchor rod can sustain smaller deformations but can fail if the system experiences large deformations.

The anchor piles should comprise of sheet piles or steel sections, as this type of construction allows for some excavation (roads, utilities and similar near surface structures) between the anchor pile and the sheet pile wall after the reclamation area is complete. A typical cross section of an anchored sheet pile structure at a concept design level is shown below.

Due to the presence of rock at shallow depths encountered within some of the boreholes, it may prove to be difficult or costly to install sheet piles as refusal of sheet piles can be foreseen in hard layers with SPT N-values exceeding 50 blows. Further geotechnical field investigations are required to estimate, at which depth the hard pan is encountered. Alternatively, if vertical boundaries are required, precast concrete cofferdams or other similar structures could be used to create shallow internal canals within the reclaimed areas.



Caisson Wall

A caisson wall consists of vertically drilled holes to form an interlocking secant wall. A sequence of soldier piles and caisson fillers make up the shoring wall with the piles reinforced with steel beams and fillers left unreinforced and filled with low strength concrete. Piles are typically spaced with every second pile reinforced. The seismic shear load on the caisson wall may be substantial, increasing the diameter of the piles and consequently the cost of the wall.

At this stage, the preferred containment structures primarily consist of sloped revetments, as they are most cost-effective when taking into account the design for seismic loads. Other vertical structures (such as sheet pile walls) will be vulnerable to seismic design loads, and will be far more expensive to construct. A solution using anchored sheet piles may require two levels of anchoring, depending on the height of the finished elevation of the reclaimed land. Dimensions of sheet piles will be substantial, and much higher than normal sheet piles in non-seismic areas

Vertical structures (such as sheet pile walls) should only be used in limited areas, where revetments are not possible.

The presence of anchor rods in a sheet pile structure would prevent the use of the area closest to the sheet piles from using it for buildings. This means a strip of approximately 15-20 m behind the sheet pile wall, which would be reserved for anchor rods, which would mean that land utilization is not optimized.

Possible boardwalk structures and other recreational areas along the coast for pedestrians etc. can be constructed as simple platforms on piles over the revetments, where it is desirable, utilizing also the revetment footprint.

Typical Equipment and Filling Methodology

Plate PD-1. A Cutter Dredger

This equipment can dredge the sea bed and place the dredged materials directly at the reclamation site

A Trailer Suction Header Dredger (TSHD) shown in Plate aa is a large vessel generally used when sourcing fill materials from a location distant from the reclamation site and transporting the same to the project site. The TSHD can dredge the fill materials from source, load at the vessel and transport to the site.

At the site, the transported fill materials can be placed at the reclamation area either by dumping from the bottom of the vessel or by spraying to the area, the latter a process called “rainblowing” seen also in **Plate PD-2.**

Plate PD-2. A Typical Trailer Suction Header Dredger (TSHD)

Soil Stabilization

The land formed will have to be consolidated and stabilized before structures can be built on this. It may take 1-2 years to complete the soil stabilization process.

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:

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.

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.

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.

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.

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.

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.

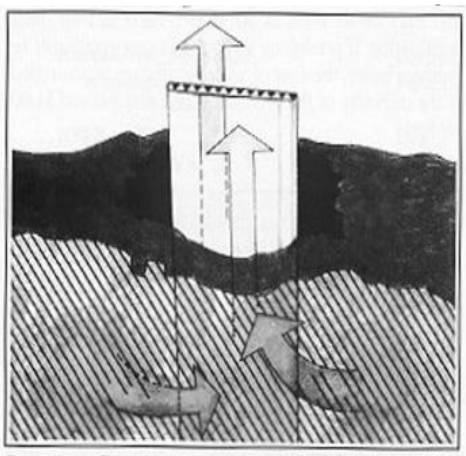
Wick Drains

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-3 is an illustration of the concept of wick drains

Plate PD-3. llustration 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

Diagrammatic Illustration of the Reclamation Process

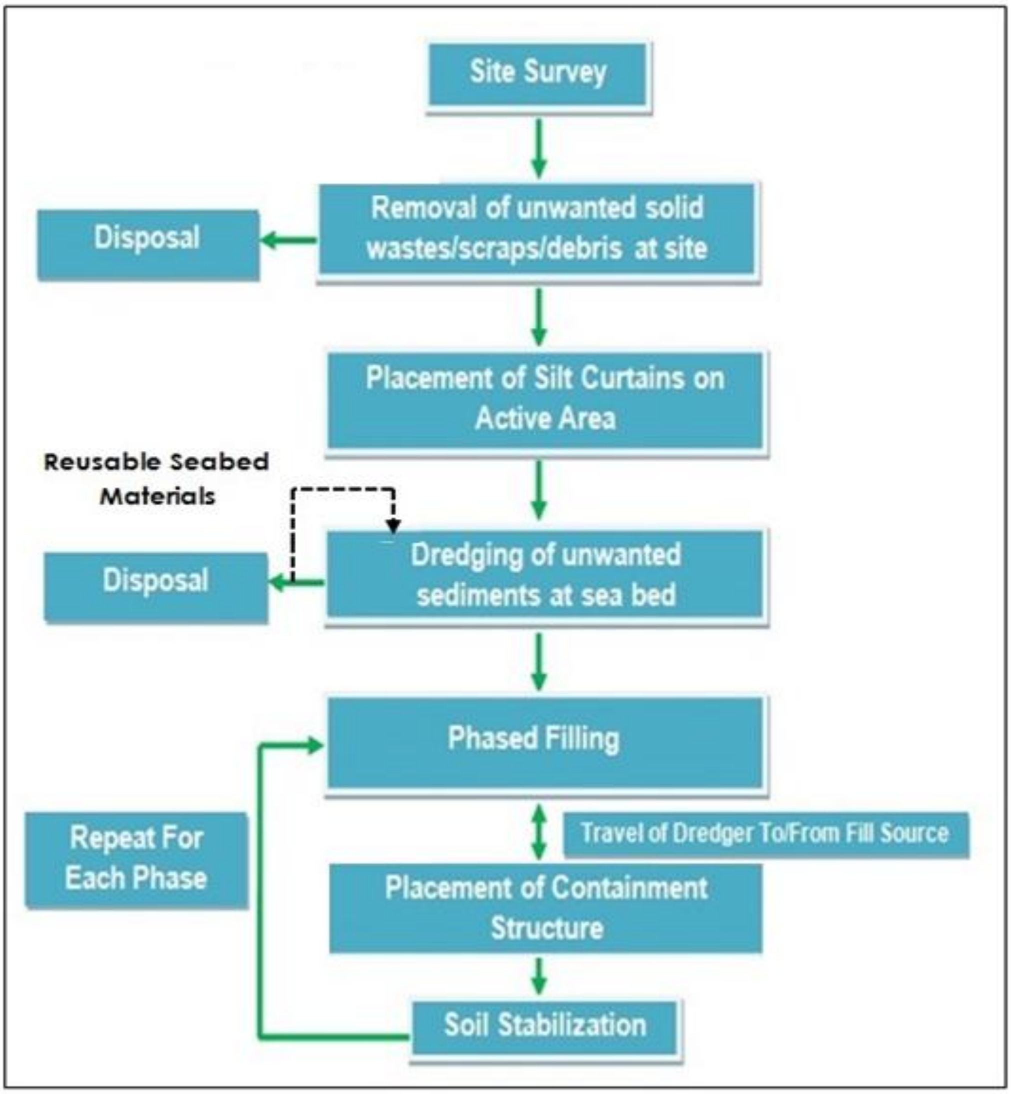


Figure PD-11. Diagrammatic Illustration of the Reclamation Process

The major activities or aspects of the reclamation works are:

1. **Clearing of the site of debris, scraps, plastic wastes and silts.**

The soil wastes will be collected and disposed on shore through a third-party disposal entity.

Silts are accumulated soil wastes discharged with storm water from onshore and are not natural components of the sea bed. Depending on the reclamation technology these will most likely be disposed outside of the reclamation site and in likelihood in an approved dump site on shore.

2. **Dredging at the Reclamation Site to remove unwanted seabed materials and prepare the seabed for filling.**

The initial layer of sub seabed of up to approximately 10 meters that is composed mainly of soft clayey fine soils which by themselves may not be suitable but which in combination with the filling sands may be fitted for re use as reclamation fill. The re-use or alternately the disposal would depend on the technology to be used by the prospective reclamation Contractor. If not suitable, these layers would be disposed outside of the reclamation site.

The dredging operation could be undertaken either hydraulically or mechanically and the former method may likely be adopted. Hydraulic dredging is a floating dredge or pump by which water and soil, sediment, or seabed are pumped onboard they are discharged overboard to an approved disposal site.

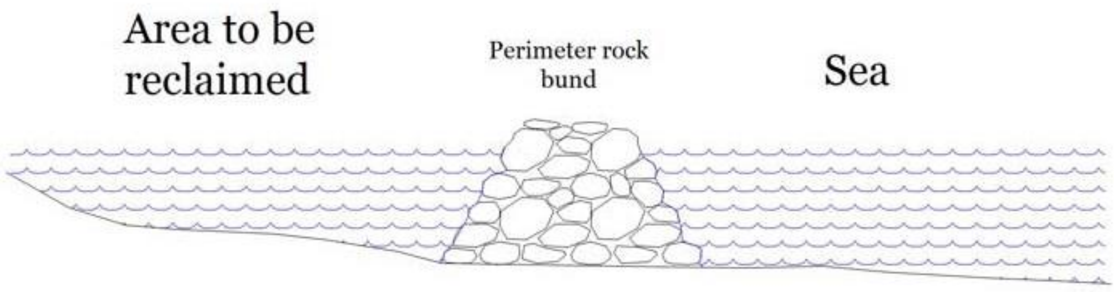
Hydraulic digging makes use of the erosive working of a water flow. For instance, a water flow generated by a dredge pump is lead via suction mouth over a sand bed. The flow will erode the sand bed and forms a sand-water mixture before it enters the suction pipe. Hydraulic digging is mostly done in cohesion less soils such as silt, sand and gravel. A hydraulic dredger is shown in the plate below for illustration purposes.

Plate PD-4. An Illustration of a Typical Hydraulic Dredger

3. **Creating a perimeter rock bund or silt curtain.**

Part of the environmental requirement is to provide a perimeter bund surrounding the proposed reclamation area. A rock bund is constructed along this perimeter to: contain the sand on the site, preventing the sand from being washed back to sea; protect the reclaimed site from storm waves and flooding; and control the level of turbidity during reclamation works.

Plate PD-5. Cross-section of a Typical Perimeter Rock Bund



Source: http://www.stp2.my/technology.php. Tanjung Pinang Development.

Another option for temporary containment is the use of silt curtains as illustrated below.

Plate PD-6. Illustration of Silt Curtain

4. **Transport of materials from source and Sand filling.**

Sand is dredged from a sand source location using trailer suction hopper dredger (TSHD) and sand carrier vessel. The sand is then transported to the site and then conveyored or directly discharged through steel pipes onto the site. During this process, both sand and seawater are pumped onto the site. The seawater subsequently drains away leaving only the cleaned sand behind. This essentially forms the reclaimed land. http://www.stp2.my/technology.php

The estimated required volume is approximately 30 Million Cubic Meters

Plate PD-7. Illustration of Sand Filling by Rainbowing

5. Construction of Containment Structures

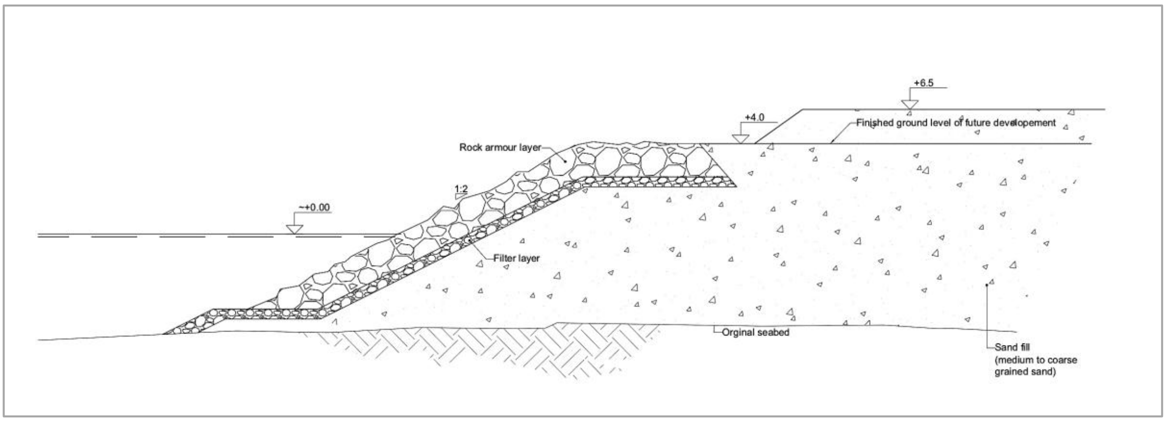
This may be done by reinforcing the rock bund into a rock revetment wall. Concurrently during the reclamation works, the rock bund is further strengthened into a rock revetment wall which makes the structure even stronger and more efficient in absorbing the force of storm waves.

The core layer (inner layer) of the structure is made using the perimeter bund that was constructed earlier to contain the fill material in the early reclamation stage.

There are different solutions to creating a boundary for the containment of the reclaimed areas. Viable methods are a revetment, an anchored sheet pile wall or a caisson wall.

Revetments

Revetments constructed as boulder embankments are recommended around the perimeter of the development to contain the reclamation areas. This type of construction behaves in a ductile manner during seismic loads, allowing the structure to deform without losing its ability to retain the reclamation. A typical cross section of a rock revetment at a concept design level is shown below. The revetment might be supplemented by a wave-breaking structure, such as a concrete barrier or an elevated crest as indicated in the figure below. The effects of the wave action may also be mitigated by the construction of an elevated area, extending as far inland as the waves are anticipated to reach during extreme weather situations. Optimum ground level is to be determined through hydraulic / flood analyses.



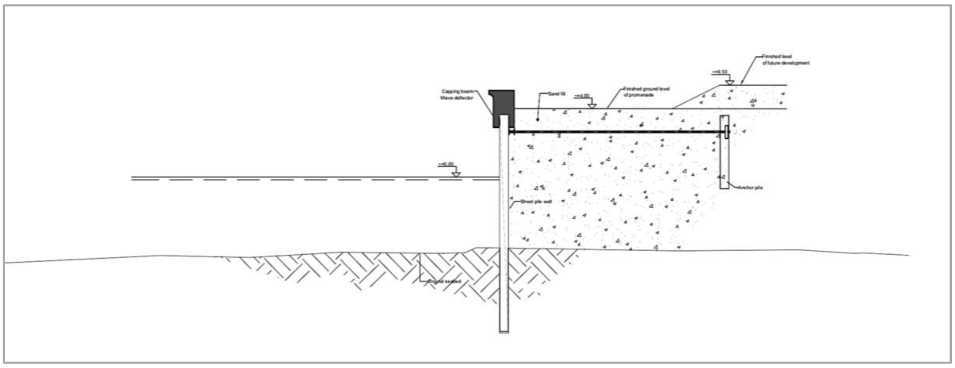
Typical Cross Section of Rock Armored Revetment

Anchored sheet pile wall

As an alternative to the revetment, the outer perimeter of the islands can be constructed as anchored sheet pile. This allows for a vertical island boundary. The construction is likely to be more expensive than the revetment and is less robust under seismic loading due to the anchor system. The anchor rod can sustain smaller deformations but can fail if the system experiences large deformations.

The anchor piles should comprise of sheet piles or steel sections, as this type of construction allows for some excavation (roads, utilities and similar near surface structures) between the anchor pile and the sheet pile wall after the reclamation area is complete. A typical cross section of an anchored sheet pile structure at a concept design level is shown below.

Due to the presence of rock at shallow depths encountered within some of the boreholes, it may prove to be difficult or costly to install sheet piles as refusal of sheet piles can be foreseen in hard layers with SPT N-values exceeding 50 blows. Further geotechnical field investigations are required to estimate, at which depth the hard pan is encountered. Alternatively, if vertical boundaries are required, precast concrete cofferdams or other similar structures could be used to create shallow internal canals within the reclaimed areas.



Caisson Wall

A caisson wall consists of vertically drilled holes to form an interlocking secant wall. A sequence of soldier piles and caisson fillers make up the shoring wall with the piles reinforced with steel beams and fillers left unreinforced and filled with low strength concrete. Piles are typically spaced with every second pile reinforced. The seismic shear load on the caisson wall may be substantial, increasing the diameter of the piles and consequently the cost of the wall.

At this stage, the preferred containment structures primarily consist of sloped revetments, as they are most cost-effective when taking into account the design for seismic loads. Other vertical structures (such as sheet pile walls) will be vulnerable to seismic design loads, and will be far more expensive to construct. A solution using anchored sheet piles may require two levels of anchoring, depending on the height of the finished elevation of the reclaimed land. Dimensions of sheet piles will be substantial, and much higher than normal sheet piles in non-seismic areas

Vertical structures (such as sheet pile walls) should only be used in limited areas, where revetments are not possible.

The presence of anchor rods in a sheet pile structure would prevent the use of the area closest to the sheet piles from using it for buildings. This means a strip of approximately 15-20 m behind the sheet pile wall, which would be reserved for anchor rods, which would mean that land utilization is not optimized.

Possible boardwalk structures and other recreational areas along the coast for pedestrians etc. can be constructed as simple platforms on piles over the revetments, where it is desirable, utilizing also the revetment footprint.

7.0 The Direct and Indirect Impact Areas

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:

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 DIAs are:

- The reclamation area itself wherein the construction activities will be undertaken. This area is currently the body of water and portions of the coastal barangays covered by the planned landform.
- All barangays fronting the proposed site such as: Sinegueslasan, Alima, Campo Santo, Tabing Dagat, Digman, Kaingin, Maliksi III, Maliksi I, Talaba II, Talaba I and Zapote V
- CAVITEX segment fronting the proposed reclamation islands
- Lift nets and mussel farms that will be affected.
- Established fishing areas that are within the proposed site
- Existing properties within the 90-hectare area that will be displaced
- Nearest existing road where access ways will be built
- Competition or otherwise enhancement of livelihood or businesses adjacent to site
- Employment and livelihood

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 IIAs are:

- Rivers and creeks situated near the proposed project.
- Impacts on traffic in nearby existing roads.
- Adjacent cities and municipalities such as Las Piñas, Kawit, Imus and Dasmariñas
- Impacts to Las Piñas – Parañaque Wetland Park and nearby mangrove communities
- Impacts to adjacent Bacoor Reclamation

Table PD-4. Impact Areas – Reclamation/Construction Phase

RATIONALE	MAJOR IMPACTS	SITES/IMPACT AREAS
DIRECT IMPACT AREA		
Land	Impacts in terms of compatibility with existing land use	Entire Proposed Project Site
	Impact in existing land tenure issue/s	Barangays Sinegueslasan, Alima, Campo Santo, Tabing Dagat, Digman, Kaingin, Maliksi III, Maliksi I, Talaba II, Talaba I and Zapote V CAVITEX segment fronting the project site
	Improper Solid Waste Management and other related Impacts	At and vicinity of site
	Inducement of natural hazards such as liquefaction, storm surge, tsunami, debris flow	Bacoor City
	Soil Erosion	At and vicinity of site
Water	Change in drainage morphology	At and vicinity of site
	Flooding	Barangays Sinegueslasan, Alima, Campo Santo, Tabing Dagat, Digman, Kaingin, Maliksi III, Maliksi I, Talaba II, Talaba I and Zapote V
	Change in bathymetry	At and vicinity of site
	Change in water circulation	Project site and vicinities
	Degradation of surface water quality	Project site and adjacent waterbodies
	Degradation of coastal water quality	Project site and adjacent waterbodies
	Displacement of lifts and mussel farms Displacement of Existing Properties	Barangays Sinegueslasan, Alima, Campo Santo, Tabing Dagat, Digman, Kaingin, Maliksi III, Maliksi I, Talaba II, Talaba I and Zapote V
People	Positive impacts on employment and livelihood	Bacoor City
	Positive impacts on economic uplift of the City	Bacoor City
	Competition or otherwise enhancement of livelihood or businesses adjacent to site	Bacoor City
INDIRECT IMPACT AREAS		
Land	Impacts on Las Piñas – Parañaque Wetland Park and nearby Mangrove Communities	Las Piñas – Parañaque Wetland Park and nearby Mangrove Communities
	Impacts to adjacent Bacoor Reclamation	Adjacent Proposed Diamond Reclamation
Water	Potential Damage to fish cages due to Navigation of Dredging Vessel	Municipal waters of Bacoor City
	Potential damage to adjacent creeks and rivers	Adjacent waterbodies
Air	Degradation of Air Quality and Increase of Ambient Noise	Adjacent Environmentally-Sensitive Receptors (ESRs)
People	Competition with Small Establishments	Bacoor City
	Impacts on traffic in nearby existing roads	Project site and adjacent areas, Cavitex

The Direct and Indirect Impact Areas Map is provided in **Figure PD-12.**

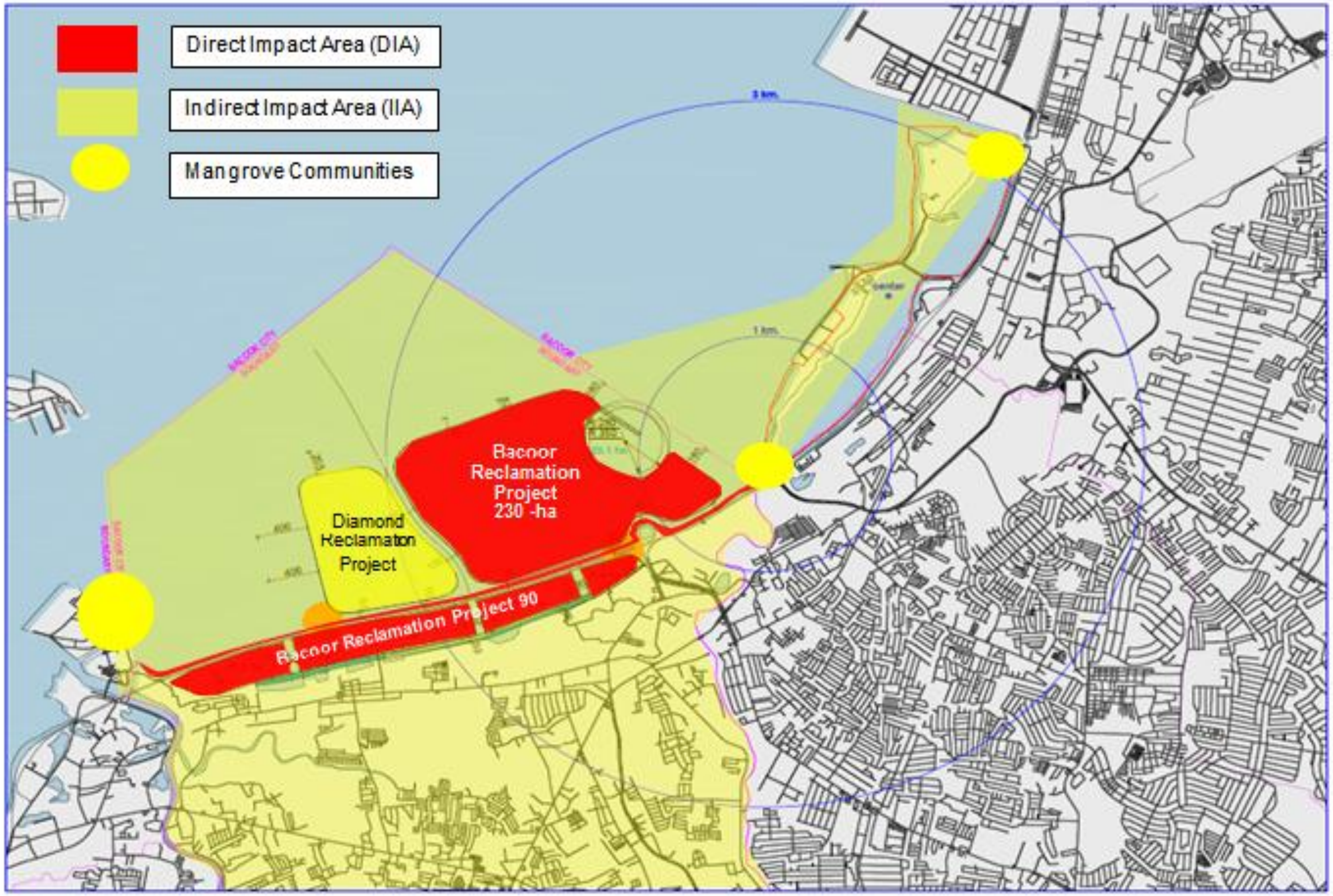


Figure PD-12. Pre-EIA Direct and Indirect Impact Areas

8.0 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.)*
- ***Pre-construction*** *(e.g. planning, acquisition of rights to use land, etc.)*

The significant Environmental Impacts during this Phase is the displacement of existing properties, establishments and institutions and the displacement of lift nets and mussel farms that are inside the proposed **Bacoor Reclamation and Development Project Inner Islands (90 ha).**

- ***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 in the previous sections are summarized in **Table PD-5** with focus on potential environmental impacts.

Table PD-5. Summary of Various Dredging and Reclamation Activities

Major Activities	Environmental Impacts
Dredging at Site	Sediment dispersal
Filling Reclamation	Sediment Disperal
Works of Construction Crews	Domestic Waste Water Discharges
Operation of equipment in vessels	Possible oil leaks
	Air Discharges

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- ***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 infrastructure), waste management (characteristics and quantities of waste materials: wastewater, air emissions, solid wastes - toxic and hazardous, non-toxic and non-hazardous)*

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.

- ***Abandonment.*** *Final Rehabilitation/ Decommissioning Plan, to include Land/soil restoration, decontamination or remediation activities and procedures & projected schedule. Should discussions about strategies and methods for final rehabilitation of the environment disturbed by the project. The land use suitability of the various land disturbance types should also be described.*

The proposed decommissioning plan envisaged in terms of the following:

Procedures for the decommissioning of the project components

The project components are largely the reclaimed land including the infrastructures therein constructed e.g. roads open spaces, drainage culverts, electrical and water lines, etc.

Transport/disposal of equipment and other materials used in the plant's operation;

The equipment and other materials used in the reclamation and dredging works would have been returned or claimed back by the contractors by the time of the decommissioning of the Project.
Remediation of contaminated soil and water resources due to spills and leakage of chemicals and other materials used in the operation

From the dredging of the site to the sand filling period, the TSHD (or other sea vessel/s) will be transporting to and from the project site. This is the only source of oil, grease and fuel that could potentially spill into Bacoor Bay/Manila Bay and cause contamination. Nevertheless, the amount of contaminants will not be that significant.

There are no spills and leakages during the process of soil stabilization.

Alternatives for the future use of abandoned area

Not applicable. The reclaimed areas, once constructed, will be a permanent land area of Bacoor City.

Rehabilitation/ restoration plans, if any

Not applicable. The reclaimed areas, once constructed, will be a permanent land area of Bacoor City.

Project Timeline

- The proposed reclamation works is estimated at 3-5 years.

9.0 Project Size

Table PD-7. Project Size

Island	Area
Bacoor Coastline Reclamation	230 ha
Bacoor Coastline Reclamation Inner Island	90 ha
Total	320 Hectares

10.0 Project Cost Estimates

Estimate at this time of the total Project Cost is placed at **Php 42 Billion.**

11.0 Initial Environmental Impacts and Management Plan (IMP)

Table PD-8. Initial Environmental Impacts and Management Plan (IMP)

Environmental Component Likely to be Affected	Potential Impact	Options for Prevention or Mitigation* or Enhancement
I. PRE-CONSTRUCTION PHASE-		
A. People	Displacement of lift nets and mussel farms	Inventory of affected area and In-City Relocation
	Displacement of Existing Properties	
	Displacement of established fishing areas within the proposed site	
II. CONSTRUCTION PHASE		
B. The Land	Perception of flooding onshore as a result of reclamation	Reclamation itself provides protection against storm surges and thus, against floods. Proper drainage plan to give consideration to existing drainage outfalls.
		Minimize blocking or disturbance of existing drainage system of the City
		Minimize blocking or disturbance of the adjacent rivers principally in the inner reclamation islands

Environmental Component Likely to be Affected	Potential Impact	Options for Prevention or Mitigation* or Enhancement
	Storm surges/waves and flooding on land	Reclamation Platform itself with wave deflector gives sheltering effect against strong waves. Drainage planning for the reclamation landform shall incorporate the existing drainage outfalls on pre-existing land and ensure that the flow will not be hampered.
	Land Subsidence	Caused by underground water extraction which will not be undertaken. Reclaimed land will rest on solid foundations. Engineering interventions will be undertaken.
	Liquefaction	Engineering intervention: structural and engineering designs to withstand earthquakes and liquefaction.
		Philippine Standards
	Disturbance of flora and fauna	Avoidance of disturbance of habitat and faunal species food
	Protected Area	Project not in Protected Areas
	Mangroves absent at the project site	Not applicable
	Exotic and rare bird species sighted hovering over the site and immediate vicinity.	
	Damage to roads	Avoidance of access roadways
	Incl. Diversions of access points	
	Aesthetics (Manila Bay sunset)	Viewing spot in the master plane
C. The Water-Manila Bay- No rivers, creeks, lakes at site Manila Bay	Permanent loss of Manila Bay water body (Compensated by water created during dredging at SNS)	Irreversible. Comply with PRA Notice to Proceed. Creation of equivalent water volume at the San Nicholas Shoal
	Silt dispersal to Bay due to dredging/filling operations	Silt curtains/containment at perimeters
	Increase in turbidity	Dredging/filling methodology; Stockpiling of earth fill shall be placed away from water bodies and covered with suitable material during rainy season
	Potential contamination with substances in filling materials	Pre-screening of filling materials; possible sourcing from Manila Bay
		Observe project boundaries
	Disposal of unwanted dredged materials	Strictly not wastes because source is Manila Bay sea bed itself
	Reclamation does not use significant water	• Arrangement with concessionaires • No underground abstraction
	Sea Level Rise	Due to other global climate change and not to the reclamation project
	Water contamination, e.g. oil leaks, domestic wastes from construction workers	• Onboard vessel oil containment and recovery equipment • Own temporary toilet facilities, Disposal on land by 3rd parties
	Domestic wastes from construction crew and possible hazardous waste material accidental spillage	Appropriate toilet facilities
		Oil and lubricants (used or spent) should be collected and treated by TSD facility
	Potential accidents and damages to marine ecosystems during transport of dredging vessel	• Sea-worthy vessels • Navigational Devices • Proper training

Environmental Component Likely to be Affected	Potential Impact	Options for Prevention or Mitigation* or Enhancement
		• Avoid transport during inclement weather • Compliance with PCG and International regulations
	• Potential damage to marine life • Disturbance of marine species/Damage to or impairment of economically significant marine life.	Absence of significant marine species at impact areas of project
		Containment wall
D. The Air	Noise	Temporary-construction -short time only
	Emissions if power generating sets used and fossil fuel using equipment	Use of quality fuel
		Proper maintenance of gensets
D. The People	Livelihood and employment opportunity	Enhancement

12.0. Drone Photographs of the Project Site

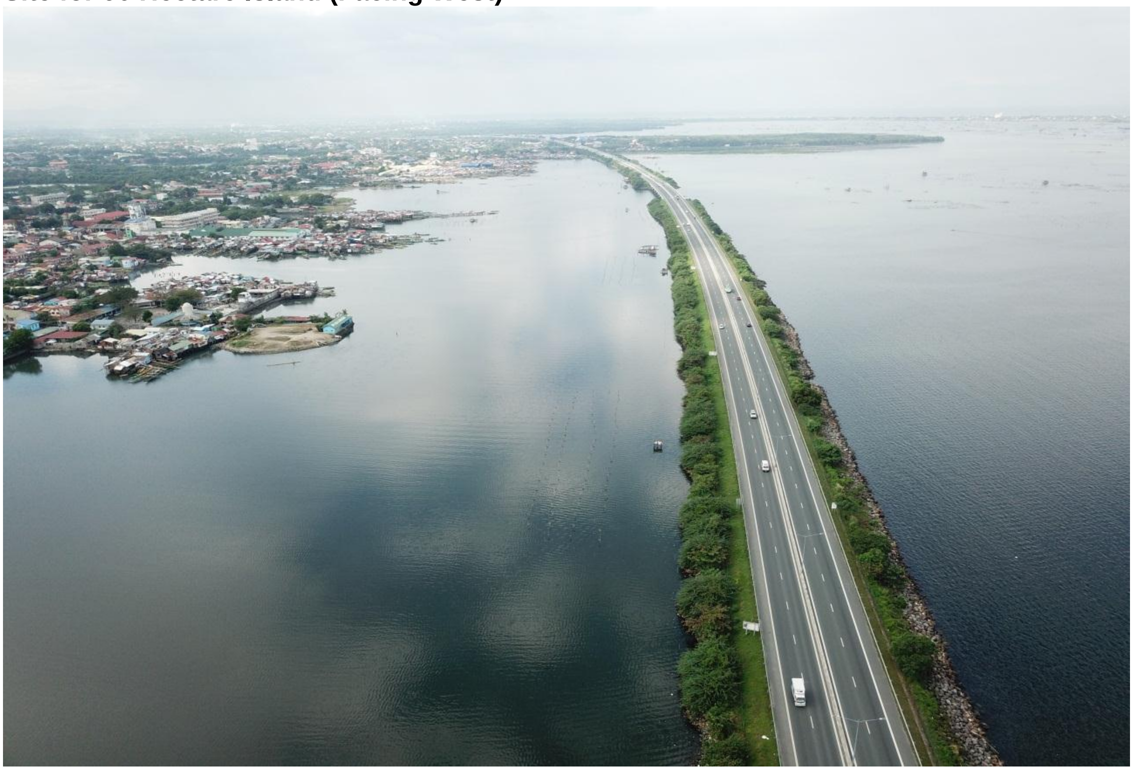
Site for 230 Hectare Island (Facing East)

Site for 230 Hectare Island (Facing North)

Site for 90 Hectare Island (Facing South)

Site for 90 Hectare Island (Facing East)

Site for 90 Hectare Island (Facing West)



Communities Along Site of 90 Hectare Island (Southeast)

Communities Along Site of 90 Hectare Island (Southwest)