Project Description for Scoping (PDS)

Parañaque Spillway Project

Cities of Muntinlupa, Parañaque, Las Piñas and Bacoor

Submitted by:

Submitted to:

Environmental Management Bureau – Central Office

PROJECT DESCRIPTION FOR SCOPING

Proposed Parañaque Spillway Project

An Environmental Report By:

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Submitted To:

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1 PROJECT DESCRIPTION

1 In 2018, the Comprehensive Flood Management Pan in the Laguna de Bay Lakeshore Areas was drafted by the DPWH and the identified measures to reduce the inundation damage at the Laguna de Bay lakeshore area and to control the rise of lake-water level are the (a) construction of the Parañaque Spillway, (b) construction of lakeshore diking system and (c) implementation of non-structural measures as response to floods on the Pasig-Laguna basin.

2 To attain an early effect, the DPWH thus positioned the Parañaque Spillway Project as a priority project, because of its short construction period. Although the Parañaque Spillway alone could not completely eradicate inundation damage at the entire lakeshore area, it may then be possible to reduce inundation damage at the entire coast by controlling the lake water level and by reducing the inundation depth to shorten the inundation period thus, reducing also the inundation damage.

3 **Table 1-1** shows the details of the Project, Proponent and EIA preparer.

Table 1-1: Proposed Project, Proponent and EIA Preparer Details

Project Name	**PARAÑAQUE SPILLWAY PROJECT**	
Project Location	**City**	**Barangay**
	Muntinlupa City	Buli Sucat
	Parañaque City	B.F. Homes San Isidro
	Las Piñas City	B.F. International Village Pulang Lupa Dos Pulang Lupa Uno Zapote
	Bacoor City	Zapote V
Type of Project (Based on DENR MC 2014-05)	3.1 Dams, Water Supply and Flood Control Project	
Project Size *(Reservoir flooded/inundated area)*	66.1 square kilometers by 2032 based on 100-year probability period.	
Project Proponent	**Department of Public Works and Highways** Flood Control Management Cluster (FCMC) Unified Project Management Office	
EIA Preparer	**LCI ENVI CORPORATION** **Engr. JOSE MARIE U. LIM** EIA Team Leader Unit 8L-M Future Point Plaza 3 111 Panay Avenue, South Triangle Quezon City, Metro Manila, Philippines Tel. No.: (+632) 442-2830 / Fax No.: (+632) 961-9226	

1.1 PROJECT LOCATION AND AREA

4 The locations of the components of the Parañaque Spillway project are summarized in **Table 1-2**. The proposed project will be constructed within the cities of Muntinlupa, Parañaque , Las Piñas and Bacoor.

5 The intake facility consisting of the jetty, open channel and inlet gate will be constructed in Brgy. Buli, Muntinlupa City.

6 The spillway connecting Laguna Lake to Manila Bay will be constructed underground and will pass through the private roads in barangays B.F. Homes and San Isidro in Paranaque City, barangays B.F. International Village, Pulang Lupa Uno Dos, Zapote and Pulang Lupa Uno in Las Pinas City and in Barangay Zapote V, Bacoor City. The spillway will be constructed 50 to 77 meters below the ground.

7 The drainage facility will be installed in the proposed reclamation area within the coastal water of Manila Bay in Brgy. Zapote V, Bacoor City.

Table 1-2: Project Location of the Proposed Project

Project Component	City	Barangay
Open Channel and Inlet Facility	Muntinlupa	Buli
Spillway Alignment	Muntinlupa	Buli Sucat
	Parañaque	B.F. Homes San Isidro
	Las Piñas	B.F. International Village Pulang Lupa Dos Pulang Lupa Uno Zapote
	Bacoor City	Zapote V
Drainage Facility	Bacoor City	Zapote V

8 The general location map of the proposed project is shown in **Figure 1-1**. Furthermore, **Table 1-3** shows the geographic coordinates defining the boundaries of the proposed Project site.

Table 1-3: Geographical Coordinates of the Proposed Project

POINT	LATITUDE	LONGITUDE
Open Channel		
1	14°26'34.92"N	121° 3'24.65"E
2	14°26'32.77"N	121° 3'24.06"E
3	14°26'38.01"N	121° 2'56.24"E
4	14°26'40.16"N	121° 2'56.07"E
Inlet Facility		
1	14°26'39.70"N	121° 2'53.98"E
2	14°26'38.51"N	121° 2'53.84"E
3	14°26'38.45"N	121° 2'50.26"E
4	14°26'38.40"N	121° 2'53.85"E
Spillway Alignment		
1	14°26'38.65"N	121° 2'50.62"E
2	14°28'11.56"N	120°58'16.12"E
3	14°28'16.96"N	120°58'4.92"E
4	14°28'25.73"N	120°58'3.39"E
5	14°28'31.65"N	120°58'8.27"E
Drainage Facility		

POINT	LATITUDE	LONGITUDE
1	14°28'31.59"N	120°58'8.38"E
2	14°28'35.46"N	120°58'5.67"E
3	14°28'32.47"N	120°58'4.58"E
4	14°28'34.90"N	120°58'9.04"E
Reclamation Area		
1	14°28'28.77" N	120°58'7.48" E
2	14°28'33.32" N	120°58'4.24" E
3	14°28'33.13" N	120°58'3.97" E
4	14°28'36.75" N	120°58'4.64" E
5	14°28'36.1" N	120°58'8.36" E
6	14°28'35.54" N	120°58'7.54" E
7	14°28'30.99" N	120°58'10.77" E

1.1.1 Project Vicinity and Impact Areas

9 The proposed Parañaque Spillway project will mostly be constructed underground. Structures that will be constructed above ground are the intake facility, which includes the jetty, open channel and the inlet gate, and the support facilities which will be constructed within the proposed reclamation area.

10 As shown in **Figure 1-2**, the proposed location of the intake facility is surrounded mostly by residential and built-up areas. Laguna Lake is located to the east of the proposed site. There are also no structures or fishing activities and settlers within the proposed reclamation area.

11 From the intake facility in Brgy. Buli, Muntinlupa City, the underground spillway will pass through the private roads in barangays B.F. Homes and San Isidro in Paranaque City, barangays B.F. International Village, Pulang Lupa Uno Dos, Zapote and Pulang Lupa Uno in Las Pinas City up to the discharge in Barangay Zapote V, Bacoor City. Located above the alignment of the spillway are residential, commercial and institutional establishments.

12 The drainage facility will be within the coast of Manila Bay in Brgy. Zapote V, Bacoor City. It is proposed to have a reclamation area within the area for the installation of the components of the drainage facility. Located to the west of the proposed drainage facility is the Zapote river, Las Piñas River in the east and Munting Ilog in the south. About 700 meters northeast of the drainage facility is the Las Piñas- Parañaque Critical Habitat and Ecotourism Area (LPPCHEA). See **Figure 1-3** for the vicinity map of the proposed drainage facility.

13 Initially, the project impact area generally consisted of the project footprint as the direct impact area (DIA) while the areas in the immediate vicinity of the project site is considered as the indirect impact area (IIA). In accordance with the guidelines provided in DAO 2017-15, after the completion of the EIA study, the delineation of the direct and indirect impact areas will be updated. Impact areas for the EIA study is shown in **Figure 1-3**.

- For the Land component, the DIA pertains to the areas that will be cleared and developed for the construction of the intake facility. This will also include the disposal sites and truck routes for the disposal of the excavated soil.

- For the Water component, the DIA refers to the portion of Manila Bay where the reclaimed area will be constructed and where the floodwater from Laguna Lake will be

discharged. There may also be short-term impacts on the water quality in Laguna Lake and other nearby rivers such as the Sucat River, Munting Ilog and Las Piñas River during the construction phase.

- For the Air Quality, Noise and Vibration components, the DIA includes the barangays where the proposed project will be located. Impact will only be limited during construction activities.

- For the People component, the DIA comprises the structures and households that will be affected by the construction of the intake facility. The IIA will include the establishments above the proposed alignment of the spillway that might be affected by the vibration and noise during construction phase.

Table 1-4: Barangays in the Direct and Indirect Impact Areas

Project Component	Structure Location	Barangay	DIA	IIA
Intake facility	Surface	Brgy. Buli, Muntinlupa City	√	
Spillway	Underground	Brgy. Buli, Muntinlupa City		√
		Brgy. Sucat, Muntinlupa City		√
		Brgy. B.F. Homes, Parañaque City		√
		Brgy. San Isidro, Parañaque City		√
		Brgy. B.F. International Village, Las Piñas City		√
		Brgy. Pulang Lupa Dos, Las Piñas City		√
		Brgy. Pulang Lupa Uno, Las Piñas City		√
		Brgy. Zapote, Las Piñas City		√
		Brgy. Zapote V, Bacoor City		√
Drainage Facility	Surface and Underground	Brgy. Zapote V, Bacoor City	√	

Figure 1-1: General Location Map of the Proposed Project

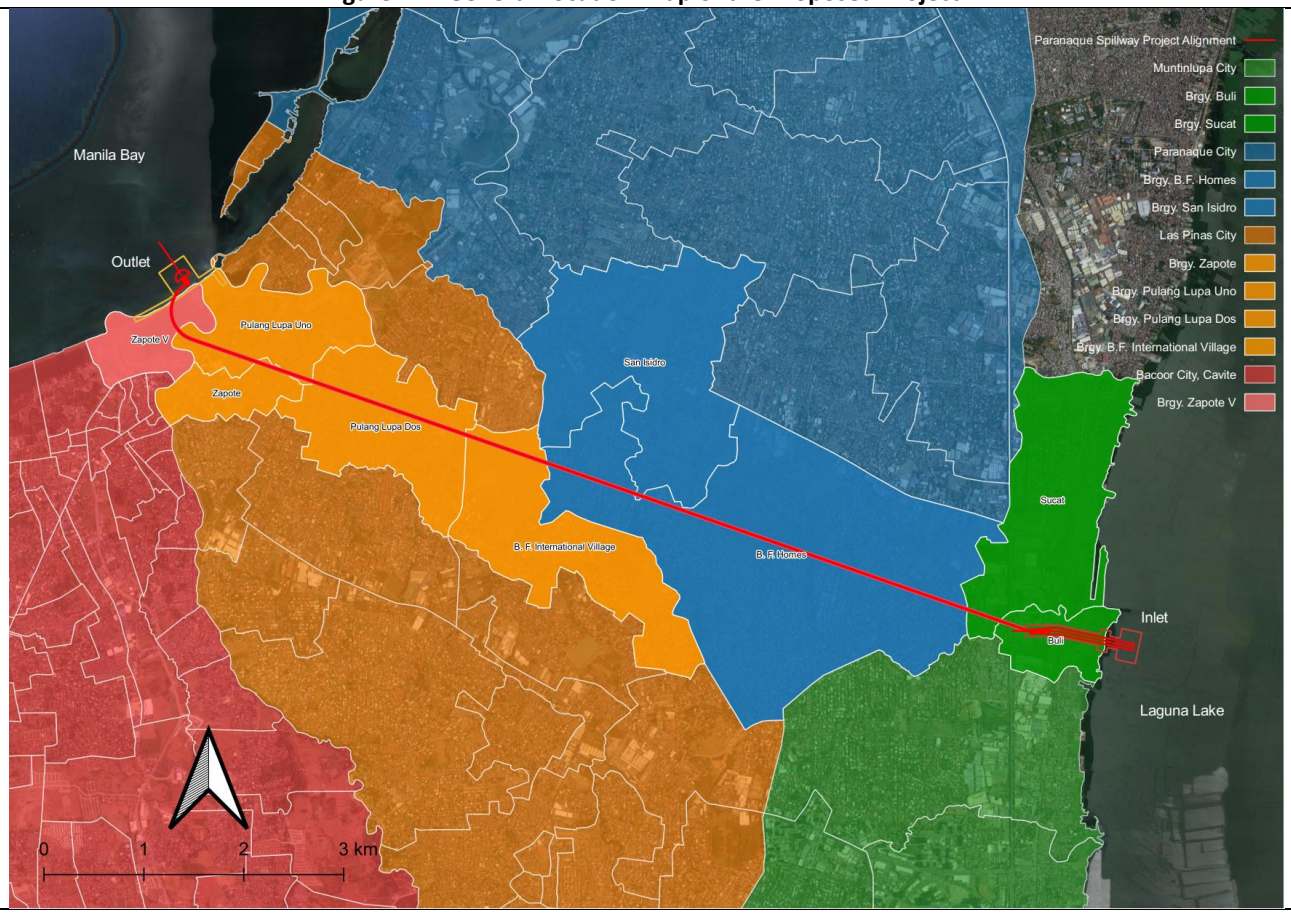

FIGURE TITLE:

General Location Map of the Proposed Project

PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
Department of Public Works and Highways Flood Control Management Cluster (FCMC) Unified Project Management Office	**PARAÑAQUE SPILLWAY PROJECT** Cities of Muntinlupa, Parañaque, Las Piñas and Bacoor	LCI ENVI CORPORATION

Figure 1-2: Vicinity and Impact Areas Map of the Proposed Intake Facility

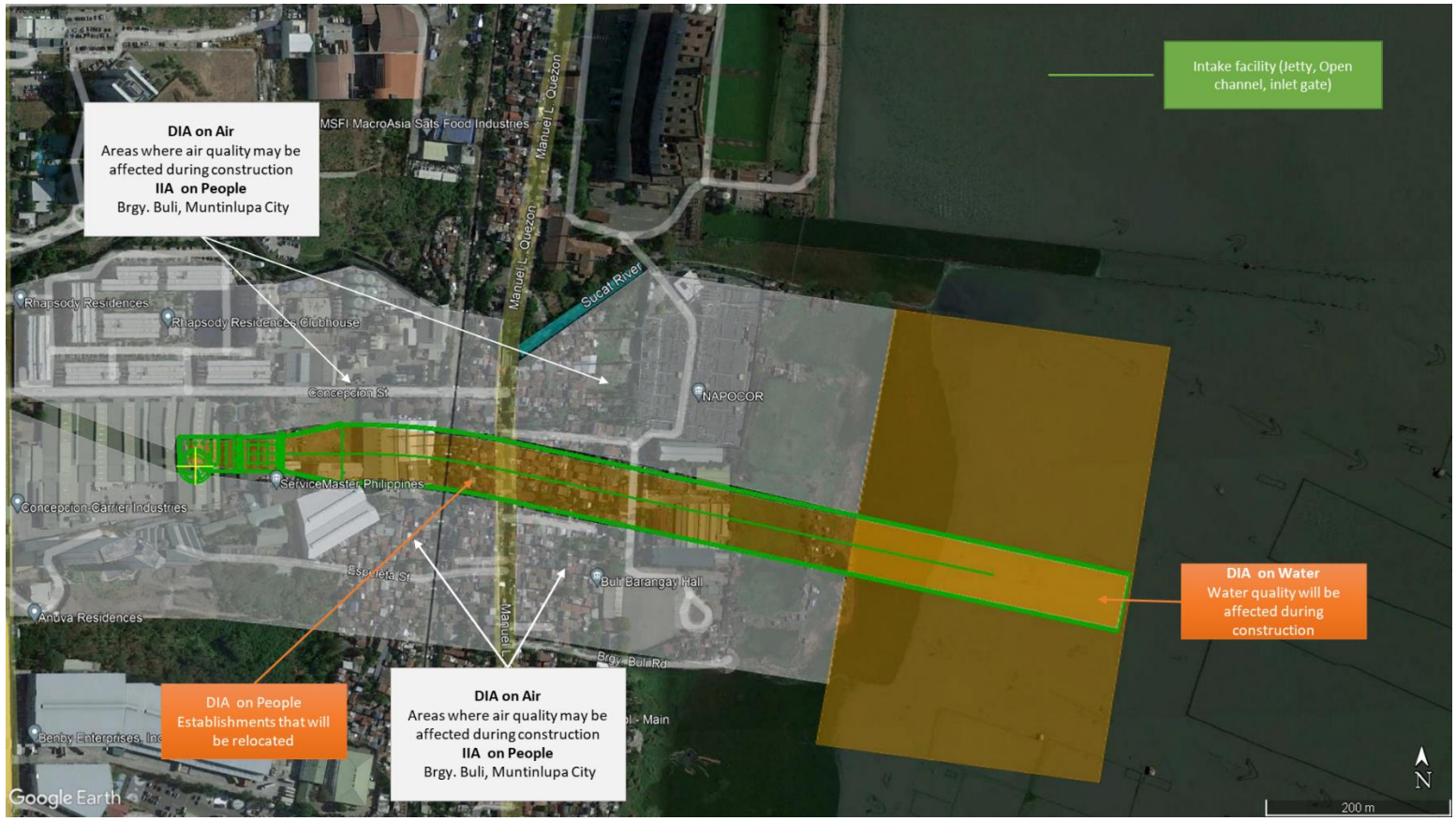

FIGURE TITLE:

Vicinity and Impact Areas Map of the Proposed Intake Facility

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Figure 1-3: Vicinity and Impact Areas Map of the Proposed Drainage Facility

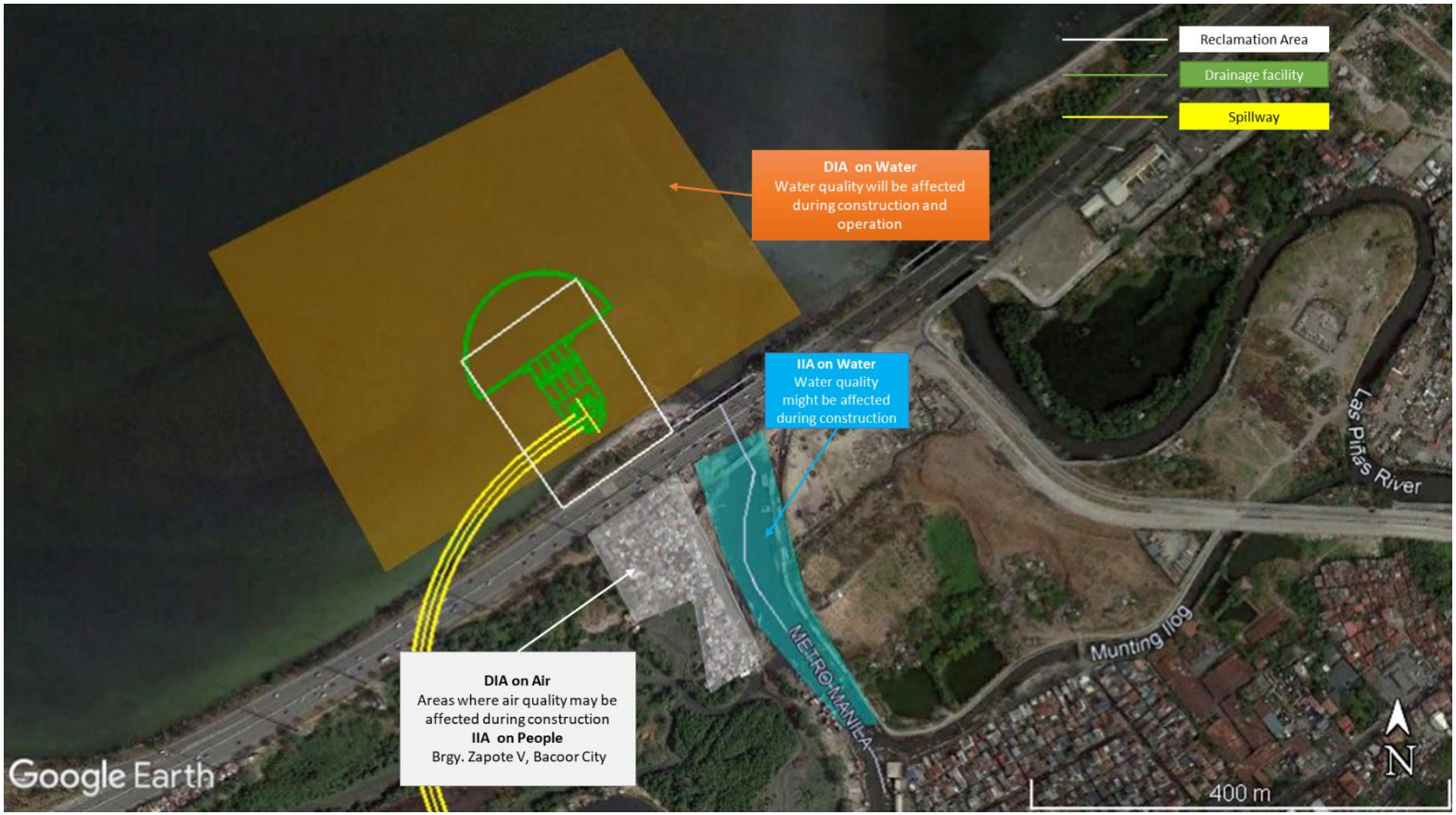

FIGURE TITLE:

Vicinity and Impact Areas Map of the Proposed Drainage Facility

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1.2 PROJECT RATIONALE

14 The Philippines is one of the countries that are most vulnerable to natural disasters in the world. The Metropolitan Manila Area, also known as Metro Manila (officially, the National Capital Region), which includes the City of Manila, the political, social, economic and cultural center of the Philippines, is located in a lakeshore lowland area that is susceptible to typhoons / storms and floods. Therefore, economic and social activities in the region are seriously affected. The Philippine government has been continuously addressing the problem for more than 50 years through the development and implementation of flood control projects; however, the government's management capacity in responding to flood events is still inadequate.

15 The Philippine government states in its Mid-Term Development Plan (2017-2022) that, in order to improve the coordination capacity for river management, continuous initiative to reduce flood risks, needed are the update of design and maintenance standards of flood control facilities, development of river information database and the update of baseline data on flood plain designation, as well as development of flood control and drainage plans especially for the 18 major river basins. Metro Manila is located in the Pasig-Laguna basin, and the Pasig-Marikina River is one of the 18 major rivers in the basin. This basin is a combination of the Laguna de Bay basin and the Manggahan Floodway, which was constructed in 1988 as a man-made facility for the reduction of flood damage in the Pasig-Marikina River basin.

16 Based on the master plan prepared and implemented with JICA's support in 1990, the Department of Public Works and Highways (DPWH), Government of the Republic of the Philippines, prioritized the river improvement project on the Pasig-Marikina River in order to protect the central part of Metro Manila where population and assets are concentrated. The Parañaque Spillway was then planned to drain the excess lake water into the Manila Bay.

17 However, thirty (30) years have passed since the Master Plan was formulated, and population around the Laguna lakeshore area has been progressing due to the increase of population in the metropolitan area. In addition, due to the effects of climate change, flood damage in the lakeshore area has become a situation that could not be further ignored. During Typhoon Ondoy in 2009, the water level of Laguna de Bay rose to about 13.9m (annual average lake water level has been 11.3m), causing flood for about 130 days and inflicting damage to around 420,000 population in the area.

18 With this, the Laguna de bay Comprehensive Flood Management Plan was formulated and drafted in 2018 and 2020. The plan identified measures that can be implemented to reduce the inundation damage and to control the rise of lake-water level at the Laguna de Bay lakeshore area, as presented in **Table 1-5**.

Table 1-5: Comprehensive Flood Management Plan in the Laguna de Bay Lakeshore

Structural Measures		Non-structural Measures
Control of Water Level Rise	**Mitigation of Inundation Damage**	
Construction of Parañaque Spillway [Underground tunnel] - Diameter: 13.0m - Length: about 10km - Max. Discharge: 240m^3/s	**Lakeshore Diking System** Lakeshore Dike (Total Length: 82.75km) [Drainage channel, Pumping stations, Backwater levees, Bridges]	• Tighter development regulations within the lake management boundary (EL. 12.5 m or less). • Promotion of land use regulation and safety assurance in flood risk areas. • Hazard map maintenance, evacuation planning, disaster prevention enlightenment activities, etc. • Construction of flood warning system.

19 During the 4th Steering Committee held on 23 January 2018, the Parañaque Spillway project was approved as a priority project. Among the structural components of the flood management plan. the Parañaque Spillway project was selected as priority from the following viewpoints:

- Inundation depth and period will be reduced at the entire Laguna de Bay Basin.
- The beneficial effects in terms of the reduction of the inundation depth and the flooding period caused by Laguna de Bay provided by the Parañaque Spillway are expected relatively early (such as within 10 years) and at wider area comparing to the ones by the Lakeshore Diking System.
- The Parañaque Spillway will be the early mitigation measure to the negative impact caused by the diverted flow from Marikina River through the Mangahan Floodway.
- DPWH can take the governmental responsibility for flood management at the entire Laguna de Bay Basin with the Parañaque Spillway.

20 The new alignment plan of the Parañaque Spillway project was finalized during the 2nd Steering Committee held on August 18, 2021.

1.3 PROJECT ALTERNATIVES

21 The succeeding sub-sections present the options that were considered for the Paranaque Spillway project.

1.3.1 Route Alternative Options

22 There were five route plans studied for the Parañaque Spillway project. Comparison of these alternative routes is summarized in **Table 1-6**. The alternative route plans considered are presented in **Figure 1-4**.

Table 1-6: Comparison of the Route Plans for Paranaque Spillway project

Item	Route 1	Route 2A	Route 2B	Route 3	Route X
Route	Lower Bicutan to South Parañaque River	Sucat to San Dionisio River	Sucat to Zapote River	Sucat to Zapote River	Buli to Manila Bay
Summary of Spillway Alignment	Straight line between	A tunnel is planned under Dr. A. Santos	A tunnel is planned under Dr. A. Santos	Straight line between Sucat and	Straight line from the inlet

Item	Route 1	Route 2A	Route 2B	Route 3	Route X
	Lower Bicutan and South Parañaque River to minimize the water head loss.	Avenue that connects Laguna de Bay and Manila Bay efficiently from the Sucat inlet shaft and is a straight line that connects to the outlet shaft of San Dionisio River.	Avenue that connects Laguna de Bay and Manila Bay efficiently from the Sucat inlet shaft, and is a straight line that connects to the outlet shaft of Zapote River	Zapote River to minimize water head loss.	site on land in Buli to the outlet site on the seashore around the mouth of Zapote River
Location of Inlet	Lower Bicutan	Sucat	Sucat	Sucat	Buli
Location of Outlet	South Parañaque River	San Dionisio River	Zapote River	Zapote River	Manila Bay
Length of Intake Open Channel (km)	1.2	0.7	0.7	0.6	0.8
Spillway length	6	7.2	8.7	8.8	9.7
Inlet Vertical Shaft Height (m)	75	-	-	75	78.6
Outlet Vertical Shaft Height (m)	75	32	32	75	74.7
Depth of Underground Tunnel	Deeper than ~50m	Deeper than 15~30m	Deeper than 15~50m	Deeper than ~50m	Deeper than ~50 to 77 m
Construction Period (months)	98	60	64	105	To be provided

23 **Intake Facility Location.** In selecting the location of the inlet facility, the following were taken into consideration: (i) current site condition of the lakeshore of Laguna de Bay, (ii) availability of open space for the open channel and (iii) availability of construction road for material handling. There were three possible locations for the intake facility, either in Lower Bicutan, Sucat or Buli. All the sites will require land acquisition and relocation of facilities.

24 **Drainage Facility Location.** Three rivers were considered to be used as connection of the spillway to Manila Bay. These were the South Parañaque River, San Dionisio River and the Zapote River. It was also considered to install the drainage facility in the coast of Manila Bay. The following were considered in selecting the drainage site: (i) river improvement requirement, (ii) possible impact to LPPCHEA, (iii) availability of open space for the drainage facility and (iv) river capacity.

1.3.2 Spillway System/Method Options

25 There are four spillway systems or methods that were considered for the Parañaque Spillway Project as shown in **Figure 1-5.** The comparison of these systems is summarized in **Table 1-7**.

26 Commercial facilities and houses are densely located on the alternative routes of the Parañaque Spillway thus, the open channel systems (Case 3 and 4) which will require a lot of resettlements are not feasible. For the underground river systems, the gravity flow open channel (Case 1) is also not feasible due to the hydraulic condition along the alternative routes and there is a small water level difference between the Laguna Lake and Manila Bay.

Table 1-7: Comparison of Spillway System/Method Options

	Underground River Systems		Open Channel Systems	
	Case 1: Gravity Flow Open Channel System	**Case 2: Pressure Pipe System**	**Case 3: Open Channel System**	**Case 4: Open Channel Tunnel System**
Description	Existing river/spillway flows into the tunnel under the road/hill.	The discharge water flows through the pressure pipe and is drained by syphon. Pumping is necessary for some hydraulic conditions.	This is the original plan of open channel. Construction cost is cheap, but land acquisition and RAP have problems.	To utilize the upper portion of channel, the tunnel system is adopted. Generally, the space is used as road or park.
Land acquisition requirement	It requires compensation for sectional surface rights over the spillway. In addition, land acquisition for inlet & outlet facilities is also necessary.	Compensation and land acquisition are not needed if the depth is over 50m. Therefore, only land acquisition for inlet & outlet facilities is necessary.	Land acquisition and resettlement for both spillway & inlet/outlet are necessary, but these are extremely difficult.	Land acquisition and resettlement for both spillway & inlet/outlet are necessary, but these are extremely difficult.

1.3.3 Drainage System

27 As presented in **Table 1-8**, three drainage systems were studied for the discharge in the Manila Bay.

Table 1-8: Comparison of Drainage Systems to Manila Bay

	Existing River Connection	Jetty (Seawall)	Direct Drainage
Description	Connects with the existing rivers flowing into Manila Bay (such as Parañaque River, Las Piñas River and Zapote River), and drained water flows indirectly to the sea.	New drainage channel is constructed. To avoid clogging by sea sand, Jetty (Seawall) is installed.	Outlet facility is constructed in Manila Bay and the drained water flows directly to the sea. In the case of Parañaque Spillway, artificial island is necessary to sustain the operation and maintenance efficiently.

Figure 1-4: Route Plan Options for Parañaque Spillway Project

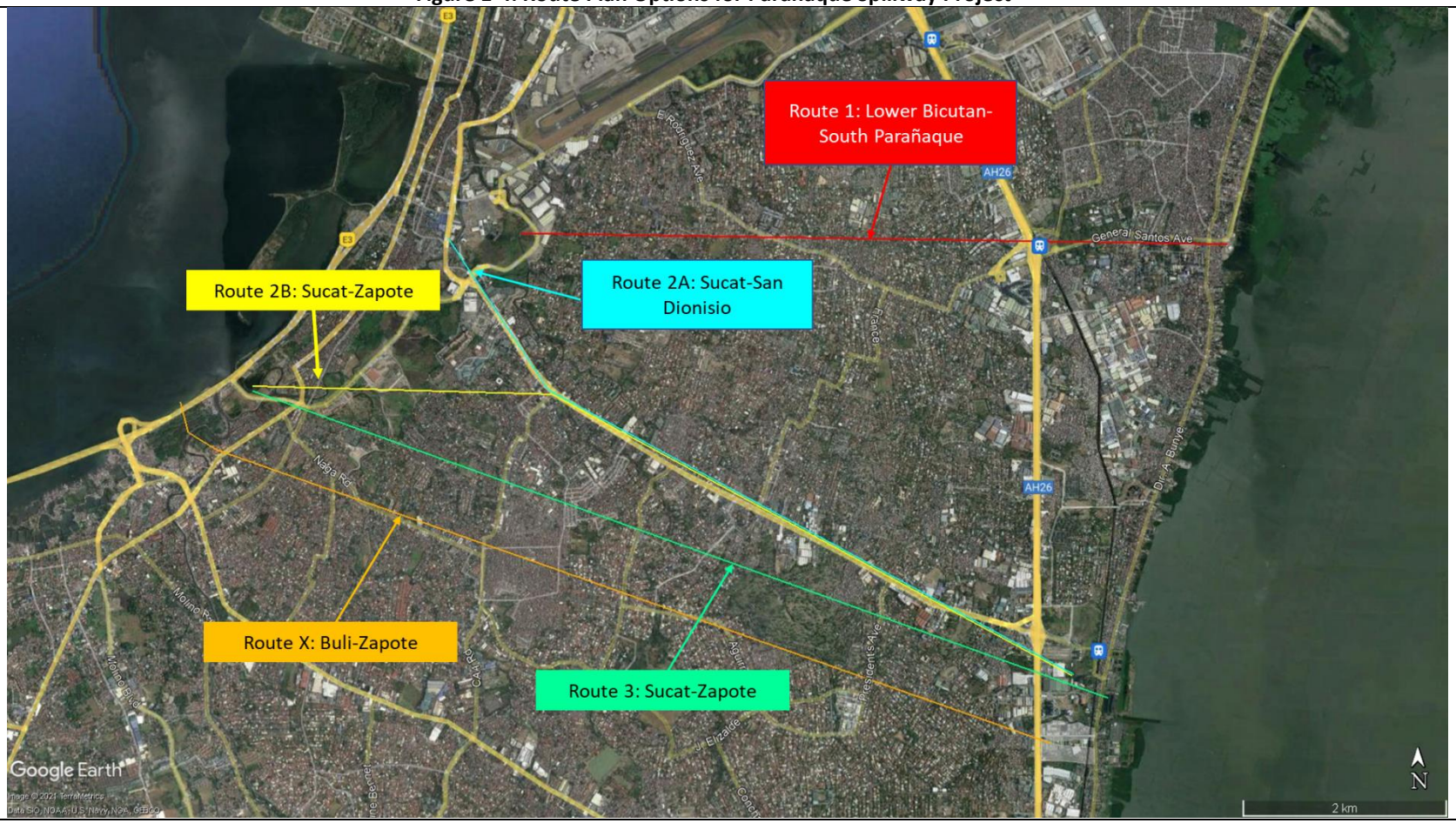

FIGURE TITLE:

Route Plan Options for Parañaque Spillway Project

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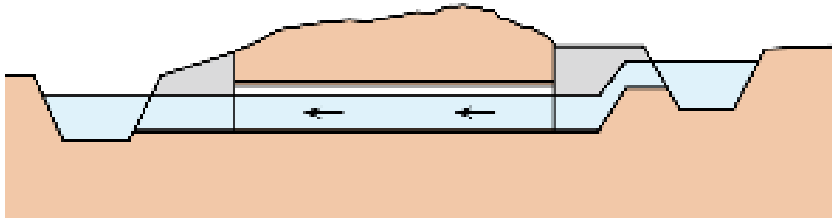
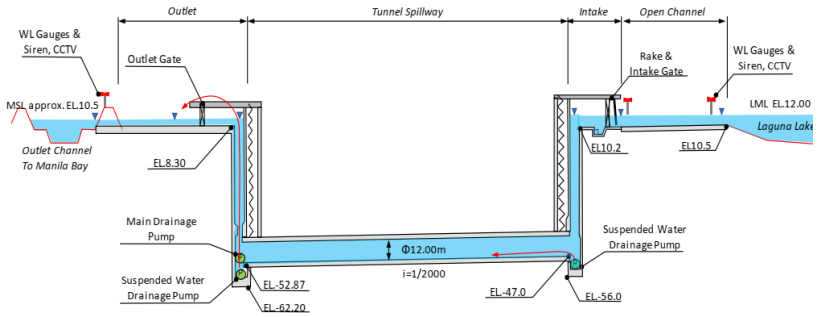
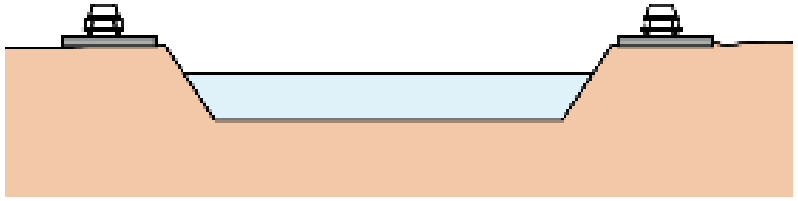
Figure 1-5:Spillway System/Method Options



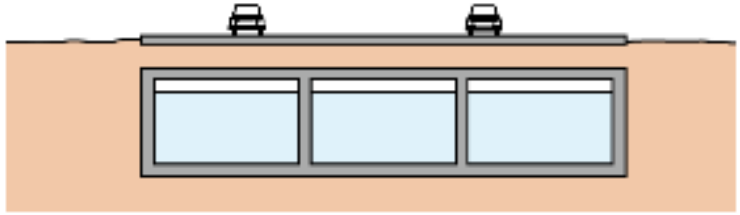
Case 1: Gravity Flow Open Channel System



Case 2: Pressure Pipe System



Case 3: Open Channel System



Case 4: Open Channel Tunnel System

FIGURE TITLE:

Spillway System/Method Options

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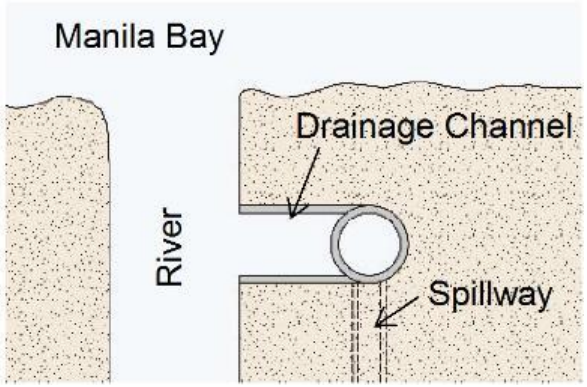
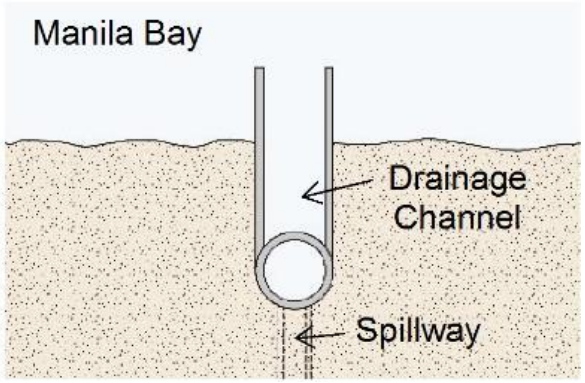
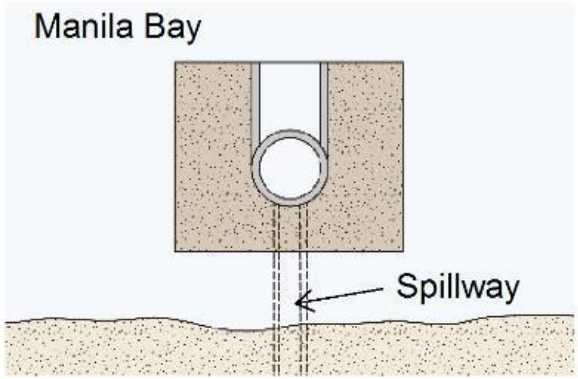
Figure 1-6: Drainage System Options for the Parañaque Spillway Project



Existing River Connection



Jetty (Seawall)



Direct Discharge

FIGURE TITLE:

Drainage System Options for the Parañaque Spillway Project

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1.3.4 Methodology of Tunneling

28 A non-open cut method will be used for the tunnel construction. There are two categories for the non-open cut method as presented in **Table 1-9**. The tunnel construction methodology that will be applied will depend on the existing geologic condition along the spillway alignment.

29 Shield Tunneling Method is being proposed since it can be applied to both soft and hard ground can be cope with leaked water. This will be finalized after the boring survey that will be conducted.

Table 1-9: Comparison of Methodology of Tunnelling

Component	Shield Tunneling Method	New Austrian Tunneling Method (NATM)
Methodology	• Excavate with the shield machine by stabilizing the face against earth pressure and water pressure using mud pressure or muddy water pressure and assemble segments to retain the ground. • Shield machine is driven coping with earth and water pressure at the cutting face by filling the chamber with slurry or excavated muddy soil. Tunnel walls are prevented from ground collapsing by a segmental lining which is erected in the shield machine.	• Makes use of ground supporting function of the area surrounding the excavation. Shotcrete, rockbolts, steel rib supports, and other methods are used for stabilization. • It requires the ground arch effect to be in effect and a self-standing face. When these two conditions are not satisfied, it may still be applied using auxiliary measures.
Applicable geologic conditions	Generally applied to the ground with very soft alluvium, diluvium and soft rocks from Neogene period. Relatively easy to adopt to changes of the ground. There are also many cases with hard rocks.	Generally applied to the ground with hard rocks and soft rocks from Neogene period. Depending on the requirements, applicable to unconsolidated ground. The changes of ground can be handled by changing support works, excavation methods, and auxiliary measures.
Advantages	• Construction is possible without auxiliary measures, except at the launching and arrival area, by using a closed-face type shield even though leaked water is detected in the ground. • Standard monthly excavation distance is 350m but 500m can be possible if the machine is built for high-speed excavation. Compared to	If auxiliary measures are not necessary; the cost of construction is about half of the cost of Shield Tunnelling method.

Component	Shield Tunneling Method	New Austrian Tunneling Method (NATM)
	NATM, construction speed is much higher.	
Disadvantages	Shield machine and segments are expensive and the total cost for construction can be much higher than that of NATM.	• In case of unexpected soft ground or leaked water, auxiliary measures are necessary so that the total cost for construction can be much higher than that of Shield Tunnelling Method. • Monthly excavation distance is about 80m and much slower than that of Shield Tunnelling Method.

1.3.5 Without Project Option

30 Flood damage in Laguna de Bay lakeshore areas is caused by long-term high-water level of the lake. Without the project the 100-year probability water level in Laguna Lake is 14.3 meters. The inundation area above 12.5 meters is 98.6 km^2 with inundation period of 4.8 months. The estimated in inundation damage population is 853,000 people.

31 The operation of the proposed Parañaque Spillway project will not reduce the inundation damage to zero but may contribute to the reduction of inundation depth and inundation period along the lakeshore area. The potential effect of the proposed Parañaque Spillway project against probable flood is shown in **Table 1-10**.

Table 1-10:Effect of Parañaque Spillway against Probable Flood

Index	100-year Probability		10-year Probability		5-year Probability	
	Without Project	With Project	Without Project	With Project	Without Project	With Project
Maximum Lake Water Level (m)	14.5	13.8	13.4	13.0	13.1	12.8
Inundation Area (km^2)	98.6	66.1	45.6	24.6	29.3	14.5
Inundation Period (month)	4.8	2.5	3.1	0.8	2.4	0.6
Inundation Damage Population (person)	853,000	513,000	339,000	160,000	206,000	89,000

1.4 PROJECT COMPONENTS

32 The hydraulic design conditions for the proposed Parañaque Spillway project are shown in **Table 1-11**.

Table 1-11: Design Parameters of Parañaque Spillway Project

Parameter	Value
Design Flood Water Level, EL	13.8 m

Parameter	Value
Planning Discharge, Q_p	300 m^3/s*
Operation Start Water Level, EL	January to May: No operation June to July: 11.5 meters August to December: 12 meters
Operation Start Discharge, Q_s	110 m^3/s
Note: * - This is the maximum discharge. Volume may vary during the 100-year return period. This is not always the flow volume	

33 The list of project components of the Parañaque Spillway is presented in **Table 1-12**.

Table 1-12: Proposed Project Components of the Parañaque Spillway Project

Name of Facility	Work Components	Main Facilities and Equipment
Intake Facility (Inlet)	Civil work structures	Intake, Intake open channel, Sand sedimentation pond, Inlet vertical shaft, Control Center Building, Jetty
	Dust removal system	Boom (Floating weed trap), Screen (Trash rack), Dust remover
	Pumping system	Suspended water drainage pump, Operation system
	Ventilation system	Ventilation fan
	Lifting system	Elevator, Stairs, Gondola, Hoist crane
	Power supply system	Generator, Transformer, Fuel tank
	Water level and discharge monitoring system	Water level gauge, Remote monitoring device, Siren
	Water level and discharge control system	Inlet control gate, Stop-log
Drainage Facility (Outlet)/Reclamation Area	Civil structures	Outlet vertical shaft, outlet, outlet channel, sub-management office, evacuation center, public park, maintenance facility
	Pumping system	Main drainage pump, Suspended water drainage pump, Transformer, Generator, Operation system
	Ventilation system	Ventilation fan
	Lifting system	Elevator, Stair, Gondola, Hoist crane, Pressure door
	Power supply system	Generator, Transformer, Fuel tank
	Water level and discharge monitoring system	Water level gauge, Remote monitoring device, Siren
	Water level and discharge control system	Outlet gate, Stop-log
Spillway (Underground Tunnel Type)	Civil structures	Underground tunnel
	Cleaning and sediment removal equipment	Manual cleaning machine, High-pressure cleaning car, Wheel-loader, Vacuum car
	Ventilation equipment	Ventilation fan

1.4.1 Intake Facility

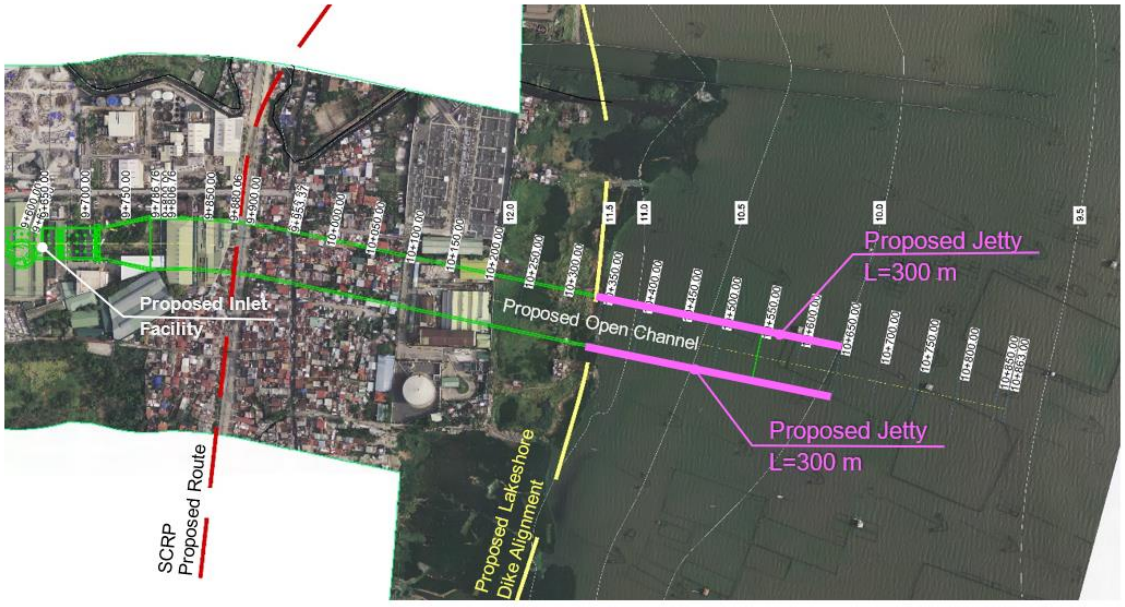
34 The intake facility of the proposed Paranaque Spillway project will include the jetty and open channel. A jetty will be installed within Laguna Lake, in both bank side of the proposed open channel, to prevent sedimentation on the channel bed. Since the bed material of Laguna Lake is silt to fine sand, the jetty is "impermeable type". The jetty will have a length of 300 meters and area of about 5,400 square meters.

35 The open channel will have a length of 600 meters. At the inlet, boom and trash-rack rakes will be installed to prevent floating materials from entering the spillway tunnel. The trash-rack rakes will be equipped with a belt-conveyor and a hopper to load garbage on a dump truck.

36 An inlet control gate will be installed at the end of the open channel to control the flow of water to the spillway. The gate will be designed to start at the opening water level of 12.0 meters.

37 An inlet shaft with depth of 78.6 meters below ground will also be installed in the intake facility to pump the floodwater from Laguna Lake to Manila Bay.

Figure 1-7: Conceptual Layout Plan of Intake Facility



Note: Since the design in conceptual, the details are still subject to change.

FIGURE TITLE: **Conceptual Layout Plan of Intake Facility**		
PROJECT PROPONENT: **Department of Public Works and Highways** Flood Control Management Cluster (FCMC) Unified Project Management Office	PROJECT TITLE & LOCATION: **PARAÑAQUE SPILLWAY PROJECT** Cities of Muntinlupa, Parañaque, Las Piñas and Bacoor	REPORT PREPARER: LCI ENVI CORPORATION

1.4.2 Spillway

38 The proposed spillway will be an underground pressure tunnel type and will have a total length of about 9.7 kilometers and an inner diameter of 13 meters. The depth is estimated to be 50 to 77 meters below ground level, depending on the subsurface condition.

39 For maintenance of the spillway tunnel, it is planned to remove and carry out sediment by using heavy vehicles. Ventilation equipment will be installed and designed to maintain a safe working

environment in the spillway tunnel and to exhaust heat generated by electric motor of drainage pump in dry area of vertical shaft.

1.4.3 Reclamation Area

40 The proposed drainage facility will be installed within the coast of Manila Bay. With this, land reclamation is needed to accommodate the components of the drainage facility. The total area of the reclamation site is about two hectares. In addition to the components of the drainage facility, an evacuation center and public park will be provided in the reclamation area.

41 It is estimated that about 50,000 cubic meters of fill materials will be used for the reclamation. This will include silt, sand and gravel that will be purchased within 20 kilometers from the project site.

42 The initial project developmental concept for the reclamation area is shown in the table below.

Table 1-13: Initial Project Development Concept of the Reclamation Area

Component	General Description	Size/ Capacity
Reclamation Land	The reclamation land is a peninsula type and the one of the edges will be connected to shoreline.	About 2 ha, 170 m x 120 m (Tentative)
Containment Structures	Revetment surrounding the Reclamation Land. Main components of the revetment are concrete retaining wall and wave suppressor	L= About 460m (170 m x2 + 120 m) H= Maximum 8 m
Pool Structure	A drainage outlet sized 7.5m x4.3mx 4 barrels will be provided at the edge of the reclamation land, and the invert elevation of the outlet is set to EL.7.8 m. As a countermeasure against sedimentation of drift sand, semicircular shaped pool will be provided in front of the reclamation land.	Radius = Approx. 80 m (Tentative) Invert Elevation: EL.7.3
Road Network	Access for the maintenance facilities will be provided. The road alignment is to be studied in the detailed design stage.	Width of the maintenance road is minimum 4.0 m. To be studied in the detailed design stage.
Drainage System	Drainage system for surface drain will be provided. The drainage planning and design it to be studied in the detailed design stage.	To be studied in the detailed design stage.
Storm Surge Protection	The top elevation of the wall is going to be set considering safety in HHWL(recorded highest tide) with wave(50 years return period). Recurved parapet is provided on the top of Wall. Wave suppressor is provided to reduce the necessary height against wave.	Parapet Height H=1.0m (from the Reclamation Ground) Wave suppressor: Hexapod 4t Type
Access Way	Access way will be provided. Its route will be studied in the detailed design stage.	To be studied in the detailed design stage.

Revetments

43 Revetments, consisting of concrete retaining wall and wave suppressor, will be installed around the perimeter of the development except for shoreline side to contain the reclamation areas.

44 Concrete retaining wall will be gravity type and will be established on rubble foundation. The area behind the concrete retaining wall will be filled with rubble material. Filter cloth will also be installed to prevent the soil particles to be suck out. In the design of the wall, seismic load, earth pressure, water pressure, wave pressure and surcharge load on the reclamation land shall be considered.

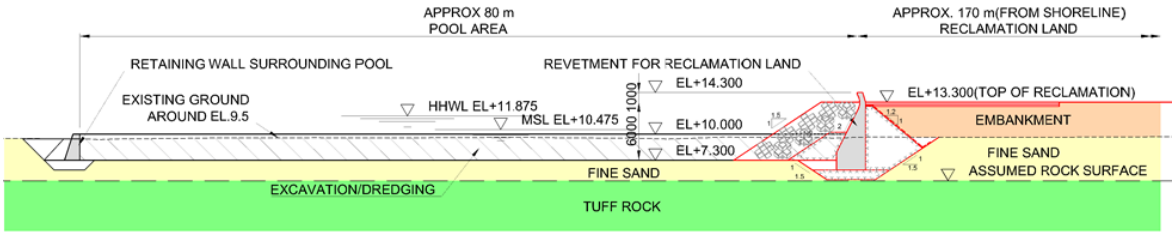
45 Wave suppressor will be piled up hextapods and rubble materials. The minimum thickness of the concrete block layer is set to 2 pieces of the blocks. Filling material inside the concrete block layer is rubble material. Basically, the passive pressure or counterweight by this portion will not be considered on the stability of the concrete retaining wall

Containment Structures

46 For the proposed containment structure, upright shaped concrete retaining wall type would be adopted considering the depth of the sea around the proposed reclamation land site. In front of the concrete retaining wall, wave suppressor by hexapods will be installed to absorb the force of storm waves and to lower the necessary revetment height.

47 **Figure 1-8** shows general illustration of the containment structure including the pool structure in front of the revetment. Since the design is still conceptual, it will be subject to be changed/updated due to consideration of the actual site conditions and relation with the other structures.

Figure 1-8: Conceptual Design of the Reclamation Land



Note: Since the design in conceptual, the details are still subject to change.

FIGURE TITLE:

Conceptual Design of the Reclamation Land

PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
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1.4.4 Drainage Facility

48 The following are the components of the drainage facility that will be installed within the reclamation area.

Outlet Shaft

49 A vertical outlet shaft will be constructed at the drainage facility for the discharge of the water to Manila Bay. The outlet shaft will have a depth of about 74.7 meters below the ground.

Main Drainage and Suspended Water Drainage Pump

50 The main drainage pump capacity is designed for dewatering of the tunnel within five days after stoppage of inflow into the spillway tunnel.

51 Suspended water remaining in the outlet shaft will be pump into the ground level.

Ventilation Equipment

52 Ventilation system composed of air supply fan and exhaust fan will be installed in the outlet shaft to send air into both the dry area in the vertical shaft and the spillway tunnel.

Outlet Gate

53 An outlet gate will be installed the end of the drainage facility to control the water discharge in Manila Bay. The gate will be designed to open upon water reaches the same water level of the river after filling the tunnel with water incoming from Laguna de Bay. The suggested material of gate is the stainless steel in view of brackish water.

Lifting Equipment

54 For the installation and inspection/repair works of pump and ventilation equipment, suspended monorail type electric hoists are designed in the inlet facility and the outlet facility.

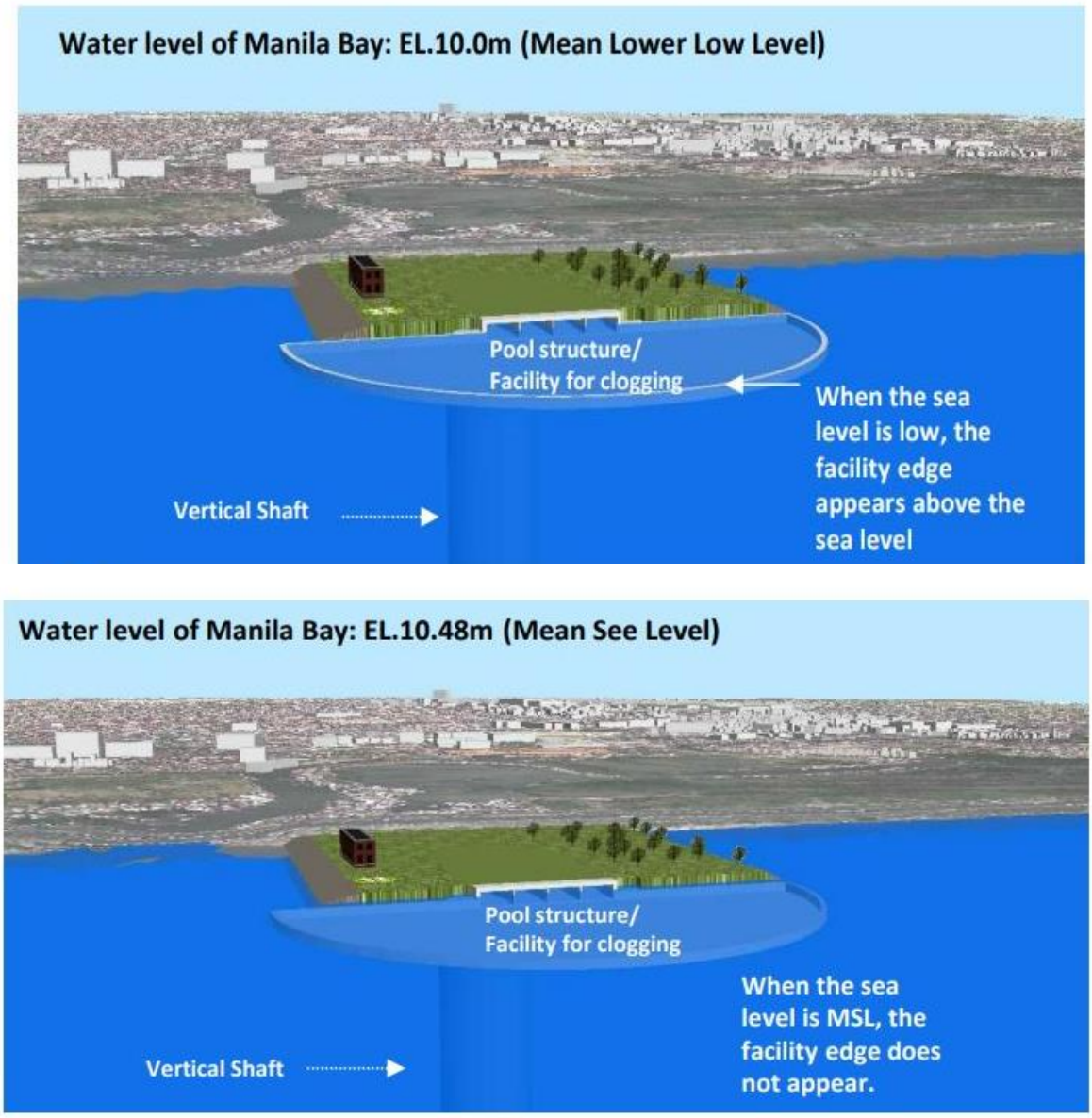
Pool Structure

55 The purpose of the pool structure is to prevent significant sedimentation in front of the gates of drainage sluice for the proper maintenance and operation of the discharge gates.

Sub-management Office

56 Gate operation to intake water from the Laguna de Bay and discharge water into the Manila Bay and the pump drainage operation and ventilation are controlled to start and stop individually in both inlet/outlet facilities by means of remote control from the central control panel stationed in the drainage facility.

Figure 1-9: Conceptual Design of the Drainage Facility



Note: Since the design in conceptual, the details are still subject to change.

FIGURE TITLE:

Conceptual Design of the Drainage Facility

PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
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1.4.5 Support Facilities

1.4.5.1 Power Supply

57 As for main drainage pumps and ventilation fan in the outlet facility, electricity supply to the equipment shall be designed to enable supply by in-house power generator instead of the electric power company. Since the equipment is estimated to operate for a short period annually, it is possible to reduce the fixed charges generally imposed for power received from the electric power company. On the other hand, lighting and air-conditioning of office building and auxiliary equipment will be operated by power received from the electric power company.

1.4.5.2 Water Supply

58 Water supply during construction and operation phase will be sourced from Maynilad.

1.4.5.3 Wastewater Treatment

59 Wastewater that will be generated during the construction and operation are limited to domestic wastewater. Portable toilet facilities will be installed on-site to cater the domestic wastewater that will be generated by the workers during the construction phase. These facilities will be regularly siphoned by DENR-accredited haulers.

1.4.5.4 Air Pollution Sources and Control Devices

60 Air pollution sources will be from the heavy equipment during construction and the operation of the in-house power generator. Air pollution control devices such as mufflers and adequate stack will be installed to mitigate the effects of the pollution source.

1.4.6 Spoils/Surplus Soil Management

61 Surplus soil will be generated from the following construction activities: (a) open channel construction, (b) tunnel construction and (c) arrival shaft construction of shield tunnel in Manila Bay side. It is estimated that about 2.5 million m^3 of surplus soil will be generated.

62 Surplus soil shall be transported and disposed by dump trucks to the soil disposal site of Laguna Lake secured within 10 kilometers from the launching shaft. The proposed location of the open channel section will be used as temporary construction road and temporary storage site for the residual soil.

1.4.7 Temporary Facilities

63 To support the construction activities, temporary facilities such as the following will be installed in the project site:

- Temporary protective fencing and lighting;
- Gatehouse and site security facilities;
- Temporary parking space;
- Temporary and secured equipment and material storage areas (i.e. diesel storage area);
- Temporary site office;
- Emergency spill kits;
- First aid stations;
- Temporary solid and hazardous waste storage areas;

- Portable sanitation facilities;
- Diesel storage tanks;
- Generator sets;

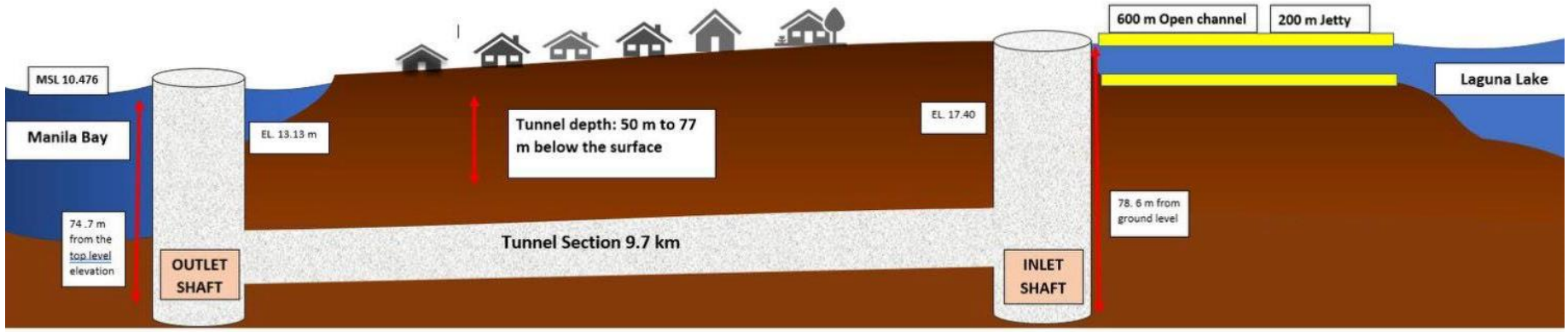
1.5 PROCESS/TECHNOLOGY

64 The proposed Parañaque Spillway project is intended to drain the excess water in Laguna Lake during heavy rainfall into the Manila Bay. The spillway operation will only operate when the lake water level rises above the designated water level in Laguna Lake. In the months of June and July, the spillway will operate if the water level in the lake exceeds 11.5 meters while in the months of august to December, the operation will start once the water level in the lake reaches 12 meters.

65 Once the lake water level rises above the designated water level, the inlet control gate will be opened to start the intake operation. To prevent inverse flow from the drainage river to the outlet, the outlet gate will only be opened after the water level at the drainage river and the outlet has stabilized. Continuous monitoring of the outflow condition is important to ensure that the operation of the spillway does not cause any rapid rise of water level in the receiving river.

66 The operation of the spillway will stop once the lake water level subsided to below the designated water level. After the stop of the spillway operation, the water in the underground tunnel will be drained, then cleaning and inspection in the tunnel is conducted as preparation for the operation of the next wet season. It is estimated that the draining of water from the underground tunnel will take about 5 days.

Figure 1-10: Schematic Diagram of Parañaque Spillway Project



Note: For illustration purposes only. Not to scale.

FIGURE TITLE:

Schematic Diagram of the Parañaque Spillway Project

PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
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1.6 PROJECT PHASES

1.6.1 Pre-construction

67 This phase shall include the conduct of the feasibility study, development of resettlement action plan and the finalization of the design of the proposed project. All necessary permits and licenses shall be secured at this phase.

68 Site preparation such as clearing of existing vegetation and removal and demolition of existing structures in the proposed intake facility will also take place during this phase. Since there are households and facilities that will be affected by the construction of the intake facility a resettlement action plan shall be developed and implemented.

69 Also, as preparation for the construction phase, hiring of workers and subcontractors and the procurement of construction materials will be done.

1.6.2 Construction

Reclamation Method

70 **Figure 1-11** presents the reclamation method diagram.

a. Excavation and Dredging

71 Since pool area will be installed in front of the reclamation land and the invert elevation of the pool area is lower than the existing seabed, the existing seabed will be excavated/dredged.

72 The extent to be excavated/dredged will be within a radius of approximately 80 meters from the edge of reclamation land with semi-circular shape and approximately one hectare. The excavation/dredging depth from the existing seabed is about 2.2 meters.

73 Furthermore, in the proposed reclamation area, there is about 4 meters sandy soil layer below the existing seabed and tuff rock appears below this sandy soi layer. This tuff rock will be supporting layer of structures.

74 The countermeasure against liquefaction of the sandy layer located below the existing seabed will be studied depending on the structures installed in the reclamation area. Hence, the replacement of the whole existing sandy soil is not proposed due to its large volume and the excavation/dredging within the perimeter of reclamation land will be implemented only in the limited areas such as around the structures to be installed in reclamation area.

b. Access road

75 The depth of water at Reclamation Area in Manila Bay is about 1m. Therefore, the construction method using the equipment on the barge cannot be used because the necessary draft cannot be kept due to insufficient depth of water. In addition, due to high permeability of soil, it is necessary to secure the dry condition by means of temporary cofferdam of single steel sheet piles (SSP) for the reclamation and subsequent construction of Vertical Shaft of Shield Tunneling works.

76 From the above condition, to proceed with SSPs driving, temporary access road, which has two purposes, i.e., access and the working platform for the excavator with Vibro Hammer, need to be constructed. The said access road will be constructed in the location surrounding reclamation area

for the construction of Vertical Shaft and Drainage Structure connecting to the Shaft. The crest elevation of access road shall be equal or higher than the HHWL+11.875 and the width of the road shall be more than 5m.

c. Temporary Cofferdam

77 The temporary cofferdam will be installed inside the said access road. Type of temporary cofferdam is single steel sheet pile (single SSP) and TypeⅢ of SSPs will be installed by using excavator with Vibro Hammer sitting on the access road. SSPs shall be installed until hitting soft rock to secure the dry condition inside cofferdam. The crest level of temporary cofferdam shall be equal or higher than the HHWL +11.875.

d. Reclamation

78 The reclamation area will become dry condition after the installation of temporary cofferdam using SSPs and subsequent dewatering by using water pumps. After the dewatering, the leveling works in the entire reclamation area will commence. About 50,000m^3 of imported soil will be delivered from the designated borrow pit. Imported soil will be spread layer by layer using bulldozer and compacted by the compaction roller. Field Density Test will be conducted in each layer by adequate frequency to secure the quality of the compaction. The said reclamation will be prioritized in the necessary area for the construction of Vertical Shaft. The working platform for Vertical Shaft will become EL13.30m which is 3 to 4m higher the existing ground level.

Construction Method for Tunnel

79 The tunnel will be constructed using the Shield Tunnelling Method. This method involves constructing a tunnel by excavating under the ground from a launching shaft to an arrival shaft with a cylindrical machine called shield machine. Excavation and construction of tunnel structure are continuously conducted while cutting through the ground with cutter bits that are attached in front of the machine and assembling segments (exterior wall of tunnel) inside of the machine. This method can be executed without occupying the land aboveground between the launching shaft and the arrival shaft and can be safely applied to soft and hard ground regardless of underground water.

80 The procedure for the Shield Tunneling Method is presented in **Figure 1-12**. Procedures in Step 1 are done simultaneously.

Construction Method for Vertical Shaft

81 The construction of the vertical shaft will utilize the open-caison method. In this method, the main frame of caisson is constructed with reinforced concrete on the ground and is installed into the ground by using reaction force of dead weight and ground anchors while proceeding with the excavation of the ground at the bottom surface of the caisson. Excavation will be done with backhoes and breakers and soil is gathered with a bucket-type machine. An overview of the procedure for the open-caisson method is presented in **Figure 1-13**

Construction Method for Open Channel

82 The work procedure for the open channel is shown in **Figure 1-14**

Figure 1-11: Reclamation Method Diagram

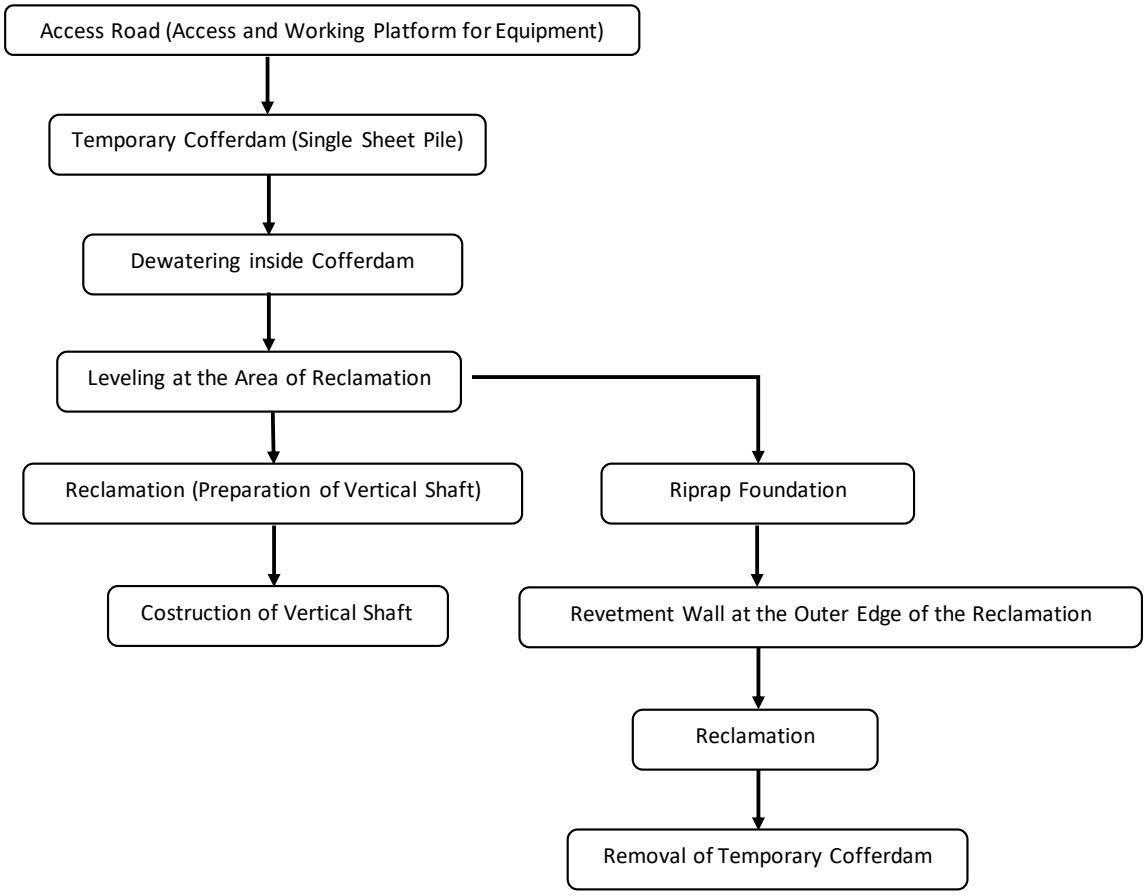

FIGURE TITLE:

Reclamation Method Diagram

PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
Department of Public Works and Highways Flood Control Management Cluster (FCMC) Unified Project Management Office	**PARAÑAQUE SPILLWAY PROJECT** Cities of Muntinlupa, Parañaque, Las Piñas and Bacoor	LCI ENVI CORPORATION

Figure 1-12: Procedure for Shield Tunnelling Method

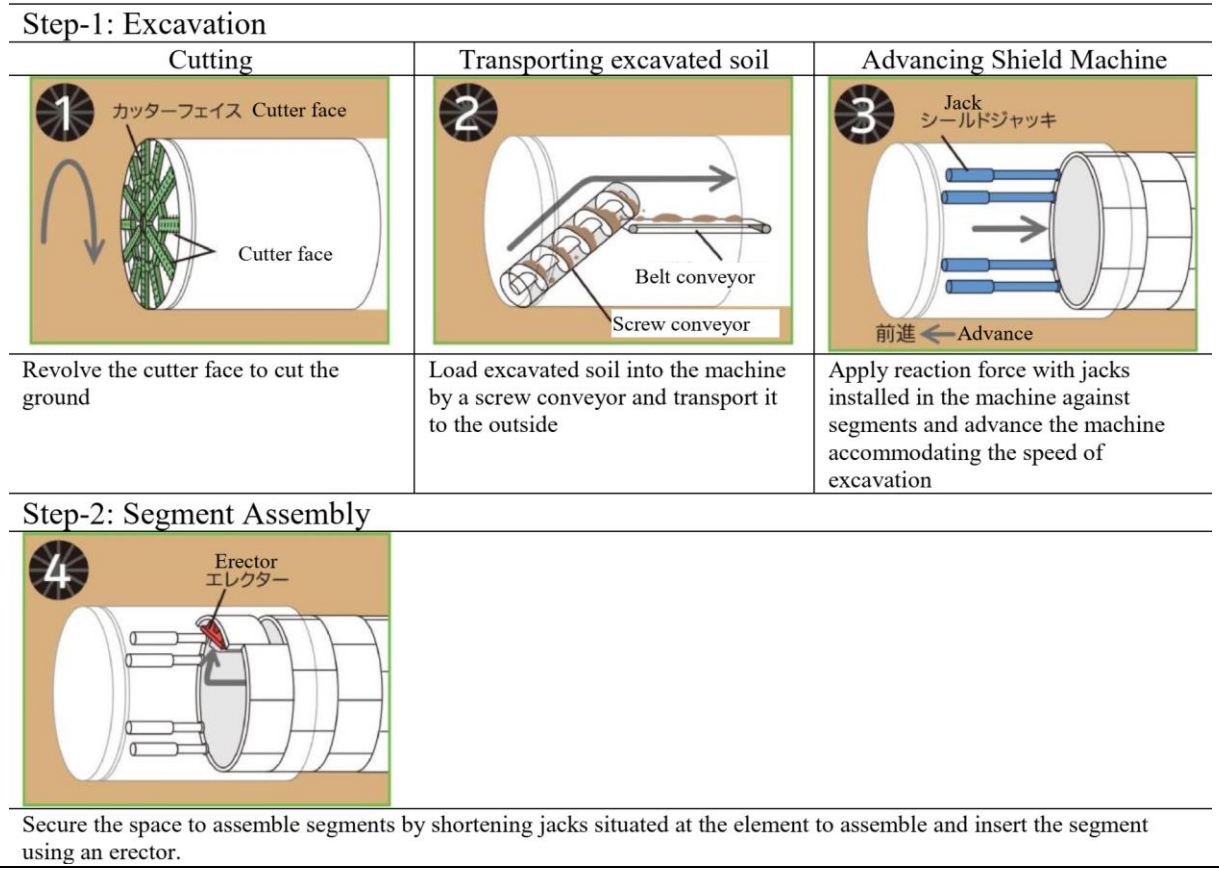

FIGURE TITLE:

Procedure for Shield Tunnelling Method

PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
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Figure 1-13: Procedure for Open-Caisson Method

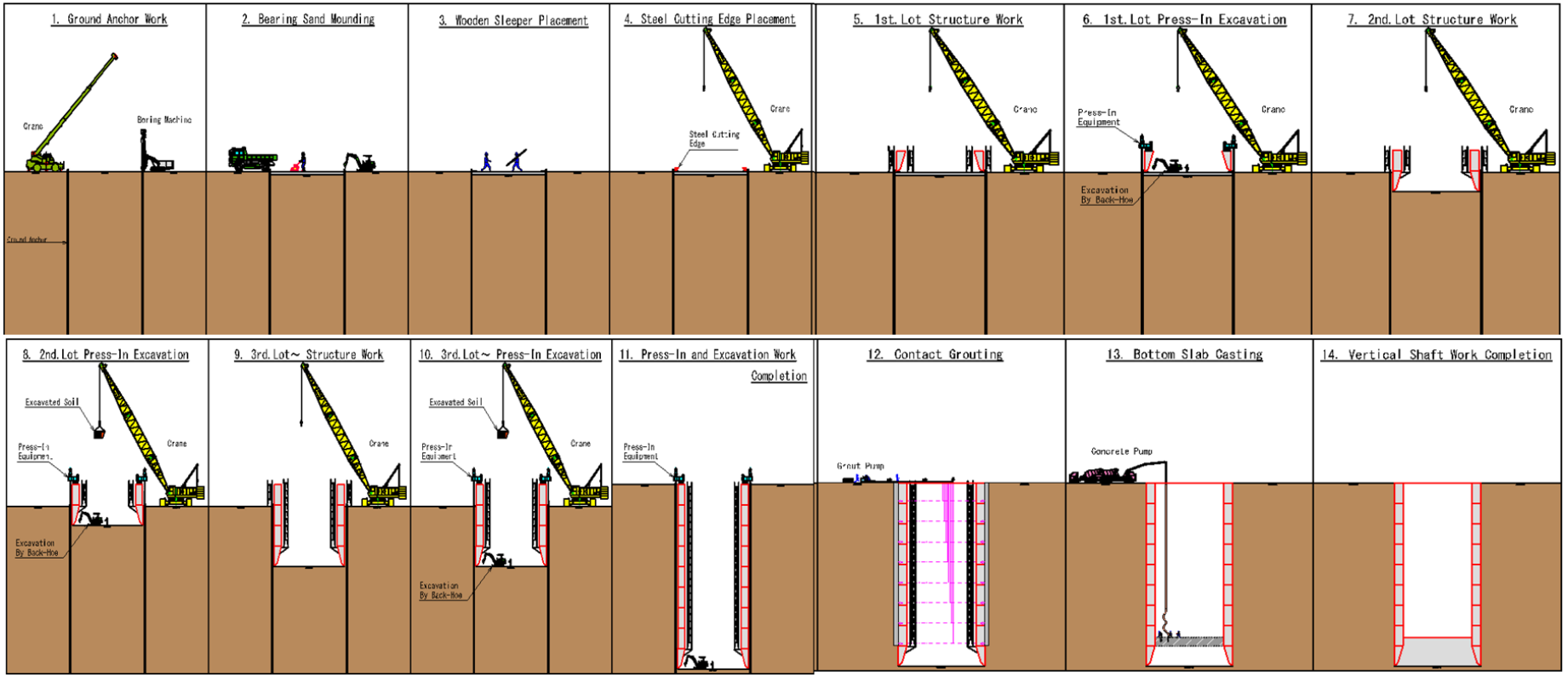

FIGURE TITLE:

Procedure for Open-Caisson Method

PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
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Figure 1-14: Workflow of Open Channel Construction

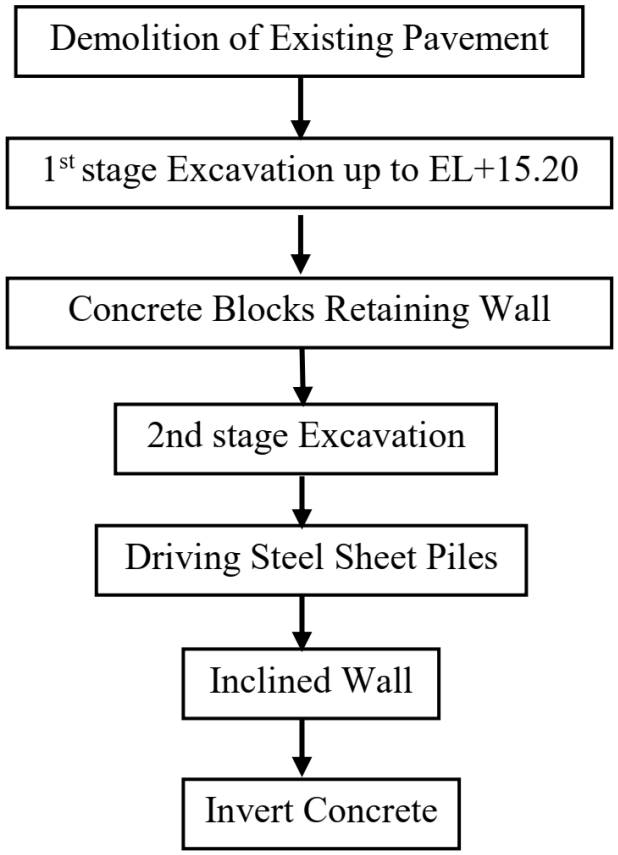

FIGURE TITLE:

Workflow of Open Channel Construction

PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
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1.6.3 Operation

83 The proposed Parañaque Spillway project will only be operated during rainy season. It is assumed that the spillway will be non-operational from January to May since these are dry season. From June to July, it will operate once the lake water level reaches 11.5 meters while in August to December, the spillway will start when the water level in Laguna Lake is 12.0 meters.

84 The operation and maintenance activities of the proposed Parañaque Spillway project include operation during the flood season and the maintenance during normal condition as presented in **Table 1-14** and **Table 1-15,** respectively.

Table 1-14: Operation of the Proposed Parañaque Spillway during Flood Season

Activity	Works	Detail of Works
Preparation for spillway operation	Monitoring of lake water level, and preparation for operation	• Contiguous monitoring of lake-water level. • Both inlet and outlet gates are closed. • Carrying out of preparation works so that all facilities and equipment will work properly and timely when the lake water level rises above the operation starting water level (EL. 12.0 m)
Spillway operation	Gate opening operation (Start spillway operation)	• In the rainy season, when the lake water level has risen above EL. 12.0 m, the inlet control gate is opened to start intake operation. • The outlet gate is closed for a while to prevent inverse flow from the drainage river to the outlet. • After the water level at the drainage river and the outlet has stabilized, the outlet gate is opened and spillway operation is started.
	Monitoring of Intake Facilities	• Before starting intake operation, safety in the adjacent area of intake in Laguna de Bay, open channel and intake should be confirmed, and notice of starting spillway operation is disseminated to concerned agencies and LGUs • During spillway operation, the operator should continuously monitor inflow condition at intake by ocular inspection and remote monitoring devise to confirm the smooth inflow without any disturbance of clogging of intake with floating garbage
	Removal of garbage at intake screen	• Floating garbage trapped at the intake screen should be timely removed manually and by dust remover.
	Monitoring of Drainage Facilities	• Before starting spillway operation, safety in the adjacent area of drainage-river and outlet should be confirmed and notice of

Activity	Works	Detail of Works
		starting spillway operation is disseminated to concerned agencies and LGUs. • During the spillway operation, the operator should continuously monitor the outflow condition at the outlet by ocular inspection and remote monitoring devise to confirm smooth drainage without any rapid increase of discharge and rise of water level.
	Gate closing operation (Stop spillway operation)	When the lake water level has subsided below EL. 12.0 m, the inlet control gate and outlet gate are closed to stop the spillway operation
Drainage, ventilation, cleaning and sediment removal after spillway operation	Drainage of tunnel	• In the latter half of the wet season when lake water level drops down below EL. 12.0 m and in case it is not predicted that the next flood would come soon referring to the long-term meteorological information, etc., storage water in the tunnel should be drained by the main drainage pump installed in the outlet shaft. • Duration of drainage operation is assumed to be within 5 days. • After that, water remaining at the bottom of the inlet shaft is drained into the tunnel by the suspended water drainage pump. • Lastly, the water remaining at the bottom of the outlet shaft is drained to the outlet river by the suspended water drainage pump.
	Ventilating and cleaning of tunnel	• Ventilation of tunnel is necessary before maintenance staff enter the tunnel. After securing enough concentration of Oxidant by forced ventilation, cleaning of tunnel can be started. • Garbage and sludge on the wall and invert of the tunnel are cleaned up manually or by using a high-pressure cleaning car.
	Removal of sediment and garbage from the tunnel	• Thrown garbage and sludge from the wall are collected into a drain ditch of the invert and transported to the outlet shaft through the ditch. • Liquids are drained out by the suspended water drainage pump, and solids are packed into a box or container, then picked out from the shaft by lifting equipment

Table 1-15: Maintenance Activities of the Proposed Parañaque Spillway during Normal Condition

Activity	Details of Work
Periodical cleaning and dredging along the lakeshore	• Cleaning and removal of floating garbage and water hyacinth along the lakeshore adjacent to the intake. • In case massive sediment deposition is observed in the area, they are removed by heavy equipment.
Removal of sediment in the intake facilitates	• In case massive sediment deposition is observed in the intake facility, they are removed by manpower or heavy equipment. Removed sediment is transported to the designated disposal area.
Inspection and measurement in Tunnel	• Ocular inspection is conducted through all tunnel area to check if there are deformations, cracks, and water leakages. • In case any abnormal condition is found, detailed measurement and investigation should be conducted to identify the reason, and countermeasures should be carried out as required.
Inspection and maintenance of civil structures and other facilities	• Ocular inspection is conducted for all civil structures. • Operational condition of drainage pumps, gates and other facilities should be confirmed. • In case any problem is found, repair and adjustment should be conducted as required, and reconfirm the structure's operational conditions.

1.6.4 Abandonment

85 The proposed project is not expected to be abandoned within the next 50 years of its planned operations.

1.7 MANPOWER REQUIREMENT

86 The specific details of each project phase with the manpower requirement are given in **Table 1-16**.

Table 1-16: Manpower Requirement per Project Phase

Project Phase	Estimated Manpower Requirements	Tasks to Perform	Skill Requirement/s
Construction	800 persons (peak period)	• Construction of Shield Tunnel, Vertical Shaft • Earthwork, Piling Works, Concrete Works • Mechanical & Electrical Works	Foreman, Tunneling Labor, Carpenter, Rebar Fixer, Rigger, Welder, Shield Machine Operator, Various Heavy Equipment Operators, Dump Truck Driver, etc.

Project Phase	Estimated Manpower Requirements	Tasks to Perform	Skill Requirement/s
Operation	30 persons	• Monitoring of lake water level • Gate opening and closing operations • Monitoring of Intake and Drainage Facilities • Ventilation, cleaning and sediment removal after spillway operation	Appropriate technical and skilled staff, Mechanical Engineer, Electrical Engineer
Abandonment	25 to 50	• Implement the abandonment plan	As required

1.8 PROJECT SCHEDULE AND TIMETABLE

87 The conduct of feasibility study and ECC application started during the 1st quarter of 2021 while detailed engineering design will start by 2nd quarter of 2022. As shown in **Table 1-17**, construction of the proposed spillway and support facilities will start during the 3rd quarter of 2023 and will end by 2030. Start of operation is expected to start in 2031.

Table 1-17: Proposed Project Schedule

Item	2021				2022				2023				2024				2025				2026	2027	2028	2029	2030	2031
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4						
1. ECC Application																										
2. Feasibility Study																										
3. Detailed Design																										
4. Land acquisition and resettlement																										
5. Construction																										
6. Operation																										

1.9 PROJECT COST

88 The indicative project cost for the proposed project is estimated at **Php ~90 Billion**. These will include the following:

- Detailed engineering studies and designs, including the feasibility study (FS) and acquisition of necessary government permits and licenses;
- Land acquisition and resettlement;
- Site preparation;
- Construction of the facilities;
- Procurement of necessary equipment and materials;
- Environmental management and protection;
- Environmental monitoring activities.

2 PRELIMINARY IDENTIFICATION OF KEY ENVIRONEMNTAL IMPACT

89 To address the potential environmental impacts of the proposed project, an environmental management plan (EMP) will be prepared. The EMP presents the proposed mitigation and/or enhancement measures that can be employed during the different phases of the project development. The initial key environmental impacts identified, and the corresponding mitigating measures are presented in **Table 2-1**.

Table 2-1: Initial Environmental Management Plan

Environmental Component	Environmental Impacts	Management and Mitigating Measures
LAND	Accumulation of construction debris and other solid waste	• Implementation of the solid waste management program by the contractor • Regularly transport of construction debris and other solid waste in the approved designated area by the DENR
	Generation hazardous wastes (used oil, busted bulbs)	• Implementation of hazardous waste management plan • Segregation of hazardous materials by waste type • Storage of wastes stored in sealed and labeled containers • Wastes are treated and disposed by DENR-EMB accredited transporters, haulers and treaters)
	Generation of excavated soil (~2.5 M m^3) from excavation and tunneling	• Provision of temporary storage on-site • Regularly haul excavated soil • Reuse excavated soil as backfill.
	Possible damage of nearby properties due to ground vibration during construction works of intake and discharge facilities	• Apply non-vibration and/or vibration-avoiding techniques during construction, if possible • Notify nearby residents about use of heavy equipment • Regularly monitor vibrations • For hauling trucks, comply with road weight limit standards to avoid ground vibration
	Slope failures, landslides and subsidence during tunneling activities	• Application of excavating techniques giving few or no impacts on landslide and surface conditions • Application of proper reinforcement of excavation and tunneling sections • Implementation of construction management plan and best engineering practices
WATER	Possible clogging of drainage due to siltation	• Regularly remove silt and sediments • Establishment of siltation ponds, silt traps and erosion barriers
	Generation of domestic wastewater from construction	• Follow basic housekeeping policies • Provision of sanitation facilities (i.e. portable toilets, showers, etc.)

Environmental Component	Environmental Impacts	Management and Mitigating Measures
	Potential impact on groundwater level	• Implementation of best engineering practices during construction • Installation of monitoring wells
	Effect on aquatic ecology of Manila Bay and LPPCHEA	• Conduct effluent diffusion analysis • Monitor water quality of Manila Bay
AIR	Generation of dust during construction	• Minimization of unnecessary earth-movement • Regularly water construction sites that will generate dust • Avoid long exposure of excavated soil piles to strong winds by applying canvass covers
	Generation of air emissions & noise during construction	• Implementation of proper and regular maintenance of heavy equipment and vehicles • Perform noisy activities during daytime
PEOPLE	Increased occupational safety and health risks during construction	• All personnel are required to wear proper PPE • All civil and electro-mechanical works will be supervised by trained engineers • First-aid stations, safety equipment and signage shall be made available on working areas
	Generation of employment, taxes and additional income	• Prioritize hiring of qualified residents of the host communities • Prioritize purchasing of local items, if applicable, within the host communities
	Relocation of informal settlers in the intake and drainage facility	• Develop Resettlement Action Plan • Provision of compensation to affected households based on RA No. 10752 and DPWH LARRIP
	Acquisition of ROW in the private properties in the intake facility	• Development of Resettlement Action Plan • Provision of compensation to affected establishments based on RA No. 10752
	Acquisition of ROW in the private properties if tunnel depth is not more than 50 meters below surface	• Provision of compensation to affected establishments based on RA No. 10752
	Generation of traffic during construction	• Provision of early warning devices/road signs • Provision of parking spaces within project site • Implementation of Traffic Management Plan • Coordination with the concerned LGU offices

3 INFORMATION AND EDUCATION CAMPAIGN

90 As stipulated in the DENR Administrative Order No. 2017-15 (Guidelines on Public Participation under the Philippine Environmental Impact Statement System), at the onset of the environmental impact assessment (EIA) process, early involvement of stakeholders must be initiated before the scoping through the conduct of information and education campaign (IEC).

91 **DPWH** invited the following stakeholder groups for the IEC:

- **City Local Government Units (LGUs):**
  i. Muntinlupa City
  ii. Parañaque City
  iii. Las Piñas City
  iv. Bacoor City
- **Barangay LGUs & Homeowners' Associations (HOAs):**
  i. Brgy. Buli, Muntinlupa City
  ii. Brgy. Sucat, Muntinlupa City
  iii. Brgy. B.F. Homes, Parañaque City
    1. BF Federation Homeowner Associations, Inc.
    2. B.F. Homes Subpres
  iv. Brgy. San Isidro, Parañaque City
  v. Brgy. B.F. International Village, Las Piñas City
    1. Phase 1 HOA
    2. Cub HOA
    3. Patola HOA
  vi. Brgy. Pulang Lupa Uno, Las Piñas City
    1. Santos Homes 2 HOA
    2. Perpetual Village HOA
  vii. Brgy. Pulang Lupa Dos, Las Piñas City
    1. Las Piñas Royale Estates HOA
    2. Vergonville HOA
    3. St. Joseph HOA
  viii. Brgy. Zapote, Las Piñas City
  ix. Brgy. Zapote V, Bacoor City
- **National Government Agencies (NGAs):**
  i. DENR NCR
  ii. DENR Region IV-A
  iii. DENR Biodiversity Management Bureau (BMB)
  iv. DENR Manila Bay Coordinating Office (MBCO)
  v. Laguna Lake Development Authority (LLDA)
  vi. EMB Central Office
- **Non-Governmental Organizations (NGOs):**
  i. Society for the Conservation of Philippine Wetlands
  ii. Wetlands International Philippines Program
  iii. Samahang Mandaragat ng San Rafael (Brgy. Zapote V, Bacoor City)

92 With the limitations of face-to-face meetings due to the current COVID-19 pandemic situation, the IEC activities were conducted online via zoom.us. The schedule of the IEC activities conducted and the number of participants that attended are summarized in the table below. The IEC documentation report is attached as **Annex 1**.

Table 3-1: Schedule of IEC Activities and Number of Participants

STAKEHOLDER GROUP	DATE & TIME	MALE PARTICIPANTS	FEMALE PARTICIPANTS	TOTAL PARTICIPANTS
A. City LGUs	22 April 2021 10:00-12:00NN	22	8	**30**
B. Barangay LGUs	22 April 2021 1:30-3:30PM	11	3	**14**
C. NGAs	23 April 2021 10:00-12:00NN	11	10	**21**
D. NGOs	23 April 2021 1:30-3:30PM	10	9	**19**
E. Barangay LGUs of Muntinlupa City	14 September 2021 1:30-3:30PM	13	8	**21**
F. Barangay LGUs of Parañaque City	15 September 2021 1:30-3:30PM	14	7	**21**
G. Barangay LGUs of Las Piñas	16 September 2021 1:30-3:30PM	11	8	**19**
H. Barangay LGU of Bacoor City	20 September 2021 1:30-3:30PM	8	3	**12**
I. NGAs (2nd Round)	21 September 2021 1:30-3:30PM	16	11	**27**
J. EMB Central Office	30 September 2021 1:30-3:30PM	9	4	**13**
TOTAL		**125**	**71**	**196**