ENVIRONMENTAL PERFORMANCE REPORT AND MANAGEMENT PLAN (EPRMP) FOR NORTH SOUTH COMMUTER RAIL (NSCR) PROJECT

VOLUME I

MAIN REPORT
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Department of Transportation and Communications (DOTC)

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LIST OF ABBREVIATIONS

AQSS	Air Quality Sampling Station
BCDA	Bases Conversion Development Authority
BMW	Bulacan Metro Warehouse
BOD	Biochemical Oxygen Demand
Brgy.	Barangay
BSWM	Bureau of Soils and Water Management
CAMANAVA	Caloocan, Malabon, Navotas, Valenzuela
CBTC	(Track Circuit System)
CCC	Climate Change Commission
CCTV	Closed-circuit Television
CIA	Clark International Airport
CIBE	Commercial, Industrial/Institutional, Businesses Enterprise
CLUP	Comprehensive Land Use Plan
CO	carbon monoxide
COD	Chemical Oxygen Demand
COPD	chronic obstructive pulmonary disease
CPH	Census of Population and Housing
CTC	Centralized Train Control
DA	Department of Agriculture
DAO	DENR Administrative Order
dB	Decibel
dBA	A-weighted decibel
DENR	Department of Environment and Natural Resources
DO	Dissolved Oxygen
DOE	Department of Energy
DOST	Department of Science and Technology
DOTC	Department of Transportation and Communications
ECC	Environmental Compliance Certificate
EDSA	Epifanio delos Santos Avenue
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EMB	Environmental Management Bureau
EMoP	Environmental Monitoring Plan
EMU	Electric Multiple Unit
EPRMP	Environmental Performance Report and Management Plan
ERP	Emergency Response Plan
F/S	Feasibility Study
FTI	Food Terminal Inc.
GHG	Greenhouse gases
GFIS	Green Framework of Innovative Strategy
GOP	Government of Philippines
HC	Hydrocarbons
IEC	Information, Education and Communication
ICETT	International Center for Environmental Technology Transfer
JICA	Japan International Cooperation Agency
Kph	km per hour
LARRIP	Land Acquisition, Resettlement, Rehabilitation and Indigenous Peoples' Policy
LGU	Local Government Unit
MBAS	Methylene Blue Active Substances
MERALCO	Manila Electric Company
MMDA	Metro Manila Development Authority

MMI	Modified Mercalli Intensity Scale
MPN	Most Probable Number
mps	Meters per second
MWSS	Metropolitan Waterworks and Sewerage System
NAAQGV	National Ambient Air Quality Guideline Value
NAAQS	National Ambient Air Quality Standards
NAIA	Ninoy Aquino international Airport
NCR	National Capital Region
NDRRMC	National Disaster Risk Reduction Management Council
NGCP	National Grid Corp. of the Philippines
NFA	National Food Authority
NFSCC	National Framework Strategy on Climate Change
NLEX	North Luzon Expressway
NLSS	Noise Level Sampling Station
NMTT	Navotas-Malabon-Tenejeros-Tullahan
NPCC	National Pollution Control Commission
NSCR	North South Commuter Rail
NSO	National Statistics Office
PA	Protected Area
PABX	Private Automatic Branch Exchange
PAGASA	Philippine Atmospheric, Geophysical and Astronomical Services
PAP	Project Affected Person
PAR	Philippine Area of Responsibility
PCO	Pollution Control Officer
PEIS	PHILVOCS Earthquake Intensity Scale
PM	Particle Matter
PPE	Personal Protective Equipment
PHIVOLCS	Philippine Institute of Volcanology and Seismology
PNR	Philippine National Railway
Pphpd	Persons per hour per direction
RAP	Resettlement Action Plan
ROW	Right of Way
SCADA	Supervisory Control and Data Acquisition
TSS	Total Suspended Solids
TSP	Total Suspended Particles
UDHA	Urban Development and Housing Act
WQSR	Water Quality Status Report

PROJECT INFORMATION

Basic Project Information

Name of Project:	North South Commuter Rail Project
Location:	• Malolos, Bulacan to Caloocan (With 2 ECCs) • Caloocan to Tutuban (This Application)
Nature of Project:	Major infrastructure, elevated commuter railway line with 10 stations from Malolos to Tutuban.
Length of Project	Malolos, Bulacan to Tutuban = 37.9 km

Proponent Profile

Proponent:	Department of Transportation and Communications (DOTC)
Contact Person:	Deo Leo N. Manalo, Director for Project Development Service
Address:	The Columbia Tower, Ortigas Avenue, Barangay Wack-wack, Mandaluyong City 1555
Contact numbers:	Trunk line (632) 727-7960 to 69 Direct line (632) 726-3493

Brief Profile of Proponent:

The Department of Transportation and Communications (DOTC) is the primary government agency that provides the policy, planning, implementation, promotion, development and regulation of the country's network of transportation, which covers the road, rail, air, and water, and communications systems, as well as in the fast, safe, efficient and reliable transportation and communications services.

EXECUTIVE SUMMARY

The Executive Summary provides a synopsis of the Environmental Performance Report and Management Plan (EPRMP) for the proposed North-South Commuter Rail (NSCR) Project, highlighting the Project Fact Sheet, brief Project Description, Process Documentation of the conduct of Environmental Impact Assessment (EIA), and the Summary of Baseline Characterization Key Environmental Impacts and Management Plan, and Monitoring Plan.

Project Description

The proposed NSCR Project will run from Malolos City in Bulacan Province to Tutuban, in Tondo, Manila, passing through 9 cities and municipalities of Bulacan and Metro Manila, using the Philippine National Railway (PNR) right of way (ROW). Its total length is 37.9 kilometers, and there will be 10 stations throughout the section, with one depot area in Valenzuela City. The structures (railway line and stations) will be elevated viaducts, with at grade embankments at the depot area.

The stations will have uniform platform width of 8 meters, with elevators and stairs for passenger vertical movement from the street to the concourse. The maintenance depot will have an area of 13.822 hectares and will house the main workshop, stabling yard, and the operations control center.

The current NSCR project which is the subject of this EPRMP has no substantial difference with the previous project of Northrail, except for the source of funding and proponent status. For this NSCR project, funding is sought from the Japan International Cooperation Agency (JICA), and the proponent will be the Department of Transportation and Communication.

Environmental Impact Assessment (EIA) Process

The EIA Process was carried out following Terms of Reference agreed with the JICA. It was also guided by the DENR Administrative Order No. 30 of 2003 or the Implementing Rules and Regulations of Presidential Decree No. 1586, establishing the Philippine Environmental Impact Statement System.

Apart from the primary and secondary data collection on the baseline environmental conditions along the study corridor, the views of the stakeholders were considered in the EIA study. DOTC, together with JICA Study Team, launched a total of 32 consultation meetings with stakeholders that included city and barangay officials, other government agencies (including the Environmental Management Bureau), project affected families and their representatives, vendors, and other community members, for the 10cities/municipalities along the NSCR alignment. The public consultation has allowed the proponent to give the community a better understanding of the planning of the Project and site-specific factors and constraints that have to be taken into account of in selecting the preferred alignment and design of the Project.

Environmental Impact Assessment and Mitigating Measures

A summary of the findings of the EIA study based on the collection of data on baseline environmental conditions along the alignment, identification, prediction and assessment of

impacts and establishment of corresponding mitigation measures, are presented in the succeeding table.

Environmental Monitoring Plan

An Environmental Monitoring Plan will be implemented to check the effectiveness of the recommended mitigation measures and compliance with relevant regulatory requirements. The proposed monitoring requirements include trees to be cut, social preparation such as Right-Of-Way (ROW) acquisition and resettlement of Project Affected Persons (PAPs) during the pre-construction stage. In addition, monitoring of solid wastes, ground subsidence, air quality, noise and vibration, water quality and tree balling and relocation, at designated monitoring stations during the construction phase. Likewise, solid wastes, ground subsidence, status of restored wetland and replanting trees, noise and vibration, wastewater effluent from depot will be monitored during the operation phase. Regular site inspections of structures will also be done as part of monitoring for signs of poor maintenance conditions (Table 7).

Background Note of Previous Northrail Project Environmental Compliance Certificates (ECC)

The original Northrail Project was conceived by the Bases Conversion Development Authority (BCDA) through its establishment of the North Luzon Railway Corporation (NLRC), which was created to spearhead the reactivation of the rail service north of Metro Manila which has long been abandoned by the Philippine National Railway (PNR).

The Northrail Project was divided into 4 phases, Phase I of which was the Clark Special Economic Zone to Caloocan City. Phase I was planned to have two sections:

Section 1 – Malolos to Caloocan

Section 2 – Clark to Malolos

Section 1 was supposed to have been constructed first because it was completely along the PNR ROW, had a viable ridership potential, and travel demand was not dependent on the opening of the Diosdado Macapagal International Airport (DMIA) in Clark. It was initially conceived to provide commuter service from Caloocan to Malolos with stations at Valenzuela, Marilao, Bocaue and Guiguinto.

For the Northrail Project, the DENR EMB has issued two ECCs for Phase I. The first ECC was issued for the Clark to Valenzuela section: ECC 9907-036-120D dated November 11, 2000 (Annex A) and the second ECC was issued for the Valenzuela to Caloocan section: ECC 0706-014-7110 dated December 18, 2007 (Annex B). These ECCs were issued to NLRC as project proponent.

The Northrail Project as described above however is not implemented due to issues with the funding agency and NLRC.

In 2013, the DOTC revived the Northrail Project as NSCR with Technical Assistance from JICA.

On 18 Jul. 2013, DOTC discussed with DENR-EMB the environmental considerations for NSCR (Phase 1: Malolos – Caloocan), and DOTC explained that the project outline of NSCR project is the same as the Northrail Project.

In his letter to DOTC dated 28 November 2013 (Annex C), former EMB Director, Atty. Juan Miguel Cuna confirmed the validity of the said ECCs, issued for the Manila-Clark Rapid Railway System, to be applicable for the same project, now called North South Commuter Railway (NSCR) Project.

With the JICA Study Team currently conducting the Feasibility Study for the NSCR Project, discussions were done with the Environmental Management Bureau for the updating of the ECCs previously validated by EMB, consolidating these 2 ECCs into a single ECC, with the addition of the Caloocan to Tutuban segment. The EMB has advised the JICA Study Team to apply for an update of the ECC from Malolos to Tutuban, by conducting an EIA to complete an Environmental Performance Report and Management Plan (EPRMP) for the entire Malolos to Tutuban section. The EIA will focus on the Caloocan to Tutuban segment, while updating and validating the previous EIA done for the Caloocan to Malolos segment.

This EMB advice was in accordance with the recent EMB Memorandum Circular No. 2014-005 dated July 07, 2014, which categorized the NSCR project as Category A (Environmentally Critical Projects), sub-categorized as A-2 (Existing and to be expanded, modified and/or rehabilitated), single project. This requires the submission of an Environmental Performance Report and Management Plan (EPRMP) provided that the monitoring data for the Valenzuela to Caloocan ECC is available. The processing and decision will be done at the EMB Central Office level.

Table 1. An Illustration of the NSCR Segments With And Without ECCs Previously Issued

Section		Clark- Malolos	Malolos - Valenzuela	Valenzuela – Caloocan	Caloocan – Tutuban
ECCs	Present	ECC 2000		ECC 2007	None
	After application	Void	← **Integrated ECC 2015** →		
Required EIA documents to be submitted to EMB			EPRMP		

Source: JICA Study Team

DESCRIPTION OF THE PROJECT'S EIA PROCESS

I. TERMS OF REFERENCE OF THE EIA STUDY

The Environmental Impact Assessment (EIA) Study was commissioned by the JICA Study Team in coordination with the Department of Transportation and Communications (DOTC). The scope of the study covers the alignment of North-South Commuter Rail Project.

The objectives of the Study were the following:

1) To review the existing documents such as the Environmental Compliance Certificate (ECC) and Environmental Impact Statement (EIS) for the former Northrail Project (Phase I Section 1);
2) To collect information and carry out the surveys which are needed to prepare the EIA report;
3) To predict and assess the impacts on natural and social environment;
4) To draw up the mitigation measures and monitoring plans;
5) To prepare the materials for the stakeholder consultation meetings hold by DOTC, and attend the meetings to assist DOTC and JICA Study Team.

II. THE EIA TEAM

1.1 Two consulting firms were hired to conduct the EIA. Delta Tierra Consultants, Inc. is a private consulting firm that provides environmental, energy and sustainability solutions to various industry sectors and public and private institutions. The firm conducted the EIA for the Malolos to Caloocan segment.

1.2 Ecosys Incorporated is also a qualified consulting firm specializing in environmental impact studies, environmental management and monitoring, and resettlement action planning and monitoring. Ecosys was engaged to conduct the EIA for the Caloocan to Tutuban segment.

Consultant	Address
Engr. Angelica A. Celicious Team Leader – Malolos to Caloocan	Delta Tierra Consultants, Inc. 514-1B Palmdale Heights Condominium 8505 Hon. A. Sandoval Avenue Pinagbuhatan, Pasig City Metro Manila
Annabelle Herrera Team Leader – Caloocan to Tutuban	Ecosys Incorporated Jocfer Building Commonwealth Avenue Diliman, Quezon City Metro Manila

III. EIA STUDY SCHEDULE

3.1 Malolos to Caloocan

The Malolos to Caloocan segment EIA was conducted from September 2013 to May 2014

Table 2 presents the completed activities for the EIA study to the Malolos to Caloocan segment.

Table 2. Completed Activities of the EIA Study for Malolos and Caloocan

Activity	Areas Covered	Date Covered
The Land		
Site survey	The entire NSCR alignment covering the PNR right of way (ROW) from Caloocan to Malolos	Sept 10 – 20, 2013
Soil sampling	Sampling was conducted at the old garbage disposal site near Meycauayan River	Sept 18, 2013
Flora and fauna survey	Along the PNR ROW from Caloocan to Malolos, with emphasis at the proposed stations in the following areas: • Guiguinto • Bocaue • Marilao • Valenzuela	Sept 18-20, Oct 19 and Oct 24-25,2013
Vibration measurement	Along the PNR ROW at the following areas: • Guiguinto • Valenzuela • Caloocan	Sept 17-18, 2013
The Water		
River water quality sampling	At rivers crossing the PNR ROW at the following areas: • Guiguinto • Balagtas • Bocaue • Marilao • Meycauayan • Malabon (Tullahan) • Valenzuela	Sept 17-18, 2013
The Air/ Noise		
Ambient air quality sampling	Along the PNR ROW in the following areas: • Guiguinto • Valenzuela • Caloocan	Sept 17-23, 2013
Noise measurement	Along the PNR ROW in the following areas: • Guiguinto • Valenzuela • Caloocan	Sept 17-23, 2013
The People		
1st Round of Stakeholders	For Environmental and Social Considerations	Aug 27 – Sept 4, 2013

Activity	Areas Covered	Date Covered
consultation meetings		
2nd Round of Stakeholders consultation meeting	For Environmental and Social Considerations	Nov 11-13, 2013

Source: JICA Study Team

3.2 Caloocan to Tutuban

The Caloocan to Tutuban segment EIA was conducted from November 2014 to March 2015. Table 3 presents the completed activities for the EIA study to the Caloocan to Tutuban segment

Table 3. Completed Activities of the EIA Study for Manila and Caloocan

Activity	Areas Covered	Date Covered
The Land		
Site survey	The entire NSCR alignment covering the PNR right of way (ROW) from Caloocan to Tutuban	Nov 26, 2014
Flora and fauna survey	Along the PNR ROW from Caloocan to Tutuban	Dec 26-29 2014
The Water		
Water quality sampling	At Estero de Maypajo	Jan 14 2015
The Air/ Noise/Vibration		
Ambient air quality sampling	At Caloocan and Tutuban	Dec 26-27 2014
Noise measurement	At Caloocan and Tutuban	Jan 27-29, 2015
Vibration measurement	At Caloocan and Solis	Jan 27-29 2015
The People		
1st Round of Stakeholders consultation meetings	For Environmental and Social Considerations	December 8-20, 2014
2nd Round of Stakeholders consultation meeting	For Environmental and Social Considerations	February 7, 2015

Source: JICA Study Team

IV. EIA METHODOLOGY

Secondary Data Gathered and Sources

The secondary data and information on the baseline environmental conditions for land, water, air, and people of the 10 cities and municipalities along the alignment of the NSCR Project from Malolos to Tutuban were collected from the following sources: (1) Comprehensive Land Use Plans (CLUP) of Manila, Caloocan, Malabon, Valenzuela,

Meycauayan, Marilao, Bocaue, Balagtas, Guiguinto and Malolos; (2) Mines and Geosciences Bureau (MGB); (3) Bureau of Soils and Water Management; (4) Philippine Institute of Volcanology and Seismology (PHIVOLCS); and (5) Philippine Atmospheric, Geophysical and Astronomical Services (PAGASA).

Other secondary information was sourced from published documents and literatures from previous studies conducted, and from the internet.

Project component and description, and other relevant data on the details of the Project were provided by the DOTC and the JICA Study Team for the NSCR Project.

Primary/Baseline Data

Primary data were obtained through ocular site inspection along the alignment to validate the secondary data and evaluate the existing environmental conditions. Field surveys and sampling/measurement at pre-identified locations were also conducted as shown in the conducted activities presented in Table 2 and Table 3.

Identification, Prediction and Assessment of Impacts

Potential impacts were identified based on description of project activities, its environmental aspects, and the existing condition of the environment or receptors that are susceptible to impacts. The identified impacts were evaluated in terms of the effects that will be encountered by the receptors, both the environment and people.

In reference to the established baseline environmental conditions, predicted and forecasted impacts will be evaluated against the Philippine and international standards. Table 4 shows the reference criteria/standards of environmental quality and natural environment used for evaluating the identified impacts.

Table 4. Criteria/Standard of Environmental Quality and Natural Environment

Criteria/ Standards	Philippine	International
Ambient air quality	National Ambient Air Quality Guideline Values, "Implementing Rules and Regulations of the Philippine Clean Air Act of 1999"	N/A
Noise	The National Pollution Control Commission (NPCC) Memorandum Circular No. 002 Series of 1980, Section 78- Ambient Noise Quality and Emission Standards for Noise	N/A
Vibration	N/A	Technology and Laws Regulation for Pollution Control, 2000", Japan Environmental Management Association for Industry
Water Quality	DENR Administrative Order (DAO) No. 34: Revised Water Usage and Classification of 1990 for Fresh Surface Water, Class C.	N/A
Soil	N/A	Environmental Standards for Soil Pollution in Japan

Criteria/ Standards	Philippine	International
		Dutch Standards of Reference Values for Soil German Federal Soil Protection and contaminated Site Ordinance
Flora and Fauna	DAO No. 2004-15, Establishing the National List of Threatened Philippine Plants and Their Categories, and the List of Other Wildlife Species.	International Union for the Conservation of Nature and Natural Resources (IUCN) Red List

Source: JICA Study Team

The severity of the identified impacts was assessed and rated according to the following:

Assessment	Criteria
High Adverse	Impact is a major problem. An accepted limit or standard may be exceeded or large magnitude impacts occur to highly valued/ sensitive receptors. Extensive disturbance to current resources resulting in some minor human health effects upon nearby residents and businesses. Considerable permanent adverse disturbance of ecology due to contamination over a local scale. Mitigation measures and detailed design work are unlikely to remove all of the significant effects.
Moderate Adverse	Adverse change resulting in some loss or permanent lowering of resources, though no impact upon human health. Loss and permanent damage to ecology on a local scale. Some recovery is anticipated following completion of the works concerned. Mitigation measures are anticipated to alleviate close to all impacts.
Low Adverse	An effect will be experienced, but the impact magnitude is sufficiently small and well within accepted standards. Limited or temporary effects resulting in low levels of disturbance or loss to local resources or ecology. No impact upon human health. Close to full recovery is anticipated following completion of the works concerned. Mitigation measures are anticipated to alleviate close to all impacts.
Negligible	The receiving environment will not be affected in any way by a particular activity. No appreciable impacts upon local resources, human health or ecology. Effects are within normal bounds of variation.
Beneficial	Impact provides major improvement to the existing environment or major enhancement to the current condition. These can include measures to improve social values, resources, ecological health and long-term protection of ecological functions.

Source: JICA Study Team

V. PUBLIC PARTICIPATION

For the Malolos to Caloocan segment, a total of eighteen (18) stakeholders' consultation meeting was conducted for the cities/municipalities along the alignment. Table 5 shows the schedules of the conducted stakeholders' consultation meetings for the 8 cities and municipalities along the NSCR alignment for this segment.

Table 5. Schedule of the Stakeholders Consultations conducted along the alignment from Malolos to Caloocan

Date and Time	Venue	Target Affected Cities and Municipalities	Main Participants	No. of Participants
EIA (Public Scoping)				
August 27, 2013, 1:30 pm -4:30pm	Finance Building, City Hall of Valenzuela, Valenzuela City	Malabon and Valenzuela	LGUs (Valenzuela and Malabon, and Barangays), PCUP, DPWH, DOTC, Northrail, PNR, DPWH, Chamber of Commerce and Industry of Valenzuela, NGOs)	29
August 29, 2013, 1:30pm – 4:30pm	3rd Floor Function Room, Bulwagan, Caloocan City	Caloocan	LGUs (City and Barangays), PCUP, DOTC, Northrail, NGOs	38
September 3, 2013, 1:30pm – 4:30pm	Hiyas Convention Center, Malolos, Bulacan	Malolos, Guiguinto and Balagtas	LGUs (Province, City and Barangays), PCUP, DOTC, Northrail, NGOs	34
September 4, 2013, 1:30pm – 4:30pm	3rd Floor Function Room, Bulwagan, Caloocan City	Caloocan	LGUs (Province, City and Barangays), PCUP, DOTC, Northrail, NGOs	38
RAP Survey				
October 7, 2013 1:30pm – 4:30pm	Hiyas Convention Center, Malolos, Bulacan	Malolos, Guiguinto, and Balagtas	PAPs, LGUs (Municipalities and Barangays), PCUP, Northrail, DPWH, Business entities	31
October 8, 2013, 1:30pm – 4:30pm	Marilao Convention Center, Marilao, Bulacan	Bocaue and Marilao	PAPs, LGUs (Municipalities and Barangays), PCUP, Northrail	18
October 9, 2013, 1:30pm – 4:30pm	AVR Legislative Bldg, City Hall of Valenzuela, Valenzuela City	Valenzuela and Meycauyan	PAPs, LGUs (Municipalities and Barangays), Northrail	25
EIA & RAP (Survey Result)				
November 11, 2013 1:30pm – 4:30pm	Marilao Convention Center, Marilao, Bulacan	Bocaue and Marilao	PAPs, LGUs (Bulacan Province, Municipalities and Barangays), NHA, Northrail	56
November 12, 2013 1:30pm – 4:30pm	AVR Legislative Bldg, City Hall of Valenzuela, Valenzuela City	Valenzuela and Meycauyan	PAPs, LGUs (Municipalities and Barangays), PCUP, Northrail	62
November 13, 2013 1:30pm – 4:30pm	Hiyas Convention Center, Malolos, Bulacan	Malolos, Guiguinto, and Balagtas	PAPs, LGUs (Municipalities and Barangays), Northrail, PCUP	55
Draft RAP (Compensation Policy)				

Date and Time	Venue	Target Affected Cities and Municipalities	Main Participants	No. of Participants
February 5, 2014 1:30 pm -4:00pm	Hiyas ng Bulacan Convention Center, Provincial Capitol Compound, Malolos	Malolos, Guiguinto and Balagtas	PAPs, LGUs (Municipalities and Barangays) , DPWH, DSWD, NHA, Northrail, PNR, PCUP	65
February 6, 2014 1:30pm-4:00pm	Marilao Guillermo Convention Center, Marilao, Bulacan	Marilao	PAPs, LGUs (Municipalities and Barangays), NHA	303
February 7, 2014 1:30 pm4:30pm	Marilao Guillermo Convention Center, Marilao, Bulacan	Bocaue	PAPs, LGUs (Barangays)	240
March 6, 2014, 1:40-4:00pm	AVR Legislative Bldg, City Hall of Valenzuela, Valenzuela City	Valenzuela andMeycauyan	PAPs, LGUs (City and Barangays), NHA,DPWH, MNTC and DSWD	72
Draft RAP (Relocation Sites)				
March 31, 2014 1:30-pm 4:00pm	AVR Room B, Legislative Building, Valenzuela City Hall	Valenzuela City, Barangay Malhacan, Meycauayan, Bulacan	PAPs, LGUs (Municipalities and Barangays), DOTC PCUP, NHA	170
April 1, 2014 1:30pm -5:00pm	Hiyasng Bulacan Convention Center, Provincial Capitol Compound, Malolos	Malolos, Guiguinto and Balagtas	PAPs, LGUs (Municipalities and Barangays), DOTC, NHA, PCUP, Northrail,	42
April 2, 2014 1:30pm -5:00pm	Casa Elum Pavilion and Resort, Barrio Patubig, Marilao	Marilao	PAPs, LGUs (Barangays), Northrail, PCUP, NHA	173
April 3, 2014 1:30pm -5:00pm		Bocaue	PAPs, LGUs (Barangays), PCUP, NHA	75

Source: JICA Study Team

For the Caloocan to Tutuban segment, a total of six (6) IEC (Information, Education and Communication) activities and eight (8) stakeholder consultation meetings were held as shown in Table 6.

Table 6. Schedule of the IEC Activities and Stakeholders Consultations conducted along the alignment from Caloocan to Tutuban

Date and Time	Venue	Target Affected Cities and Municipalities	Main Participants	No. of Participants
IEC Activities				
November 19, 2014, 2:00pm -4:00pm	City Engineer's Office, Manila City Hall, Manila	Manila	LGUs (Manila Building Officer, Drafting and Survey Division), DOTC	6
December 2, 2014, 1:00pm -4:00 pm	Caloocan City Hall, Caloocan	Caloocan	LGUs (Barangay), DOTC	5
December 4, 2014, 9:00am-12:00nn	EMB, Visayas Avenue, Quezon City	Technical Scoping with EMB	EMB, DOTC, ECOSYSCORP, INC.	13
December 9, 2014, 3:00pm-4:00pm	Mayor's Office, Caloocan City Hall, Caloocan	Caloocan	LGUs (Mayor, City Administrator, City Assessor, Urban Poor Affairs Office Head), DOTC	7
January 14, 2015, 9:00am-11:00am	National Housing Authority, Elliptical Road, Quezon City	Manila and Caloocan	National Housing Authority (National Capital Region)	10
January 20, 2015, 9:00am-11:00am	National Historical Commission of the Philippines, Manila	Manila and Caloocan	National Historical Commission of the Philippines (NHCP)	8
EIA & RAP (Public Scoping)				
November 27, 2014, 1:00pm -4:00 pm	PNR Office, Tutuban, Manila	Manila	LGUs (Barangay officials), DOTC, PNR, PCUP, MNTC	63
December 8, 2014, 9:00am-11:00am	Barangay 186, Manila	Manila	PAPs (homeowner's association) and LGUs (Barangay 186, Zone 16, Tondo)	5
December 11, 2014, 2:00pm-4:00pm	Back Conference Room, Caloocan City Hall	Caloocan	LGUs (Barangay Officials), PAPs	43
December 13, 2014, 9:00 am- 11:00am	Barangay 204, Manila	Manila	PAPs (homeowner's association) and LGUs (Barangay 204, Zone 18, Tondo)	12
December 13, 2014, 1:00pm-3:00pm	Barangay 186, Manila	Manila	PAPs (homeowner's association) and LGUs (Barangay 186, Zone 16, Tondo)	37
December 20, 2014, 9:00am-11:00am	Barangay 15, Caloocan	Caloocan	LGUs (Barangay Officials) and PAPs (vendors) along Barangay 15	34
EIA & RAP (Survey Results)				
February 7, 2015,	Covered Court,	Manila	LGUs (Barangay Officials)	87

Date and Time	Venue	Target Affected Cities and Municipalities	Main Participants	No. of Participants
9:00am-11:00am	Barangay 204, Zone 18, Tondo, Manila		and PAPs in Barangay 204 (officials of homeowners associations, residents), DOTC	
February 7, 2015, 2:00pm-4:00pm	Barangay Hall, Barangay 15, Zone 2, Caloocan City	Caloocan	LGUs Barangay Officials) and PAPs in Barangay 15 (vendors), DOTC	54

Source: JICA Study Team

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SUMMARY OF ALTERNATIVES

Without project
There is no mass transit service to connect Metro Manila with the adjacent northern and southern cities and municipalities outside of the metropolis. PNR trains operate only from Calamba to Tutuban, and with the expansion of residential and urban development north of Metro Manila, there is a pressing need to provide mass transit system for the faster movement of people and goods to and from the metropolis.

With project

a) Comparative analysis of route plan

ROW alternatives
Option 1: Use of PNR ROW and Northrail
Northrail has cleared the PNR railway ROW of informal settlements and encroachments, which remains unused, from Malolos to Tutuban. With some adjustments, NSCR can use this route. However, at a certain section of the railway, NSCR will run parallel with Segment 10 of DPWJH, thus adjustments will have to be made.

Option 2: Use of road ROW of NLEX and Quezon Avenue
From Malolos to Guiguinto, the NSCR proposes to use the Northrail ROW, then from Guiguinto to NLEX, then runs thru NLEX until the NLEX exit, from thence to use the Quezon Ave ROW from the Quezon memorial circle.

Table 7. Comparison of ROW alternatives are summarized as follows

	Option1	Option 2
Social		
Involuntary resettlement	About 300 affected households	No involuntary resettlement at NLEX portion
	At segment 10 portion about 1,000 affected households	From NLEX to Mindanao Ave portion, about 2,000 affected households
Historical/cultural	Old PNR stations to be preserved	No sites affected
Natural		
Protected areas	No Pas	Quezon Memorial National Park

Land alteration	Minimal land alteration due to few access roads	Temporary land alteration at swamp areas
Flood risk	Lower flood risk	Higher flood risk due to swampy areas
Pollution		
Noise and vibration	Will cause nuisance to residential areas	Will cause nuisance to residential areas
Water quality	Low risk of water quality deterioration	Deterioration of swamp due to suspended solids from construction sites

Source: JICA Study Team

b) Comparative analysis of depot location

Two proposed sites are in Valenzuela and Marilao.

Table 8. Comparison of Proposed Sites in Valenzuela and Marilao

	Valenzuela	**Marilao**
Social		
Land use	Unused land with small wetland	Agricultural land
Land acquisition	Lease from NFA	Land acquisition required
Involuntary resettlement	20 ISF to be relocated	100 ISF to be relocated
Natural		
Protected areas	No PAs	No PAs
Land alteration	Loss of wetland	Loss of agricultural land
Flood risk	Lower flood risk	Higher flood risk due to swampy areas
Pollution		
Noise and vibration	Will cause nuisance to residential areas	None
Water quality	Low risk of water quality deterioration	Deterioration of small creek due to suspended solids from construction sites

Source: JICA Study Team

c) Comparative analysis of structure type

Three options are as follows:
Option 1: At grade including embankment
Option 2: Elevated viaducts
Option 3: Underground

Table 9. Comparison of Options for Structure Type

	Option1	**Option 2**	**Option 3**
Construction cost	Lowest cost	Lower cost than underground	Very high cost
Row width	Additional row needed	Land acquisition for stations entrances and exits	Land acquisition for stations entrances and exits and ventilation shafts

Construction period	Shorter construction period	Shorter construction period than underground	Long construction period
Measures for flooding	Need for additional drainage system to minimize flooding	No measures required	Drainage system, pumping systems, floodgates required
Operation and maintenance	Easy due to access	Easy due to access	Difficult due to underground access
Disaster prevention	Safe; easier to take countermeasures	Safe; easy to take countermeasures	Fire in tunnel will cause big disaster
Ground subsidence	Possible in soft soil areas	Not likely	Possible during construction of TBM
Earthquake	Embankment designed for earthquake loads	Viaduct designed for earthquake loads	Not susceptible to earthquakes but must be designed for earthquake loads
Land acquisition	Additional row need will cause involuntary resettlement	Additional row need will cause involuntary resettlement	Land acquisition less required
Community severance	May cause physical and social barrier to neighborhoods	No community severance	No community severance
Noise inside train	Little noise	Little noise	Much noise
Noise outside train	Noise will occur but noise barriers will mitigate noise	Noise will occur but noise barriers will mitigate noise	No noise along railway
Landscape	Design Shape of structures to consider landscape	Design Shape of structures to consider landscape	No influence
Safety	Need for level crossing; accidents and congestion are expected	No level crossing	No level crossing
Overall evaluation	Lowest cost; recommended for non-flood prone areas and no crossings at main roads	Recommended for flood prone areas and many main roads crossings	Highest cost; however, not recommended since because NSCR will use PNR row.

Source: JICA Study Team

Table 10. Integrated Summary of Main Impacts and Mitigating Measures

Environmental Aspect	Impacts	Mitigating/ Enhancement Measures
PRE-CONSTRUCTION PHASE		
THE PEOPLE		
Involuntary Resettlement	• Displacement of residents and commercial establishments along the proposed alignment	• A Resettlement Action Plan (RAP) will be prepared to ensure that affected households are provided a proper relocation area and/or justly compensated.
Living conditions	• Improvement of living conditions	• A noted positive impact of the project is that the affected families may eventually be provided a guaranteed property ownership. • The project may also lead to improvement of living condition because the relocation areas are provided for with basic utilities such as power and water and health and educational facilities.
CONSTRUCTION PHASE		
THE LAND		
Soil contamination due to chemical spills	• Soil contamination due to leaks and spills of fuels, lubricants, solvents • Endangerment of health and safety of worker and community by exposure to hazards	• Establish and implement health and safety management plan and emergency and contingency plan in case of spills; and • Comply with environmental requirements for the storage, transport, treatment and handling of hazardous substances and wastes
Solid wastes from the construction workforce	• Land and water contamination; aesthetic impacts; spread of diseases	• Submission and implementation of Solid Waste Management Plan as part of contractors' engagement; • Provision of waste bins to avoid dispersal of litter and regular site maintenance duties; and • Regular collection, transportation and disposal of wastes to minimize the attraction of vermin, insects and pests
THE WATER		
Water Quality Demolition, excavation and bore piling activities	• Siltation and Water pollution	• Regular hauling of construction spoils and excavated materials to DENR-approved disposal site/s
Domestic wastewater generation	• Water Pollution	• Provision of portable toilets and garbage bins at the construction areas; • Regular disposal of wastes generated by the personnel to city approved disposal site/s; and • Conduct weekly inspection of the construction areas to ensure proper management of the wastes generated by the construction personnel

Fuel and oil leaks from vehicles and other equipment	• Pollution of receiving water bodies due to fuel and oil leaks from vehicles and other equipment eventually draining into the storm system	• Equipment and machinery should be regularly checked for fuel and oil leaks. • During repair of equipment and machinery, containers/ drip trays should be used to collect leakage; and • Any spilled or spent oil should be collected, stored properly and disposed by accredited waste haulers.(Washing of equipment and machineries along or anywhere near the waterways should be prohibited)
THE AIR		
• Earthmoving, demolition and earth-balling will generate dust and particulate matters • Operation of equipment, machineries and service vehicles will generate gas emissions	• Air Pollution	• Regular spraying of water at exposed and cleared construction areas; • Regular preventive maintenance of heavy equipment and service vehicle: and • Conduct regular hauling of construction spoils and excavated materials to DENR-approved disposal sites
	• Noise Pollution	• Installation of control devices such as mufflers and noise suppressors to all construction equipment; • Regular maintenance of heavy equipment, construction machinery; • Provision of temporary noise barriers such galvanized iron shields, particularly in noise-sensitive areas such as churches, schools, and hospitals in the immediate vicinity of the construction area; • Scheduling of high noise generating activities during daytime;
	• Increase in ground vibration level due to operation of heavy equipment and machineries	• Use of equipment with minimal vibration generation; and • Identify nearby weak and fragile structures likely to be affected
THE PEOPLE		
Local economy such as employment and livelihood	• Possible interruption of the service utilities such as water and power supplies	• Ensure that existing utilities are protected against damage due to construction; • All affected basic service utilities, should be properly relocated; and • Relocation of affected basic service utilities should be done in the shortest possible time to limit interruption period
Local economy such as employment and livelihood	• Generation of temporary employment	• The project proponent should mandate contractor to give priority to the local residents. This may be help boost economic activity of affected LGUs.
Traffic Condition	• Possible aggravation of traffic congestions along busy areas adjacent to the construction sites	• Traffic flow restrictions may be minimized during daytime hours; • Work should be performed during nighttime to the extent possible; • Beams should be transported during nighttime; • Parking time of idle dump trucks and the other construction vehicles along constricted areas and major thoroughfares should be limited; and • Well-trained traffic aides and flagmen duly deputized by MMDA should be designated at critical construction areas to direct traffic

	• Safety of pedestrians, passersby, as well as residents	• All excavation sites should be enclosed with corrugated metal sheet barriers • Well-trained traffic aides duly deputized by the MMDA should be designated along busy portions (in terms of pedestrians) • Installation of adequate lighting and reflectorized warning signs along the entire stretch of the construction site • Parking time of dump trucks and the other construction vehicles along the major thoroughfares should be limited to prevent accidents, especially during nighttime.
Occupational Health and Safety	• Increased risk of accidents due to improper work ethics, which may threat health and safety of workers and local residents.	• Appropriate personal protective equipment (PPE) must be provided to all construction workers • Contractors shall submit an Occupational Health and Safety Management Plan prior to commencement of work. • The project site should be fully fenced and access points should not be available for the public. • The project site should be fully fenced and access points should be available for residents in selected areas only;
	• Hazards of communicable and infectious diseases	• Medical certificates should be requested to ensure workers are fit to work. • Appropriate sanitary facilities should be provided at all construction sites.
OPERATIONAL PHASE		
THE LAND		
Land Use	• Increase in land development along or near the corridor	• Identification of future land use of surrounding areas that will result to a significant increase in commercial activities especially near train stations, to guide urban planners of the LGUs to adapt future development plans accordingly
Solid wastes from staff and patrons	• Land and water contamination; aesthetic impacts; spread of diseases	• Proper segregation of wastes; • Provision of waste bins that may be allow proper waste segregation; • Regular collection and transportation of wastes for recycling or disposal at licensed facilities; and • Formulation and implementation of policies on solid waste minimization and solid waste management for patrons and staff
THE WATER		
Domestic wastewater generation	• Water Pollution	• Wastewater treatment facility such as septic tanks designed to appropriate standards should be installed from every station to treat domestic sewage.
THE AIR		
Operation of Trains	• Air Pollution	• Reduction of pollutants from vehicles

	• Occurrence of higher noise level	• Proper preventive maintenance of trains such as regular inspections and reconditioning • Noise barriers in areas with sensitive receptor such as, hospitals, schools and places of worship;
	• Generation of Vibration	• Proper preventive maintenance of trains such as regular inspections and reconditioning • Proper maintenance of structures and tracks, such as regular rail grinding, must be conducted • Regular reconditioning of train and its components, such as, suspension system, brakes, wheels and slip-slide detectors
THE PEOPLE		
Traffic Condition	• Traffic congestion near railway stations	• Provision for loading and unloading areas • Provision for jeepney / bus terminals, if possible
Local economy such as employment and livelihood	• Boost of regional economic activities along the route	• An efficient mass transit system should enhance workforce mobility. This fast and continuous means of transportation gives the labor force in NCR and parts of Region more chances of getting available jobs without having to consider the distance between their home and their place of work. • Shorter and more comfortable travel time should also bring workers better physical and psychological state resulting to work productivity. • Employment for skilled personnel to operate and maintain the railway system • The presence of the stations may also attract future commercial development around the area
Occupational Health and Safety	• Risk of accidents at the stations	• Strict implementation of precautionary, safety and security measures to ensure safe, fast, efficient and reliable transportation services
	• Hazards of communicable and infectious diseases	• Sanitary facilities or utilities to maintain sanitary and healthy conditions should be made available in all stations and depot.

Source: JICA Study Team

1. PROJECT DESCRIPTION

1.1 Project Location and Length of Alignment

The North South Commuter Rail (NSCR) Project will run from Malolos, Bulacan to Tutuban, City of Manila. The line will be passing through 6 cities and municipalities of Bulacan Province (Malolos, Guiguinto, Balagtas, Bocaue, Marilao, and Meycauayan), and 3 cities of Metro Manila (Valenzuela, Caloocan and Manila). In all, there will be 10 stations (Table 1.5), and the total length from Caloocan to Tutuban will be 37.9 kilometers. The entire line will utilize the existing PNR right-of-way.

1.2 Project Rationale and Background of the Project

1.2.1 Project Rationale

Although the Government of Philippines (GOP) has been developing transport infrastructure in Metro Manila such as ring and radial roads, expressways and light rail, severe traffic congestions still remain a critical problem for the capital. Such escalation of traffic congestions has been a bottleneck for the smooth distribution of goods and movement of people, resulting in huge economic loss and necessitating the expansion of Metro Manila in the North-South direction.

While Philippine National Railway (PNR) service runs from Manila to Santa Rosa in Laguna as a commuter line for the direction of South, there is currently no railway service that goes Northward beyond Caloocan despite the expansion of residential area towards the North. With the expansion of residential area towards the North, the Northern Luzon Expressway alone does not serve enough as means of transportation for those who commute to the center of Metro Manila because of heavy traffic congestion from the expressway exit to the center of the capital and of the need for developing means of transportation for those who do not own cars.

Expansion of mass transportation network is recognized as one of its highest priorities in the Philippine Development Plan (PDP) 2011-2016.A commuter railway service to connect Metro Manila with its adjacent northern and southern suburban areas is deemed as one important mass transit backbone for the metropolis as well as for the growth corridor of the Greater Capital Region (GCR), which comprises of Region III, Metro Manila and Region IV-A. This is the focus of many mass transit studies of the Department of Transportation and Communication (DOTC) and the commuter rail service from Malolos to Calamba, in particular, is highlighted as one of the priority projects for the region. The significance of the project is likewise reflected in the recent National Economic Development Authority (NEDA) study on the Roadmap for Transport Infrastructure Development of Metro Manila and Its Surrounding Areas (Region III and Region IV-A).

1.3 Project Alternatives

1.3.1 Without Project Option (Zero Option)

A mass transit service to connect Metro Manila to its adjacent areas has not been provided and therefore it becomes a bottleneck in the sound development of Metro Manila with its adjacent northern and southern suburban areas. The PNR diesel commuter has been operated to Calamba City, Laguna, southern suburban areas of Metro Manila, but only a few train services are currently provided. On the other hand, there are no train services to the northern suburban areas of Metro Manila. In

particular, from northern Metro Manila to Malolos City, Bulacan, since the residential area has been expanded without any public mass transit services, development of mass transit service in these regions has been recognized as a pressing issue.

Therefore, if the NSCR project, the mass transit system to connect Metro Manila to its adjacent northern suburban areas, will not be implemented, the sustainable development of the commerce and industry of these regions will be hindered. Furthermore, the surrounding environment might be further degraded due to the traffic congestion and air pollution. Thus, the without the project case was not selected.

1.3.2 Comparative Analysis of Route Plan

1.3.2.1 ROW Alternative Options

The alternative options for the railway ROW from Malolos to Tutuban are considered first to minimize land acquisition and involuntary resettlement. The ROW options are selected to use the railway ROW, road ROW and public land as much as possible. The following alternative options are compared and their routes are shown in Figure 1.2 Alternative Options for Route and Depot.

Option 1: Use of Railway ROW of PNR and Northrail

There is a railway ROW developed by the Northrail Project Phase 1 Section 1 from Malolos to Caloocan. The most of the ROW remains unused. In addition, there is the existing PNR ROW from Caloocan to Tutuban. Although some sections are still used by the PNR operation, the PNR ROW can be used for the NSCR project after necessary adjustments with PNR. Thus Option 1 is the alternative to use the existing railway ROW.

However, in part of the section between Caloocan to Tutuban, NSCR will run parallel to the highway planned by the Department of Public Works and Highways (DPWH). Therefore necessary adjustments for both projects have been discussed in the Philippine government. Currently, the alignment of NSCR is considered to use preferentially the existing PNR ROW in Option 1 (refer to Case 2 in Figure 1.3 Relationship between NSCR and Highway in terms of the Use of PNR ROW). However, after the arrangement with DPWH, it may run off the existing PNR ROW (refer to Case 1 in Figure 1.3 Relationship between NSCR and Highway in terms of the Use of PNR ROW). In this case, additional land acquisition and involuntary resettlement may occur. In Table 1.1, the worst case, i.e., the largest impact case will be used for comparison of alternative options.

Option 2: Use of Road ROW of NLEX and Quezon Avenue

The North Luzon Expressway (NLEX) is an 8-lane limited-access toll expressway that connects northern Metro Manila to Pampanga Province of the Central Luzon region. The expressway has a length of 82.6 kilometers. From Malolos to Guiguinto, the proposed route uses the ROW of Northrail as same as Option 1. From Guiguinto to the NLEX Guiguinto exit, it goes through the local road to connect the NLEX. Then it runs through the inside of NLEX up to the northern Metro Manila exit. After the NLEX exit, it uses the ROW of Quezon Avenue, which is a radial road from the city center to Quezon Memorial Circle.

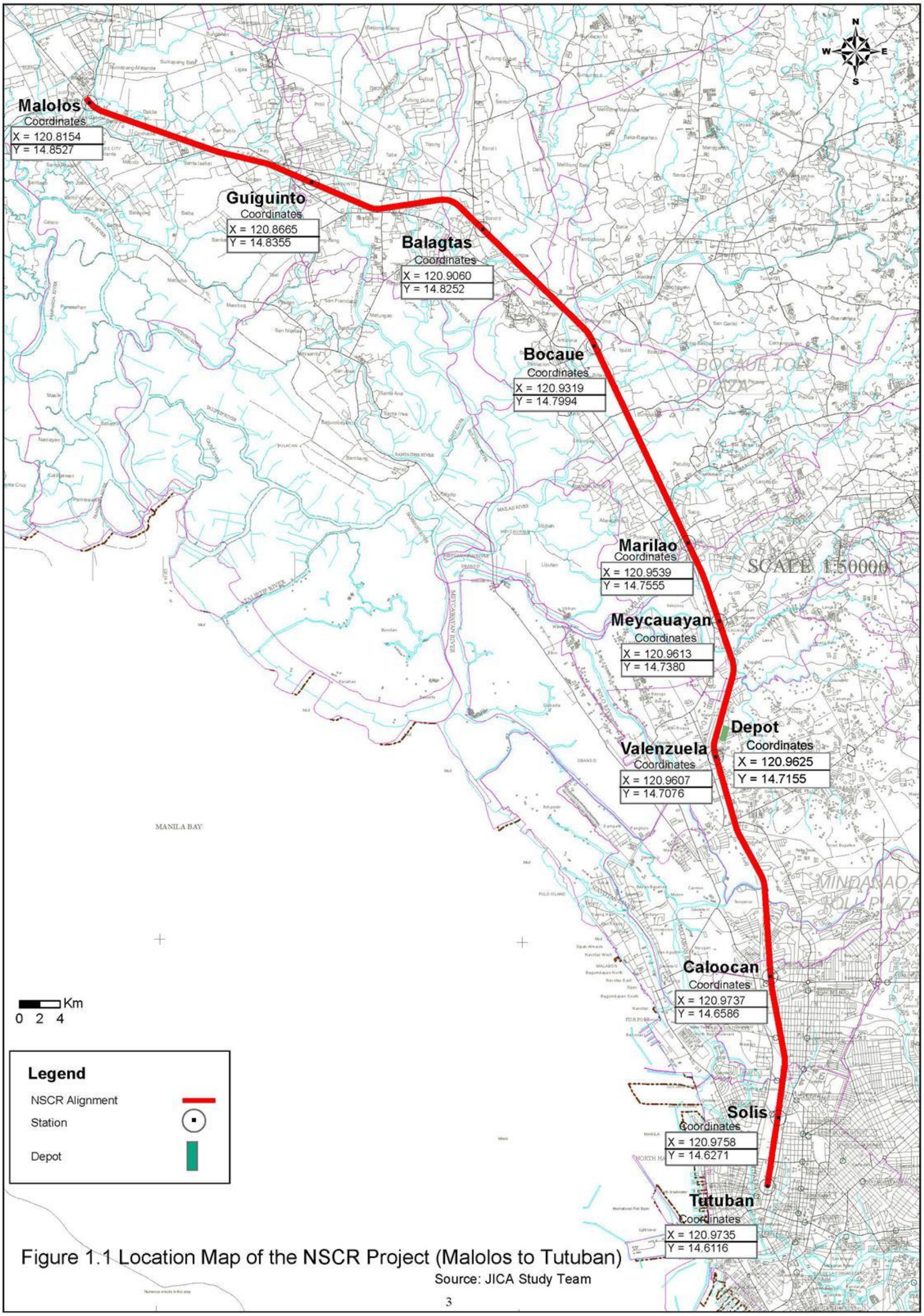
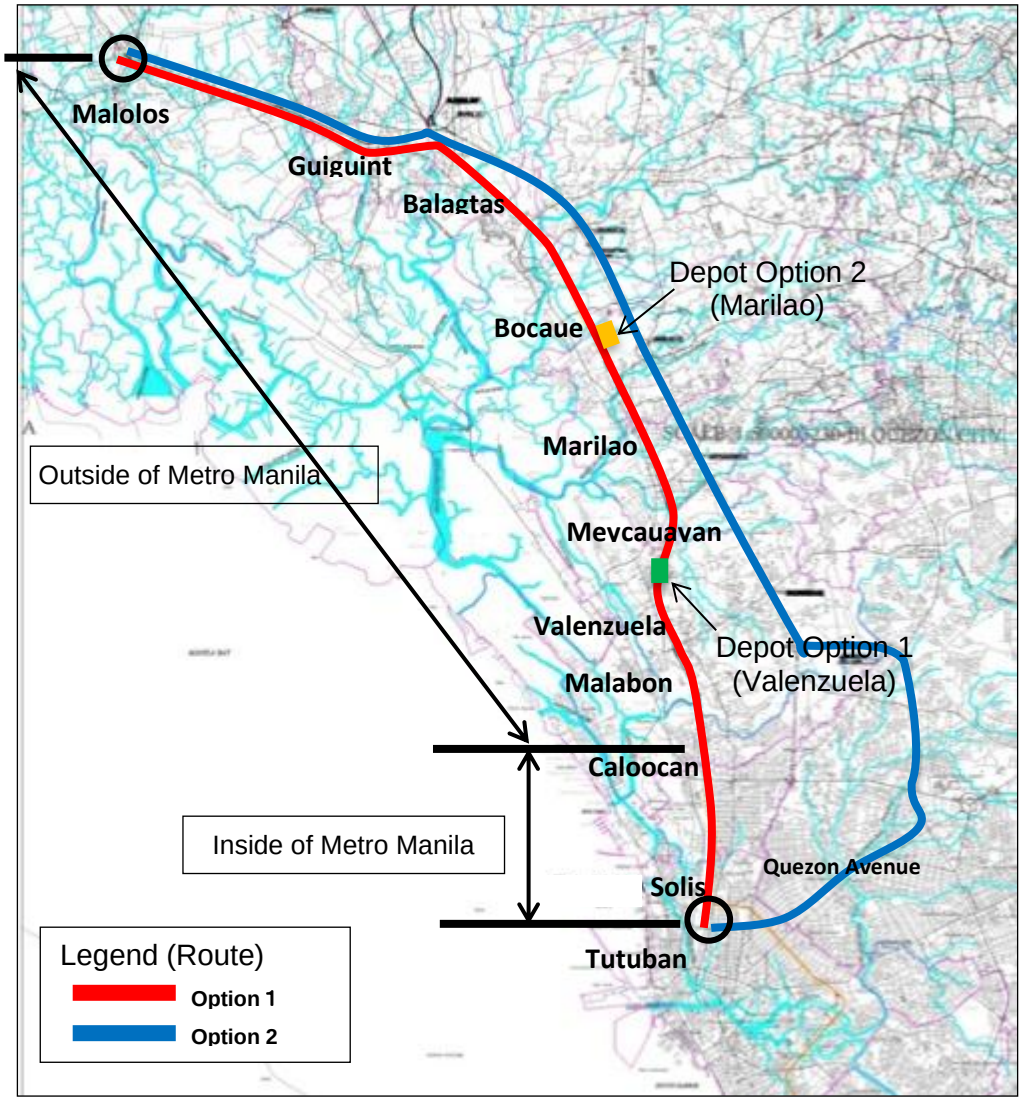


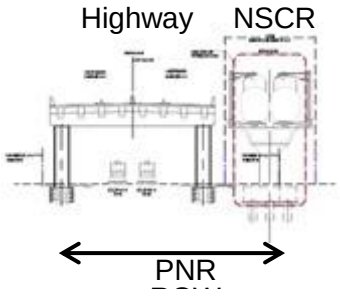
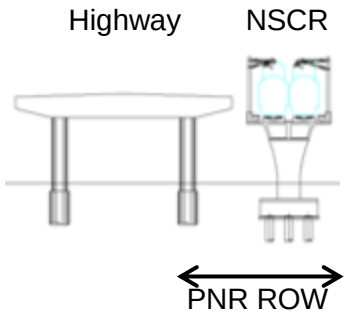
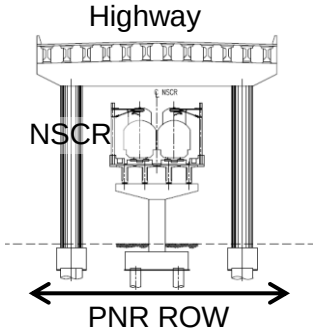
Figure 1.1 Location Map of the NSCR Project (Malolos to Tutuban)

Source: JICA Study Team



Source: JICA Study Team

Figure 1.2 Alternative Options for Route and Depot

		
Case1: NSCR run off the existing PNR ROW (NSCR share the existing PNR ROW with the highway side by side.)	Case 2: NSCR preferentially uses the existing PNR ROW	Case 3: Both NSCR and the highway use the existing PNR ROW

Source: JICA Study Team

Figure 1.3 Relationship between NSCR and Highway in terms of the Use of PNR ROW

1.3.2.2 Result of Comparison of Alternative Options

The result of comparison of 2 alternative options is shown in Table 1.1. In the social environment, the estimated total number of affected households to be resettled is about 1,300 for Option 1 and about 2,100 for Option 2. Therefore the affected households of Option 1 are fewer than that of Option 2. In the natural environment, because the route of Option 2 passes through the swamps, land alteration and access during the floods are the concerned impacts. Both options require the abatement measures for noise and vibration, especially for residential areas. Considering these impacts on natural and social environment, Option 1, which uses the railway ROW of PNR and Northrail is selected for the NSCR route.

Regarding the part of section between Caloocan to Tutuban where NSCR and the highway share the existing PNR ROW, based on the meeting result of the Secretaries of DOTC and DPWH, the necessary adjustments on the policy that NSCR preferentially uses the existing PNR ROW have been carried out in the Philippine government. A further coordination with the highway project will be made to minimize the involuntary resettlement.

Table 1.1 Comparison of ROW Alternative Options

Items \ Alternatives	Option 1 Use of Railway ROW of PNR and Northrail	Option 2 Use of Road ROW of NLEX and Quezon Ave
Social Environment		
Involuntary Resettlement	• Malolos - Caloocan: Resettlement due to additional land acquisition for ROW and stations and depot will be needed. The estimate of affected households will be about 300. • Caloocan – Tutuban: In the section of side by side with the highway, if the NSCR alignment will run off the existing PNR ROW, resettlement due to additional land will be unavoidable. About 1,000 households need to be resettled. If NSCR will be able to use the existing PNR ROW, the estimate of affected households will be less than 200.	• No involuntary resettlement in the NLEX ROW is expected. • Resettlement due to additional land acquisition to connect from Guiguinto to NLEX will be needed. The estimate of affected households will be about 100. •Resettlement due to additional land acquisition from NLEX interchange to Mindanao Avenue and Quezon Avenue will be needed. The estimate of affected households will be about 2,000.
Total number of households to be resettled	About 1,300 households	About 2,100 households
Historical/cultural heritage	• The old PNR stations are recognized as historical heritage sites and are considered for preservation.	• There is no historical/cultural heritage along the route.
Natural Environment		
Protected Area	• There is no protected area in the vicinity of the project area.	• There is Quezon Memorial National Park. The distance between the park and the proposed route is about 500 m.
Land alteration	• Land alteration area will be smaller than other that of Option 2 because there are a few access roads.	• Temporary land alteration in swamp area will likely occur due to the installation of access roads to the

Alternatives / Items	Option 1 Use of Railway ROW of PNR and Northrail	Option 2 Use of Road ROW of NLEX and Quezon Ave
		construction sites.
Risk of flooding	• Risk of flooding is lower than that of Option 2 because there are a few access roads through swamps.	• The access to the railway will become difficult during flooding because the route passes through the swamps.
Pollution		
Noise and vibration	• Noise and vibration will cause a nuisance along the route, especially for residential areas.	• Noise and vibration will cause a nuisance along the route, especially for residential areas.
Water quality	• Risk of water quality deterioration will be lower than that of Option 2.	• Water quality of swamps will be likely to be deteriorated by suspended solids discharged from construction sites.

Source: JICA Study Team

1.3.3 Comparative Analysis of Depot Location

1.3.3.1 Depot Alternative Options

Two candidate sites for the depot were compared (Figure 1.3 Relationship between NSCR and Highway in terms of the Use of PNR ROW). The required area of the depot is about 14 hectares.

Option 1: Valenzuela
The Northrail has leased 13.822 hectares of the property of National Food Authority (NFA) to be used as exclusively for the Depot.

Option 2: Marilao
The candidate site is agricultural land located at the border of Marilao and Bocaue.

1.3.3.2 Result of Comparison of Alternative Options

The result of comparison of 2 alternative options is shown in Table 1.2. If DOTC will be able to continue to lease the site in Valenzuela from NFA, acquisition of the land will not be needed. On the other hand, the candidate site in Marilao is agricultural land and there are many informal settler families (ISFs). Resettlement of affected families and loss of livelihood of agricultural workers are unavoidable. Therefore, the Option 1, Valenzuela was selected for the depot site.

Table 1.2 Comparison of Alternative Options for Depot Sites

Alternatives Items	Option 1 Valenzuela	Option 2 Marilao
Social Environment		
Land use	• Unused land including small wet land	• Agricultural land (palay)
Land Acquisition	• The site can be leased from NFA.	• Land Acquisition is required.
Involuntary resettlement	• About 20 ISFs need to be relocated.	• About 100 ISFs need to be relocated.
Natural Environment		
Protected Area	•There is no protected area in the vicinity of the project area.	•There is no protected area in the vicinity of the project area.
Land alteration	•Loss of about 2 ha wet land	•Loss of about 13ha agricultural land
Pollution		
Noise and vibration	•Noise and vibration will cause a nuisance for residential areas.	•Noise and vibration will not cause a nuisance because there are few houses.

Alternatives Items	Option 1 Valenzuela	Option 2 Marilao
Social Environment		
Water quality	•Risk of water quality deterioration will be lower than that of Option 2.	•Water quality of a small creek will be likely to be deteriorated by suspended solids discharged from construction sites.

Source: JICA Study Team

1.3.4 Comparative Analysis of Structure Type

1.3.4.1 Structure Alternative Options

The following three structure types were compared:

Option 1: At grade structure type including embankment
Option 2: Elevated structure type (viaduct)
Option 3: Underground structure type

The type of railway structure is mainly determined based on development conditions of the adjacent area along the NSCR. Also it will consider the following: (i) construction cost, (ii) construction period, (iii) social and environmental impacts, (iv) risk of flood, and (v) from the point of view of operation and maintenance. In particular, risk of flood must be considered for selection of structure type because people in the vicinity of the NSCR project are worried about frequent flooding.

1.3.4.2 Result of Comparison of Alternative Options

Comparisons of the advantages and disadvantages of three structure types, embankment, viaduct and underground were discussed in Table 1.3.

At-grade structure (embankment) is the lowest construction cost and applicable to the section where the risk of flood is low and there are few level crossings. On the other hand, the elevated structure (viaduct) is recommended for the section where the railway goes through flood-prone areas or there are the intersections with the main road. Although the underground structure type may have the smallest impacts on natural and social environment, the construction cost is the highest. There are no obstacles to be avoided since the NSCR alignment will use the existing PNR ROW, therefore the underground structure will not be adopted for all sections.

(1) Malolos to Meycauayan

The elevated structure will be selected for the section where the alignment goes through the build-up areas and crosses the main roads. The embankment structure will be used for the section where there are no crossings of the main roads. However, the elevated structure will be selected for the section where the alignment goes through the flood-prone areas in this section.

(2) Meycauayan to Tutuban

The alignment will not pass through the flood-prone areas in this section. However, the elevated structure will be selected for the section where the alignment goes through the build-up areas and crosses many main roads.

Table 1.3 Comparison of Structure Type of Railway Structure

Item	Option 1 At-grade Structure (Embankment)	Option 2 Elevated Structure (Viaduct)	Option 3 Underground Structure (Shield Tunnel)
Construction Cost	Lowest cost	Low cost compared to underground structures	Very high cost
Width of ROW	In case where high embankment are necessary, additional ROW is needed.	Land acquisition is necessary for entrance and exit of the stations	Land acquisition is necessary for entrance and exit of stations and ventilation shafts.
Construction Period	Short in comparison to viaducts except in the case of ground improvement	Short in comparison with underground structure	Long construction period is required
Measures for Flooding	Embankment acts as a dam, therefore it is necessary to construct additional drainage to minimize flooding	No specific countermeasures are required	Drainage systems such as emergency pump systems must be provided. Floodgate will be required.
Operation /Maintenance	Easy due to availability of access	Easy because of ease of access	Difficult, maintenance cost is high because the systems are underground systems. Periodical inspections must be carried out especially for underground leakage of water which causes electrolytic corrosion.
Disaster Prevention	Comparatively safe. Easier to take countermeasure compared to an underground structure.	Comparatively safe. Easier to take countermeasure compared to underground structures.	Fire in a tunnel can cause big disaster.
Ground Subsidence	In case where soft soil is encountered, there is possibility that ground subsidence can occur.	Ground Subsidence will not occur.	There is a possibility of ground Subsidence during construction of TBM.
Earthquake	Embankment must be designed considering earthquake loads.	Structure must be designed considering earthquake load	An underground structure is not susceptible to earthquake. However underground structures must be designed considering earthquake load
Land Acquisition and involuntary resettlement	Additional land acquisition is necessary for the narrow ROW section and cause involuntary resettlement.	Additional land acquisition is necessary for the narrow ROW section and cause involuntary resettlement.	Land acquisition is less required and can be minimized.
Community Severance	The embankment will pass through a community which may cause physical and social barrier to the neighborhood	No community severance	No community severance
Noise (Inside Train)	Little noise	Little noise	Much noise
Noise (Outside Train)	Noise will occur along the railway but installation noise barrier can mitigate noise.	Noise will occur along the railway but installation noise barrier can mitigate noise.	No noise pollution along the railway.
Landscape	Shape of structures shall be designed considering landscape.	Shape of structures shall be designed considering landscape.	No influence
Safety	Level crossing is needed and traffic accidents and congestion are expected.	No level crossing	No level crossing
Overall evaluation	O: Lowest construction cost: X: Increase risk of flooding X: Level crossings The lowest cost. Recommend for not flood-prone area and not crossing the main roads	X: Construction cost is higher than that of embankment O: Low risk of flooding O: No level crossing Recommend for flood-prone area and many crossings of the main roads	X: Highest construction cost O: Low risk of flooding, but needs drainage systems O: No level crossing Not recommended since there are no obstacles since the NSCR alignment will use the existing PNR ROW. Moreover highest cost.

Source: JICA Study Team

1.4 Project Components

The project will consist of the following components:

- Main railway line on embankment and elevated viaducts
- Elevated stations
- Maintenance depot

MAIN RAILWAY LINE

The railway alignment will utilize the PNR and Northrail right of-way (

Figure 1.4 Malolos to Tutuban Railway Line along PNR and Northrail Right-of-way). The structures of the guideway and the stations are mostly elevated (Table 1.4). Figure 1.5 Viaduct (PC Beam Girder) to Figure 1.7 Station (2 Platforms and 4 Tracks) show the typical cross sections of the viaduct and stations. The proposed NSCR Project will have a total length of 37.9 kilometers.

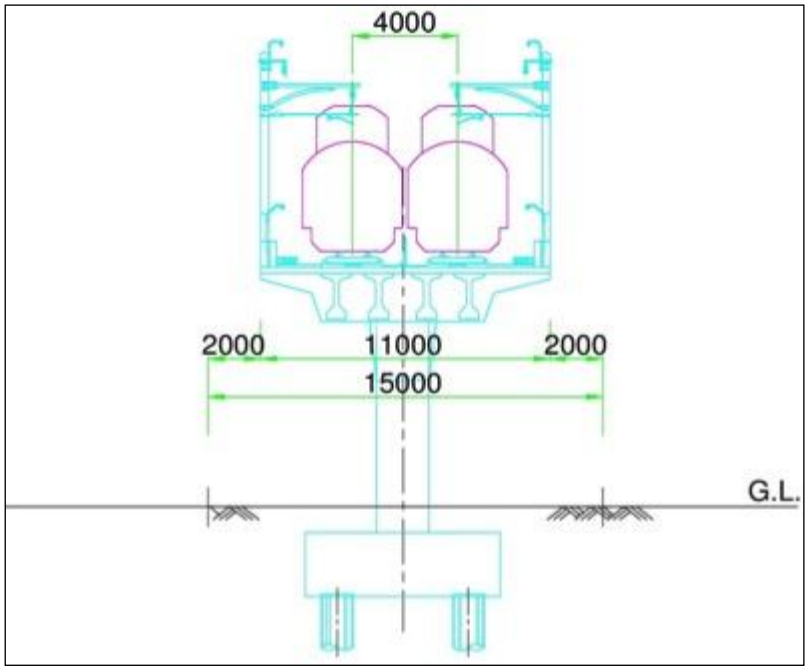
Table 1.4 Descriptions of Elevated Structures

Elevated Structure	Description
Viaduct	• PC Beam Girder • Long Span Bridge • Portal Pier
Station	• 2 Platforms and 4 Tracks • 2 Platforms and 2 Tracks

Source: JICA Study Team

Source: JICA Study Team

Figure 1.4 Malolos to Tutuban Railway Line along PNR and Northrail Right-of-way



Source: JICA Study Team

Figure 1.5 Viaduct (PC Beam Girder)

STATIONS

There will be 10 stations as shown in Table 1.5.

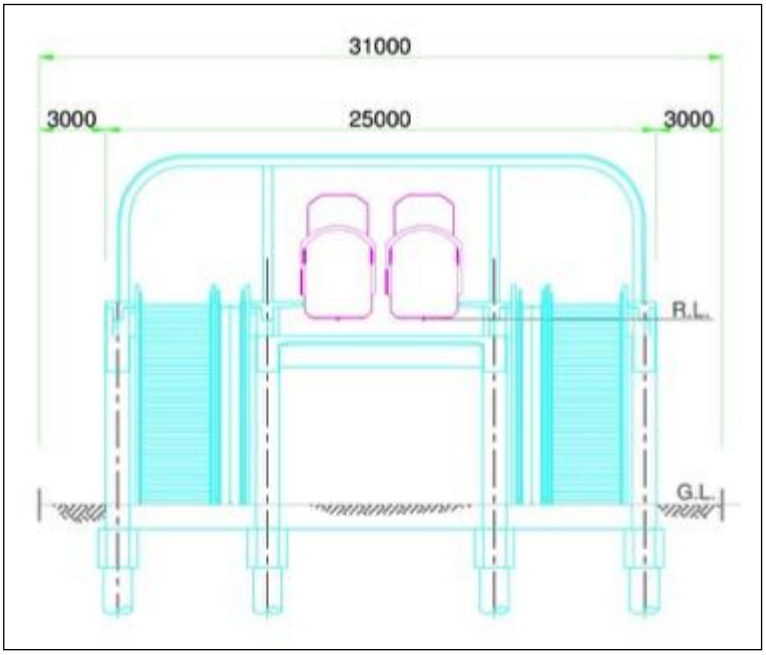
A uniform platform width of 8 m wide is proposed for the stations. These platform widths also will be checked for holding capacity of the platform for worst-case scenario at detail design stage. It is proposed to provide lifts in addition to stairs for vertical movement of passengers from street to concourse.

Table 1.5 Number of NSCR Stations and Distances between Stations

	Station	Distance to next station (km)	Coordinates
1	Malolos	6.2	x=120.8154 y=14.8527
2	Guiguinto	4.7	x = 120.8665 y =14.8355
3	Balagtas	4.0	x=120.9060 y=14.8252
4	Bocaue	5.4	x=120.9319 y=14.7994
5	Marilao	1.9	x=120.9539 y=14.7555
6	Meycauayan	3.6	x=120.9613 y=14.7380
7	Valenzuela	5.7	x = 120.9607 y = 14.7076
8	Caloocan	6.1	x = 120.9737 y = 14.6586
9	Solis	2.8	x = 120.9758 y = 14.6271

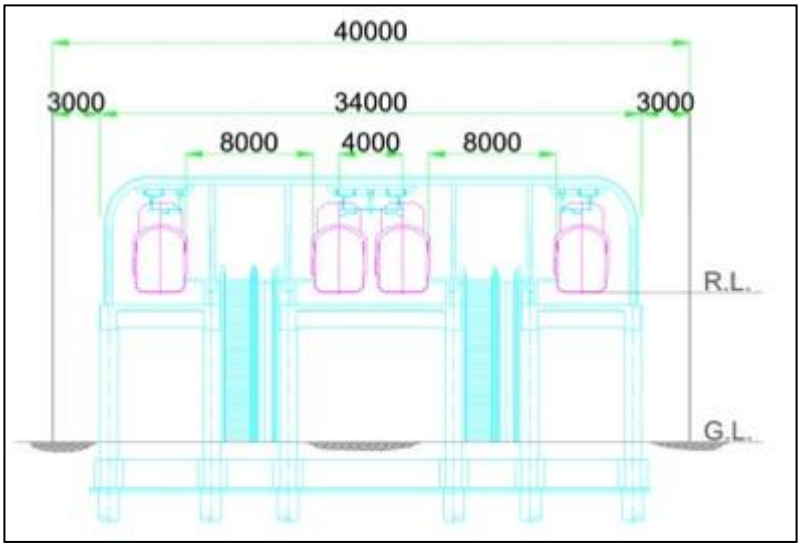
10	Tutuban	-	x = 120.9735 y = 14.6116

Source: JICA Study Team



Source: JICA Study Team

Figure 1.6 Station (2 Platforms and 2 Tracks)



Source: JICA Study Team

Figure 1.7 Station (2 Platforms and 4 Tracks)

MAINTENANCE DEPOT

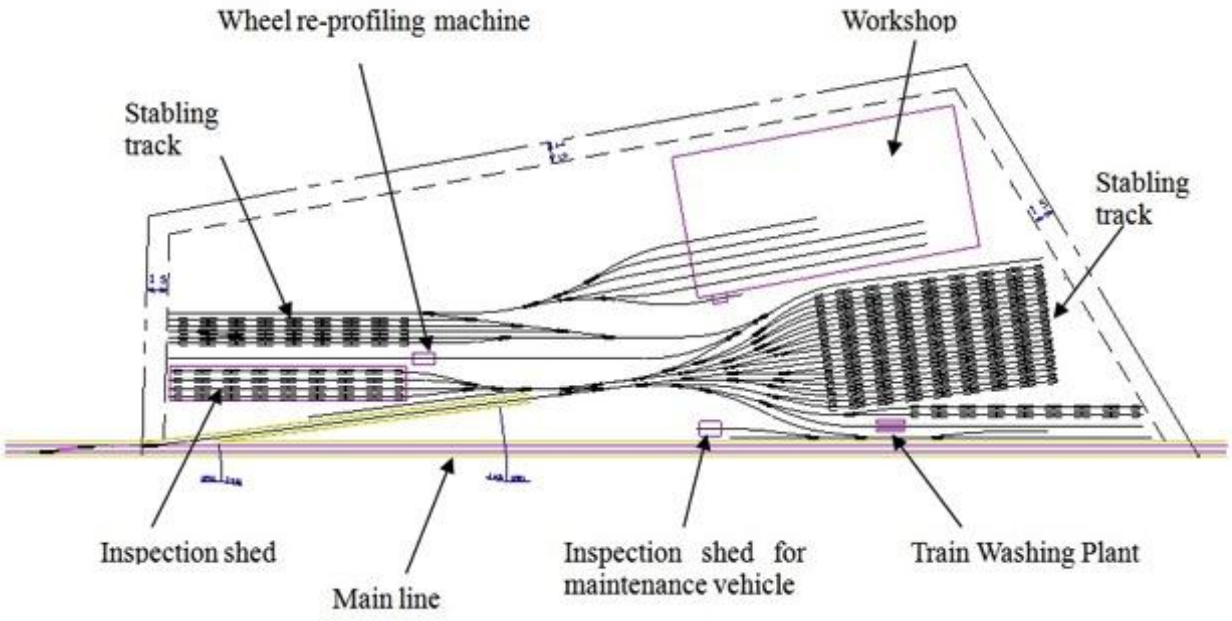
The depot will be located in Valenzuela (Figure 1.8 Location of depot along the NSCR alignment). The proposed layout plan is shown in Figure 1.9 Layout Plan of Valenzuela Depot Site. The lot area is 13.822 hectares and will include the following facilities

- Main workshop

- Stabling yard for approximately13 train-sets for Phase 1, and 26 train-sets for Phase 2
- Operations control center
- Substation
- Automatic train washing machine, etc.

Source: JICA Study Team

Figure 1.8 Location of depot along the NSCR alignment



Source: JICA Study Team

Figure 1.9 Layout Plan of Valenzuela Depot Site

SUMMARY TECHNICAL SPECIFICATIONS OF NSCR

The summary technical specifications of the project are as follows:

Table 1.6 Summary of Technical Specifications of NSCR

No.	Parameter	NSCR
1.	Transport system	EMU (Electric Multiple Unit)
2.	Route length	phase 1: 37.9 km (Malolos – Tutuban)
3.	Number of stations	phase 1: 10 stations (Elevated) future: 5 stations (Elevated)
4.	Traffic demand	2020: 13,170 pphpd
5.	Daily ridership	Phase 1: 340,000 passengers/day
6.	Train frequency during peak hour	Malolos – Marilao: 12 minutes Marilao – Tutuban: 6 minutes
7.	Track gauge	1,067 mm
8.	Traction system	
a.	Voltage	DC 1,500 V
b.	Method of current collection	Overhead catenary system
9.	Rolling stock	
a.	Train composition	8 cars: 4M4T (Tc+M+M+T+T+M+M+Tc) Tc: Trailer car with driver's cab M: Motor car T: Trailer car
b.	Vehicle dimensions Length Width	 Leading car length 20.0 m Intermediate car length 20.0 m Body width 2.95 m
c.	Carrying capacity per train	8 cars: 2,120 passengers
d.	Saloon Design Doorways Seat type	 4 doorways each side Longitudinal seat
e.	Maximum operation speed	120 km/h
f.	Acceleration	3.3 km/h/s
g.	Deceleration	Service: 4.2 km/h/s Emergency: 4.7 km/h/s
10.	Power Supply	
a.	Source	MERALCO (Manila Electric Co.), NGCP (National Grid Corp. of the Philippines)
b.	No. of receiving substations	4 substations
c.	Power supervision	SCADA system
11.	Type of signaling	CBTC or Track circuit system
12.	Train control system	ATP, CTC, ATO with driver
13.	Telecommunication	Digital Trunk Radio, PABX, PIS, Broadcasting, Time facilites, CCTV, UPS, Optical fiber transmission lines
14.	Fare collection	Automatic Fare Correction system
15.	Horizontal curve radius	Main line: more than 300 m Station: more than 400 m
16.	Maximum gradient	Main line: 25/1000 (standard) 35/1000 (absolute maximum) Station: Level (0) 5/1000 (absolute maximum)

No.	Parameter	NSCR
		Stabling track: Level (0)
17.	Minimum gradient Underground section only	2/1,000
18.	Vertical Curve	Radius 3,000m (4,000m where curve radius is less than 800m)
19.	Distance between Track Centers	More than 4.0m
20.	Station platform	Separated type and Island type
a.	Platform length	180 m
b.	Platform width	8 m (standard)
c.	Platform height	Same level as car floor
21.	Depot	Phase 1: One (1) Depot, Area 14.1 hectares

Source: JICA Study Team

1.5 Process / Technology

The project is an infrastructure project that will not involve processing or manufacturing technology.

There will be no pollution control devices and waste management system involved except for the wastewater treatment that will be installed in the depot area.

Operations and maintenance of the project is explained in section 1.7

1.6 Project Size

The project is a linear infrastructure, with a total length of 37.9 kilometers. The depot area will be 13.822 hectares in size.

1.7 Project Phases

This section describes the various activities to be undertaken during the Pre-Construction, Construction, and Operational Phases of the Project.

1.7.1 Pre-Construction

During this phase, site preparation activities will be conducted, including clearing of existing vegetation, especially on proposed station and depot location; removal and demolition of existing structures that are along the NSCR alignment, earth moving activities, such as excavation, and backfilling of soil or reclamation of low lying or swampy areas, especially at the proposed locations of stations and depot.

Activities conducted during the pre-construction phase will generate waste such as concrete debris, re-bars, and rubble from the demolition, soil and other land clearing debris, such as stumps, rocks and dirt.

Increase level of noise will be generated during destruction and demolition of structures from machines and equipment that will be used, and from trucks coming in and out of the site hauling the debris.

Recycling and re-use is highly prioritized as a management option for wastes generation from the pre-construction phase. Contractors/ sub-contractors will be required to submit a recycling and disposal plan for the utilization and disposal of wastes from demolition and land clearing operations.

1.7.2 Construction Phase

Detailed construction design will have to be finalized during the detailed design phase of the Project. Detailed construction plan will be submitted to DENR for review prior to start of construction. Construction would basically include the following:

- Guideway structure, which includes construction of guideway substructure such as foundation and columns
- Passenger stations and depot
- Rolling stock

Structure Plan

Majority of the structures are planned to be elevated (Figure 1.5 Viaduct (PC Beam Girder) to Figure 1.7 Station (2 Platforms and 4 Tracks)).

Platforms

A uniform platform width of 8 m wide is proposed for the stations. These platform widths also will be checked for holding capacity of the platform for worst-case scenario at detail design stage. It is proposed to provide lifts in addition to stairs for vertical movement of passengers from street to concourse.

Rolling Stock

Considering the characteristics of the project, specifications of rolling stock should be finalized at detailed design stage.

Table1.7 Main Specifications of Rolling Stock

Item		Commuter
Train Formation *Tc: Trailer car with driver's cab *M: Motor car *T: Trailer car		EMU: 10 cars, 6M4T Tc+M+M+T+M+ M+T+M+M+Tc
Major dimensions	Leading car length	20,000 mm
	Intermediate car length	20,000 mm
	Body width	2,950 mm
Passenger capacity per train	Seat	Approx. 520
	Aw (4 pax./m^2)	Approx. 1,800
Weight per train (Tare)		Approx. 320 metric tons
Body materials		Light weight stainless steel/ Aluminum alloy
Maximum operation speed		120 km/h
Propulsion system	Power collector	DC 1500 V/ AC 25kV Single-arm pantograph 3 units per a train-set
	Control system	VVVF inverter with IGBT elements
		6 sets per train set
	Traction motor	3-phased induction motors
		120kw X 24 units
Air conditioning equipment		On roof type

Source: JICA Study Team

Source of Power Supply

Power or electricity will be sourced either by tapping at the nearest electricity source or through a generator set. Contractors will be required to submit an environmental and safety management plan for the use of generator sets.

Water for Construction

Water for construction of the project will be taken from the nearest water source/ provider. In the absence of such water provider, water will be sourced from the groundwater after obtaining necessary permits.

Depot

The depot will be located in Valenzuela. The proposed layout plan is shown in Figure 1.9 Layout Plan of Valenzuela Depot Site. The lot area is 13.822 hectares and will include the following facilities:

- Main workshop
- Stabling yard for approximately13 train-sets for Phase 1, and 26 train-sets for Phase 2
- Operations control center
- Substation
- Automatic train washing machine, etc.

1.7.3 Operational Phase

The proposed train operation plan is shown in Table 1.8.

Table 1.8 Summary of the assumed Train Operation Plans

Items		Description
Features of Operation Conditions		
Gauge(mm)		TBD
Traction Energy supply		Overhead wire
Route length (km) (Phase 1)		37.9
Demand Forecast (PPHPD)		
2020		13,170
2022		18,270
2025		20,620
2030		19,260
Train Plan		
Train composition	2020	6 Cars
	2025	8 Cars
Passenger capacity/ train	2020	1,620
	2025	2,180
Operation Plan		
Maximal Speed (kph)		120
Train Operation		
Service hours		6:00-24:00 (18 Hours)
Head way at Peak hours (Min)	2020	6
	2025	6
	2030	6
	2040	6
Transportation Capacity (Pphpd)	2020	16,200
	2025	21,800

Items		Description
	2030	21,800
	2040	21,800

Source: JICA Study Team

Traveling Time

Traveling time of the train is calculated by simulation and regular running time is defined to be applied for train schedule based on calculated time. Regular running time of each operation pattern is indicated in Table 1.9.

Table 1.9 Traveling Time of Train

Year	Section	Traveling time	Remarks
2020	Malolos – Tutuban	35 min 20 sec	10 stations are opened
2030	Malolos – Tutuban	43 min 0 sec	15 stations are opened

Source: JICA Study Team

Assuming that minimum turn back time at terminal is 6-minute round trip time of each phase is also indicated in Table 1.10.

Table 1.10 Round Trip Time of Train

Year	Section	Round trip time	Remarks
2020	Malolos – Tutuban	82 min 40 sec	10 stations are opened
2030	Malolos – Tutuban	98 min 0 sec	15 stations are opened

Source: JICA Study Team

Rolling Stock Procurement Plan

Required numbers of trains are calculated from round trip time and headway of peak hour.

Table 1.11 Required Number of Trains

	2020	2025	2030	2040
Trains in operation	14	14	17	17
Reserved trains	3	3	3	3
Required number of trains	17	17	20	20
Train consist	6 car	8 car	8 car	8 car

Source: JICA Study Team

Based on the train operation plan described above rolling stock procurement plan is indicated as follows.

Table 1.12 Rolling Stock Procurement Plan

	2020	2023	2030
Train consist	6 car	8 car	8 car
Number of trains	17	17	20
Number of rolling stock	102	136	160
Rolling stock to procure	102	34	24

Source: JICA Study Team

Source of Power Supply

To ensure high reliability of power supply during the operation, adequate redundancies in the transmission and distribution will be incorporated in the detailed design stage.

Water Supply and Demand

Water supply during operational phase will be sourced from the local water district. Water usage shall be minimal, and limited to domestic use only, i.e., for usage in, and maintenance of comfort rooms.

1.8 Manpower Requirements

During the pre-construction and construction phases of the Project from Malolos to Tutuban, there will be approximately 2,000 to 3,000 laborers – both skilled and non-skilled.

During the operation phase, it is estimated that the NSCR operation will provide employment to more or less 300 employees for the manning of the stations, operations and maintenance of the NSCR and maintenance of the trains at the depot.

1.9 Indicative Project Cost

The project cost for North-South Commuter Rail Project (Malolos to Tutuban) is shown in Table 1.13.

Table 1.13 Project Cost

Items		Estimated Cost	
		(US$ Million)	(Php* Million)
Basic Cost	Civil	1,126	49,867
	E&M System	560	24,786
	Rolling Stock	254	11,272
	Total	1,940	85,925
Land Acquisition		25	1,108
	Sub-total	1,965	87,032
Tax	Import Duty	98	4,327
	VAT	233	10,311
Engineering Cost		87	3,849
Physical Contingency		118	5,221
TOTAL COST		2,500	110,740

Source: JICA Study Team
** Exchange rate: 1US$ = 44.3 Php*

2. BASELINE ENVIRONMENTAL CONDITIONS AND ASSESSMENT OF KEY ENVIRONMENTAL IMPACTS

This Chapter discusses the state of the existing environment before the onset of the proposed project. The baseline data presented in this section are based on primary and secondary data collection. Primary data were obtained through field surveys, consultation meeting and interviews with key stakeholders, and sampling and analyses of environmental parameters. Secondary data were collected from the Comprehensive Land Use Plan (CLUP) of the affected LGUs and relevant government authorities such as the DENR, DOST and DA. Specific information sources are referenced accordingly.

1. THE LAND

1.1 Land Use Classification

1.1.1 Compatibility with existing land use classification

Areas within the PNR ROW have already been cleared when the Northrail Project Phase 1 (Clark to Caloocan) was initiated for the Malolos to Caloocan segment. Likewise, the Caloocan to Tutuban segment has also already been cleared. In general, the areas within the PNR ROW are clear of any structures.

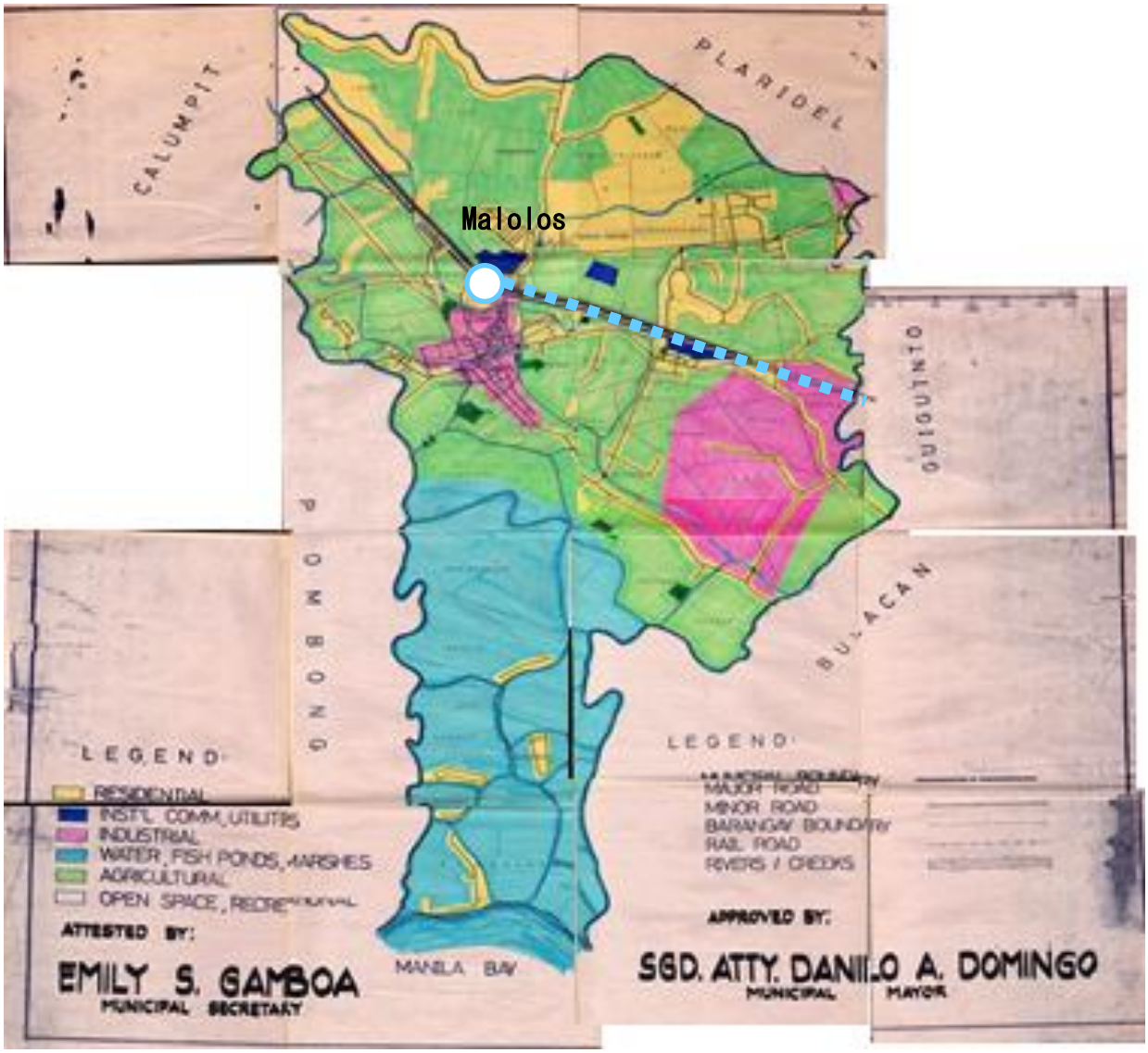
Land use analysis extending 250 m from each side of the alignment boundary shows that the proposed NSCR project traverses various land uses and development conditions, including commercial, agricultural, industrial and residential areas along the Malolos to Caloocan section. Areas become more densely built-up as the proposed railway project travels through the urban centers of Caloocan and Manila at approximately 3.5 kilometers (km). Hence, land uses and development conditions are predominated with built-up areas that are commercial and residential in nature.

The section that follows provides a summary of the existing land uses by municipality or city.

Malolos

Majority of the land adjacent to the PNR alignment is utilized for commercial uses, with some institutional facilities due to its close proximity to the McArthur Highway (Figure 2.1) Notable institutional structures situated in the immediate vicinity of the proposed railway are La Consolacion University in Brgy. Catmon, Sacred Heart Hospital, Holy Infant School of Malolos and Holy Spirit Academy in Brgy. Bagong Bayan. The alignment also passes along the industrial park of First Bulacan Industrial City in Brgy. Tikay. Other land uses within the 250 m radius from the railway are residential and agricultural, particularly rice paddies.

A number of viaduct columns/piers which were constructed under the Northrail Project Phase 1, exists along the Malolos stretch. The old PNR Station in Malolos (Photo Nr. 29 – Annex E) is currently being utilized as Northrail Security Contractor's office.



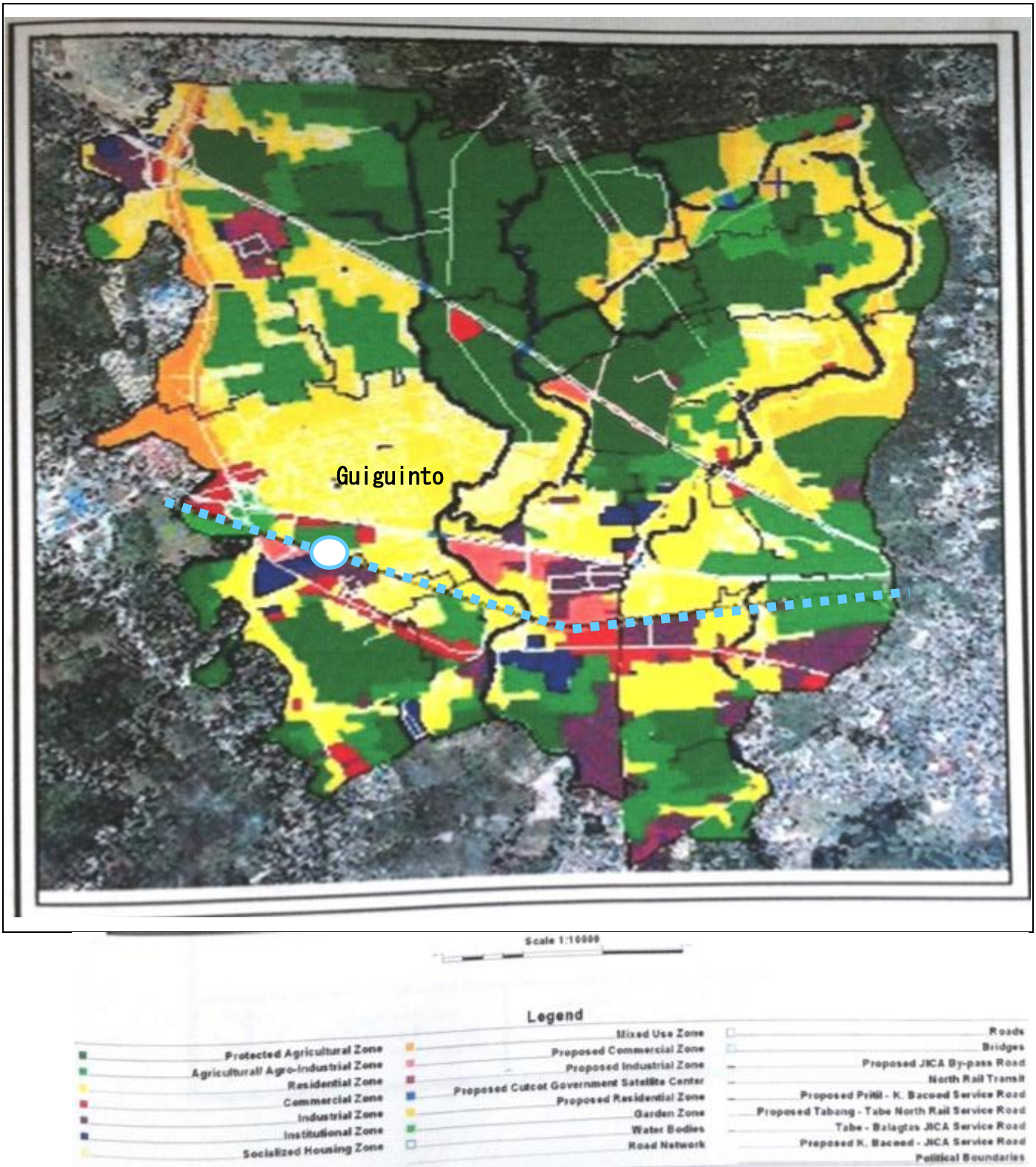
Source: Malolos City CLUP

Figure 2.1 Malolos City Land Use Map showing NSCR Alignment

Guiguinto

The corridor extends for about 4.66 km in Guiguinto and passes through mixed land uses including agricultural for rice cultivation, industrial, low density residential areas, commercial and open spaces (Figure 2.2).

The proposed site for the Guiguinto Station (Photo Nr. 30-Annex E) in Tabang is adjacent to a vacant area covered with vegetation on its northern side, and the Technical Education and Skills Development Authority and an industrial facility on the southern portion. The road along the PNR ROW is also currently being accessed by residents on their way to a nearby residential area. The station is also close to several ornamental plant culturing facilities. Horticulture, particularly in Tabang, abounds as this area is a popular destination for ornamental plants market.



Source: Municipality of Guiguinto CLUP

Figure 2.2. Land Use Map of Municipality of Guiguinto Showing NSCR Alignment

Balagtas

In Balagtas, the proposed railway extends for approximately 3.96 km, passing through Barangays Borol 1st, Longos and San Juan (Figure 2.3). Land use along the sides of the PNR ROW in Brgy. Borol 1st and Brgy. Longos is predominantly low density residential, with scattered institutional and commercial areas. Most of the commercial areas in Balagtas are located along Mc Arthur Highway, which is within 250 meters from the alignment.

However, land use becomes largely agricultural in the alignment's northern portion along Brgy. San Juan, and is classified as irrigable lands. Based on Balagtas' CLUP, the land parcel in Brgy. San Juan between the NLEX and the PNR ROW is being planned for commercial and agro-industrial development, through the establishment of the North Food Exchange Project.

The old PNR post still exists in the proposed site for the Balagtas Station (Photo Nr. 31-Annex E). Balagtas Resort, a recreational establishment, is located adjacent to the station, along with some residential houses.

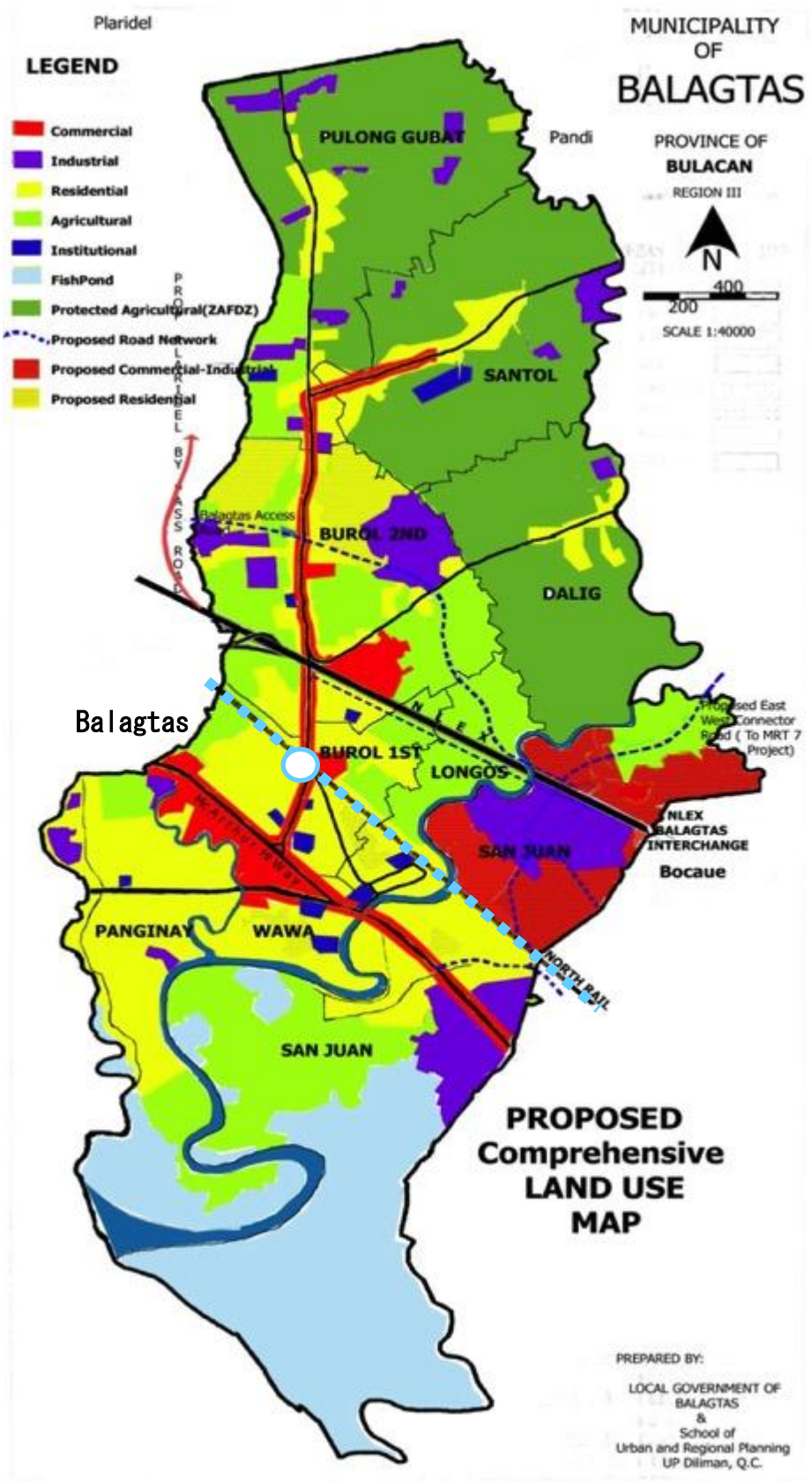
Bocaue

The NSCR project will extend for approximately 5.39 km in Bocaue, passing through mostly existing settlement areas in Brgys. Taal, Biñang 1st and 2nd, Turo and Bundukan (Figure 2.4). Commercial areas are generally situated along McArthur Highway.

The proposed Bocaue Station in Brgy. Turo (Photo Nr. 32-Annex E) is situated across Gov. Fortunato Halili Ave., where a number of fireworks dealers are lined up. However, these are more heavily located along the NLEX side. This side of Bocaue has been called a Fireworks Village due to the number of fireworks manufacturers in the area. Based on Bocaue's CLUP, there is a plan to relocate these establishments to a proposed fireworks center along the planned East Service Road of NLEX at Brgy. Bolacan, with the main of purpose of decongesting Gov. Fortunato Halili Ave, especially during Christmas and New Year's season.

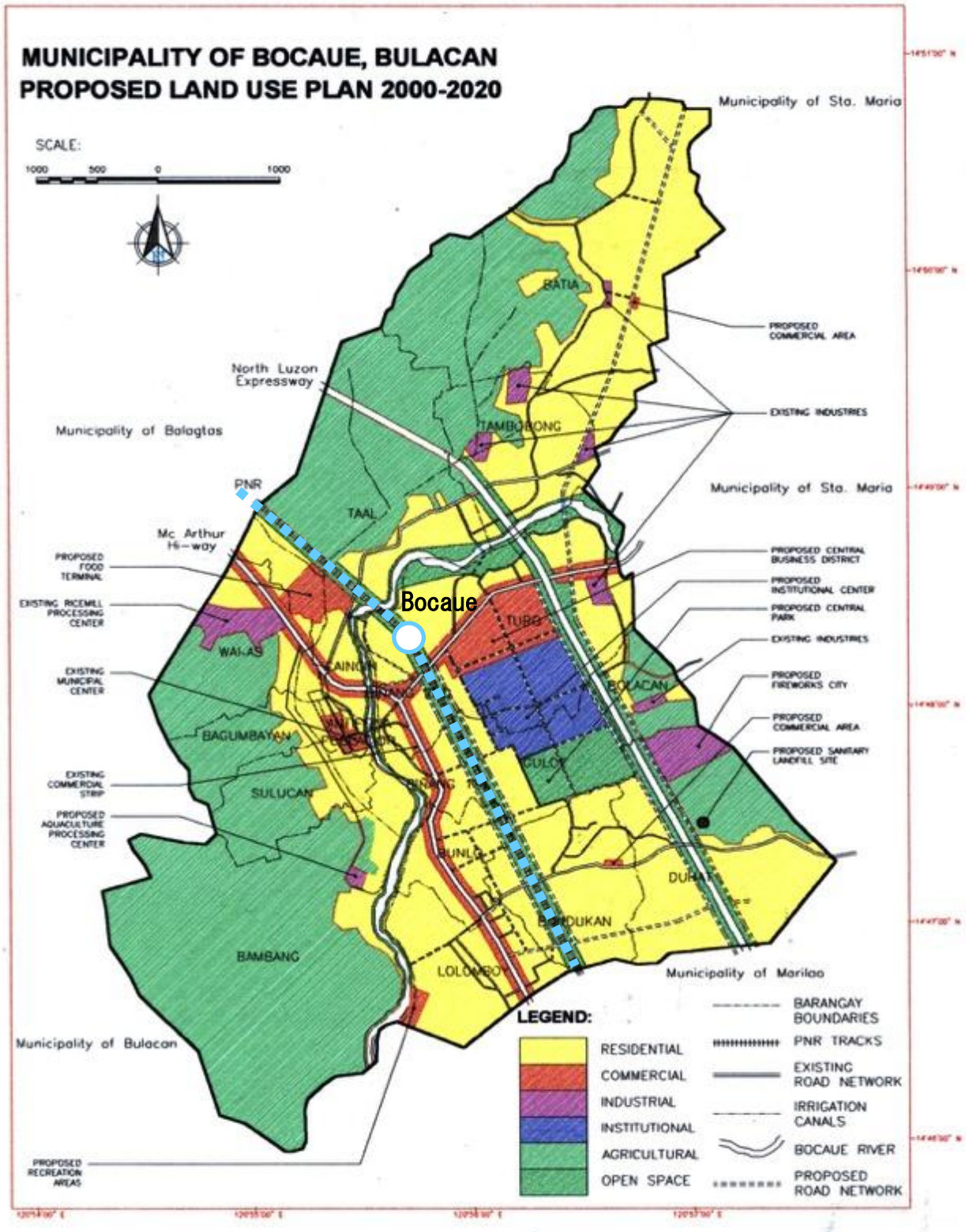
Marilao

The PNR alignment is generally almost parallel and within a few meters away from the McArthur Highway (Figure 2.5). Land use along the alignment is agricultural, residential and commercial in nature. The proposed Marilao Station will be in front of SM Marilao, located along McArthur Highway (Photo Nr. 33-Annex E).



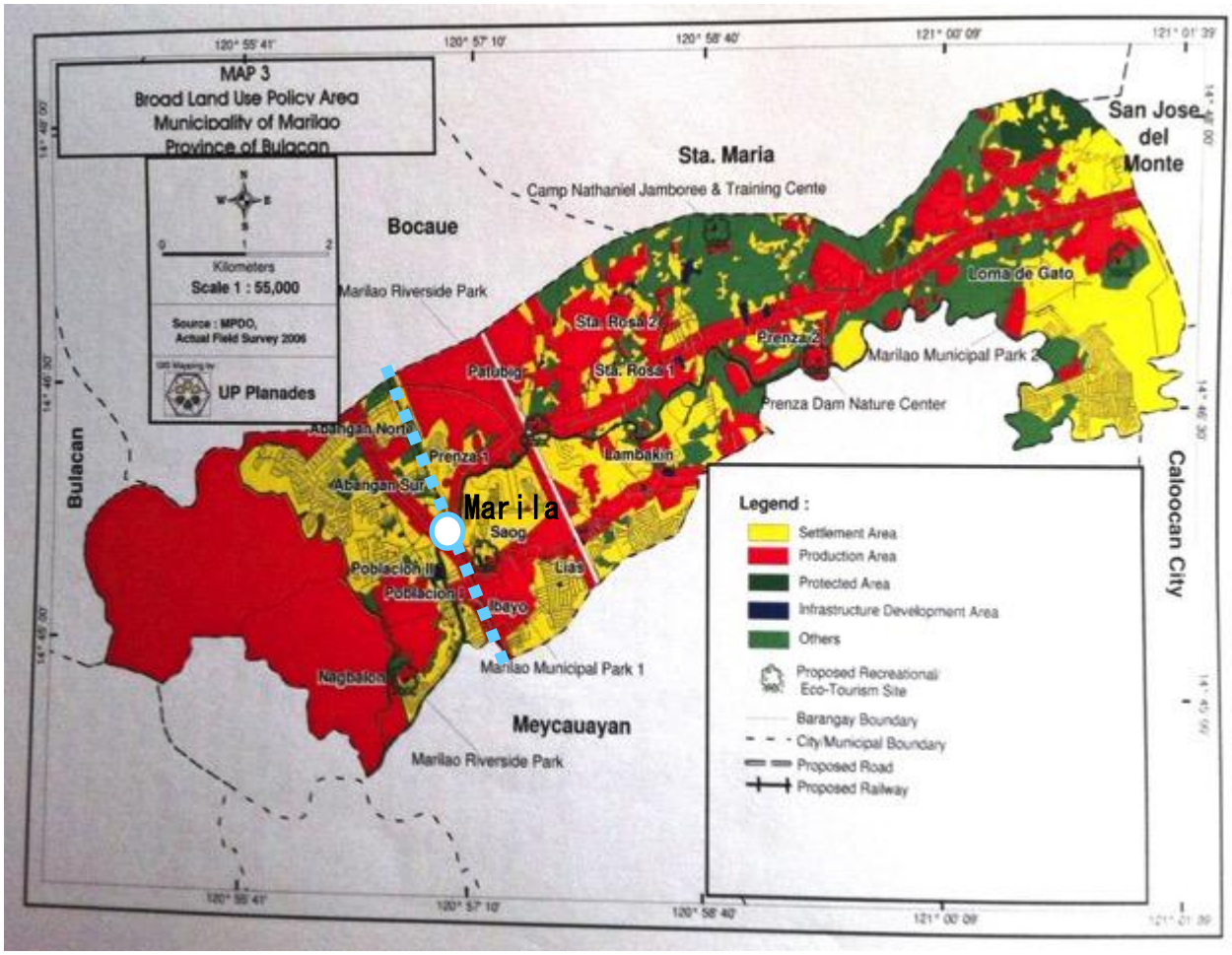
Source: Municipality of Balagtas CLUP

Figure 2.3 Municipality of Balagtas Land Use Map showing NSCR Alignment



Source: Bocaue City CLUP

Figure 2.4 Bocaue City Land Use Map Showing NSCR Alignment

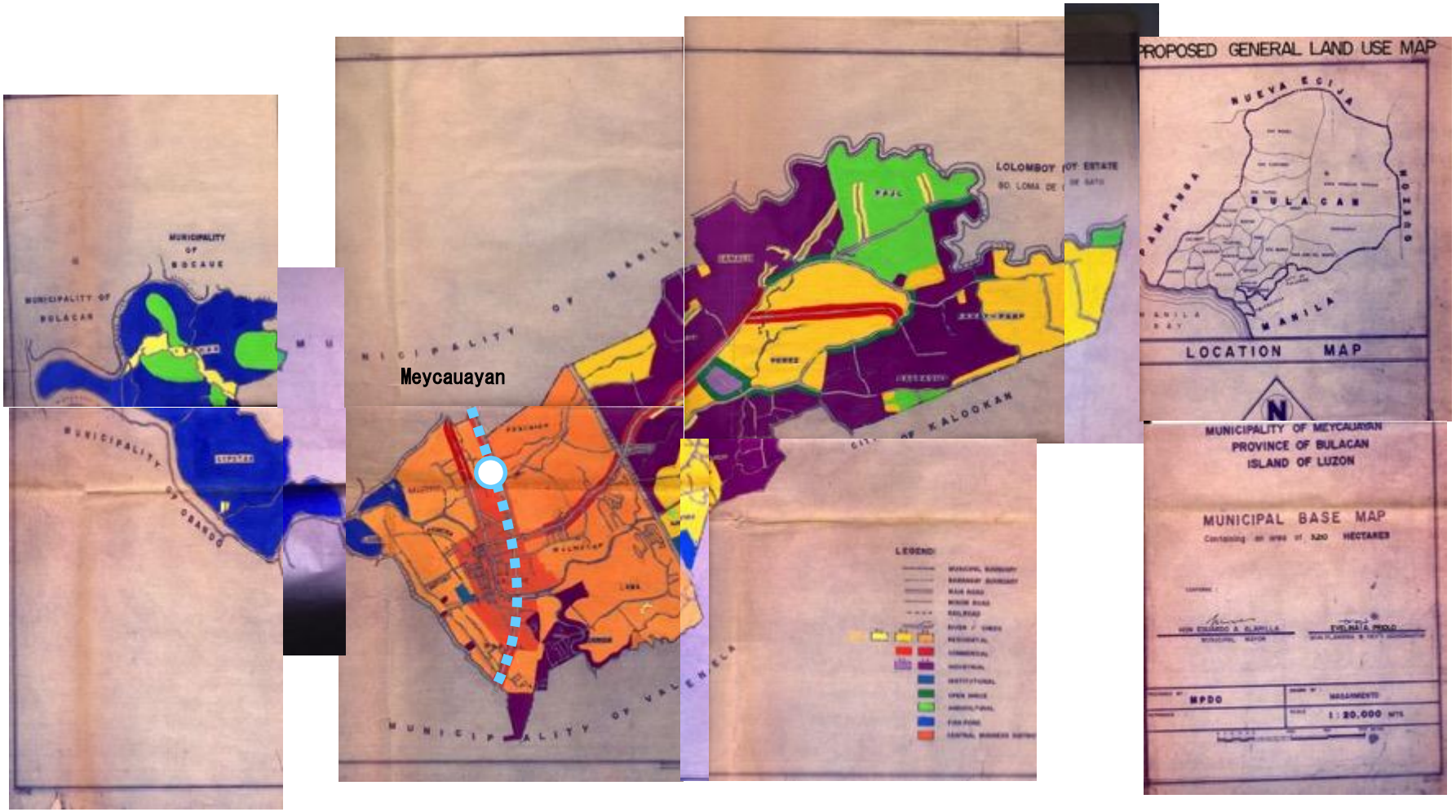


Source: Municipality of Marilao CLUP

Figure 2.5 Municipality of Marilao Land Use Plan Showing NSCR Alignment

Meycauayan

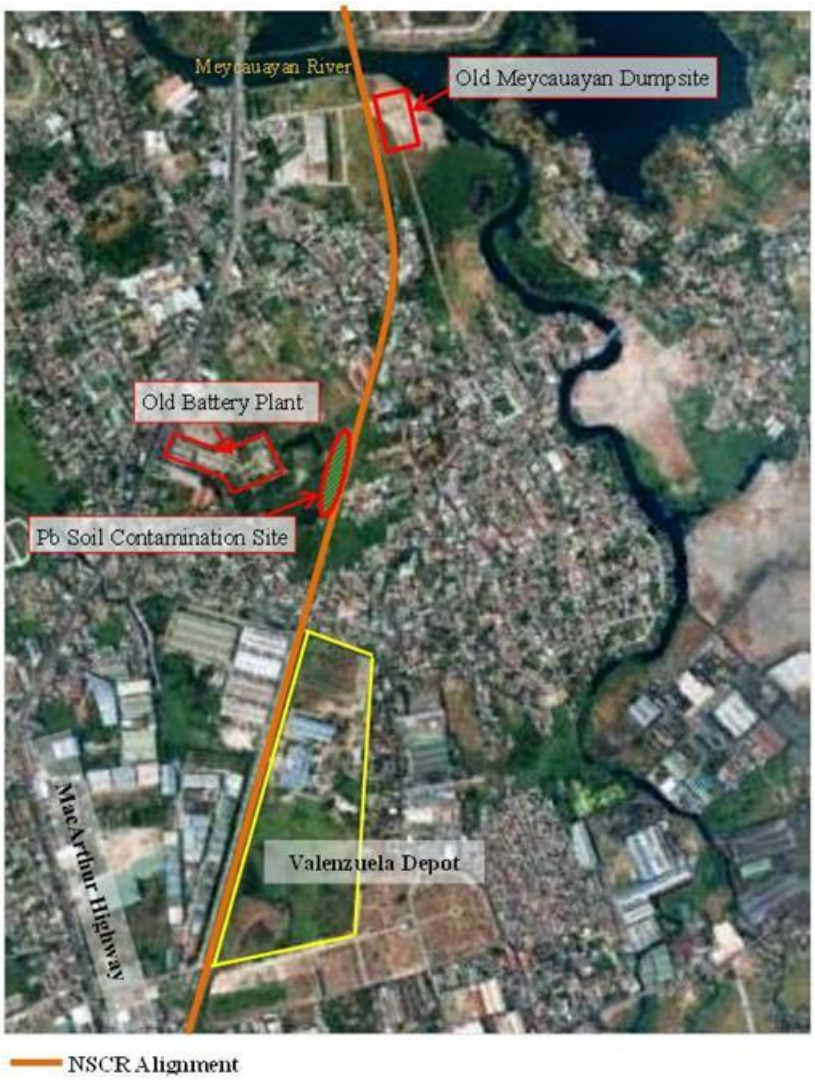
The proposed alignment passes through about 3.59 km in Meycauayan, traversing Brgys. Saluysoy, Pandayan, Calvario, Banga and Tugatog.The PNR alignment in Meycauayan generally runs in parallel alignment with the McArthur Highway (Figure 2.6). Sites along the alignment are predominantly residential and commercial in nature. Noted institutions that lie close to the PNR ROW consist of schools, colleges and churches like St. Mary's College of Meycauayan and Meycauayan College, San Bartolome de Apostol Quasi Parish, Tugatog Chapel, Our Lady of the Holy Rosary Academy of Meycauayan, Meycauayan Seventh Day Adventist Church. The old PNR Meycauayan Station in Brgy. Calvario (Photo Nr. 35-Annex E) still stands at present, bounded on its east by residential area.



Source: Meycauayan City CLUP

Figure 2.6 Meycauayan City Land Use Plan showing NSCR Alignment

An old garbage dumpsite for domestic wastes (Figure 2.8) is situated close to the Meycauayan River, which is also along the PNR ROW. The area now covered with grasses is currently vacant and is adjacent to a backyard leather tannery (Photo Nr. 36 -Annex E).



Source: JICA Study Team

Figure 2.7 Satellite Photo of old Meycauayan dumpsite

In terms of the level of contamination, composite bore samples taken from the site at 1.85m to 2m, 4.55m to 5m and 5.55m to 5.69m depths showed concentrations of polychlorinated biphenyls (PCBs), organophosphorus pesticides, organ chlorinated pesticides and volatile organic compounds that are below the method detection limits. The Certificate of Analysis for the soil sample is included in Annex H.

The results of heavy metals analysis (as dry basis) are shown in Table 2.1. There are no soil standards in the Philippines. Environmental standards for soil of three countries; Japan, Netherlands and Germany are also presented for reference in Table 2.1.

Results of the soil sample analysis show that all heavy metals tested were well below the three countries' standard values. It should be noted that soil samples were taken during the rainy season, which may have an influence on the quality of results.

Table 2.1 Summary of Heavy Metals Analysis for Soil Sample in the former Meycauayan dumpsite(mg/kg dry matter)

Heavy metals	Results	Environmental Standards for Soil Pollution in Japan[1]	Dutch Standards reference values[2]	German Standards Trigger values[3]
Arsenic	1.3	150	29.0	25
Barium	155	4,000	160	-
Cadmium	<0.1	150	0.8	10
Chromium	2.0	250	100.0	200
Lead	7.1	150	85.0	200
Mercury	<0.05	15	0.3	10
Selenium	<0.02	150	0.7	-
Silver	<0.4	-	-	-

Source: JICA Study Team

Note: 1) Soil Contamination Countermeasures Act, 2002, Hazardous Category: Class 2 Designated Hazardous Substances
2) Dutch Target and Intervention Values, 2000. Reference values for soil are adjusted for the organic matter (humus) content and soil fraction < 0.2 μm (lutum). Values are calculated for a "Standard Soil" with 10% organic matter and 25% lutum.
3) Federal Soil Protection and contaminated Site Ordinance: trigger values pursuant to Article 8 para 1 Sent. 2 no.1 of the Federal Soil Protection Act for the direct intake at the playground.

Also, along the ROW of PNR in Barangay Bangcal, Meycauayan, is an area that has been contaminated with lead but has since been remediated. The area was used by informal settlers as a "leaded material sorting & cleaning" encampment for their recycling of unauthorized extracted materials from the adjacent RAMCAR Battery Manufacturer Facility. RAMCAR was required by DENR EMB Region III to complete a site remediation action in the specified lead contaminated site. Contamination was generally composed of soil materials with residual lead content after extraction of the lead material.

The Leelin Industrial Corporation, which operated the RAMCAR Battery Manufacturer, conducted remediation from July 04 to August 29, 2014 with the following protocols:

a) Subject area was surveyed to determine size and technical points of the contaminated area
b) Soil samples were gathered from previously identified points in the subject area for independent testing to determine variables
c) Grating – complete and thorough topsoil scraping of up to 0.6 meters, to loosen the topsoil for hauling and relocation to a secure temporary holding area
d) Backfilling – after scraping and removal of topsoil, a new 0.6 layer of clean topsoil will be compacted to coat the subject area.
e) Retesting and monitoring – upon completion of remediation works, retesting and periodic monitoring will be performed to verify effectiveness of remediation.

The "Summary Report for the Remediation and Clean Up of the Identified Lead – Contaminated Site within the NLRC ROW at Barangay Bangkal, Meycauayan City" is attached in Annex G. The report is under evaluation by DENR EMB to determine its effectiveness.

Valenzuela

About 5.67 km of the PNR railway traverse Valenzuela City. Predominantly a mixed-use of residential and commercial land uses characterize the areas along the PNR ROW. Land use becomes primarily industrial as the railway passes through Brgy. Marulas and Karuhatan. Institutions such as churches and schools are also found near the alignment.

The alignment crosses three major roads as it reaches Brgy. Karuhatan: Mc Arthur Highway, Maysan Road and A. Pablo St.-Kahurahatan Road-Gen. T. de Leon Road. The alignment will also intersect with the proposed road of the NLEX-C5 Northern Link Project, which will link Valenzuela to other localities of Metro Manila.

The proposed stabling yard or parking location for trains is located in a government-owned lot within the National Food Authority (NFA), which is situated at the boundary of Meycauayan and Valenzuela. The site is a vacant area covered with grasses and becomes swampy during the rainy season. It is bounded by the NFA North District Office, First Valenzuela Industrial Company and Valenzuela Memorial Park.

Malabon

In Malabon, the alignment passes through Brgys. Potrero, Tinajeros, Acacia and Tugatog. The area along the PNR railway is dominated by high-density residential, industrial and commercial land uses (Figure 2.9).

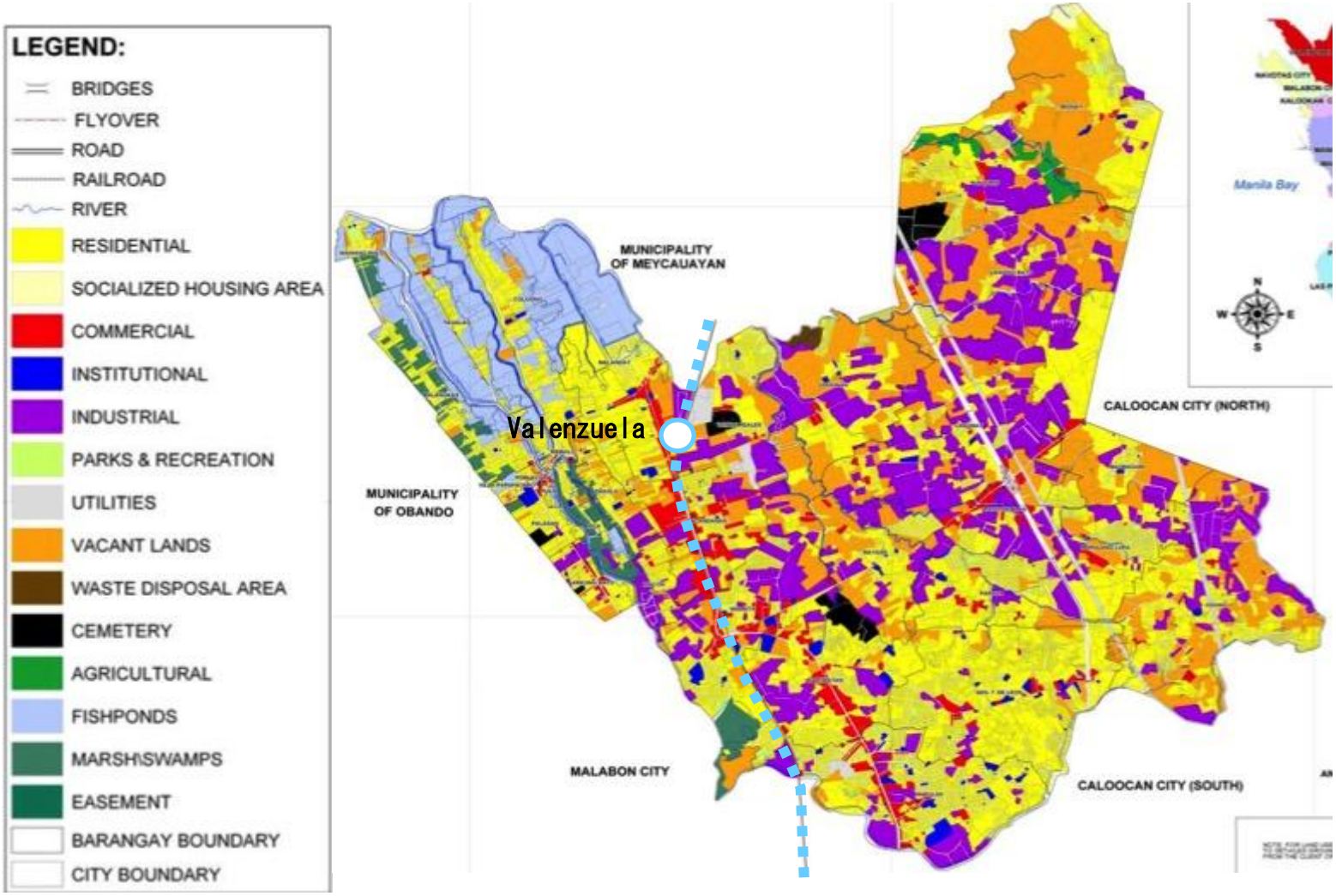
Caloocan

The railway runs from the barangays of Sangandaan, A. Mabini, Grace Park West and Maypajo in Caloocan City. Existing PNR Stations along the alignment are the Caloocan Station along Samson Road, Asistio Station along 10th Avenue, C-3 Road Station along 5th Avenue and the Solis Station (Figure 2.10).

The area surrounding the PNR ROW in Caloocan includes heavily built-up areas consisting of mixed residential houses, commercial establishments and other institutional facilities such as elementary schools and churches. Social and government institutions noted within 100 meters from the alignment are Andres Bonifacio Elementary School, Caloocan Central Elementary School, Marulas Elementary School, Caloocan Regional Trial Court and Martinez Memorial Hospital. The alignment also traverses the Caloocan PNR Maintenance Workshop located in Sangandaan before reaching 10th Avenue from Samson Road. The Depot can accommodate 88 rail cars units, the old PNR Station near Samson Road and the old Caloocan Station.

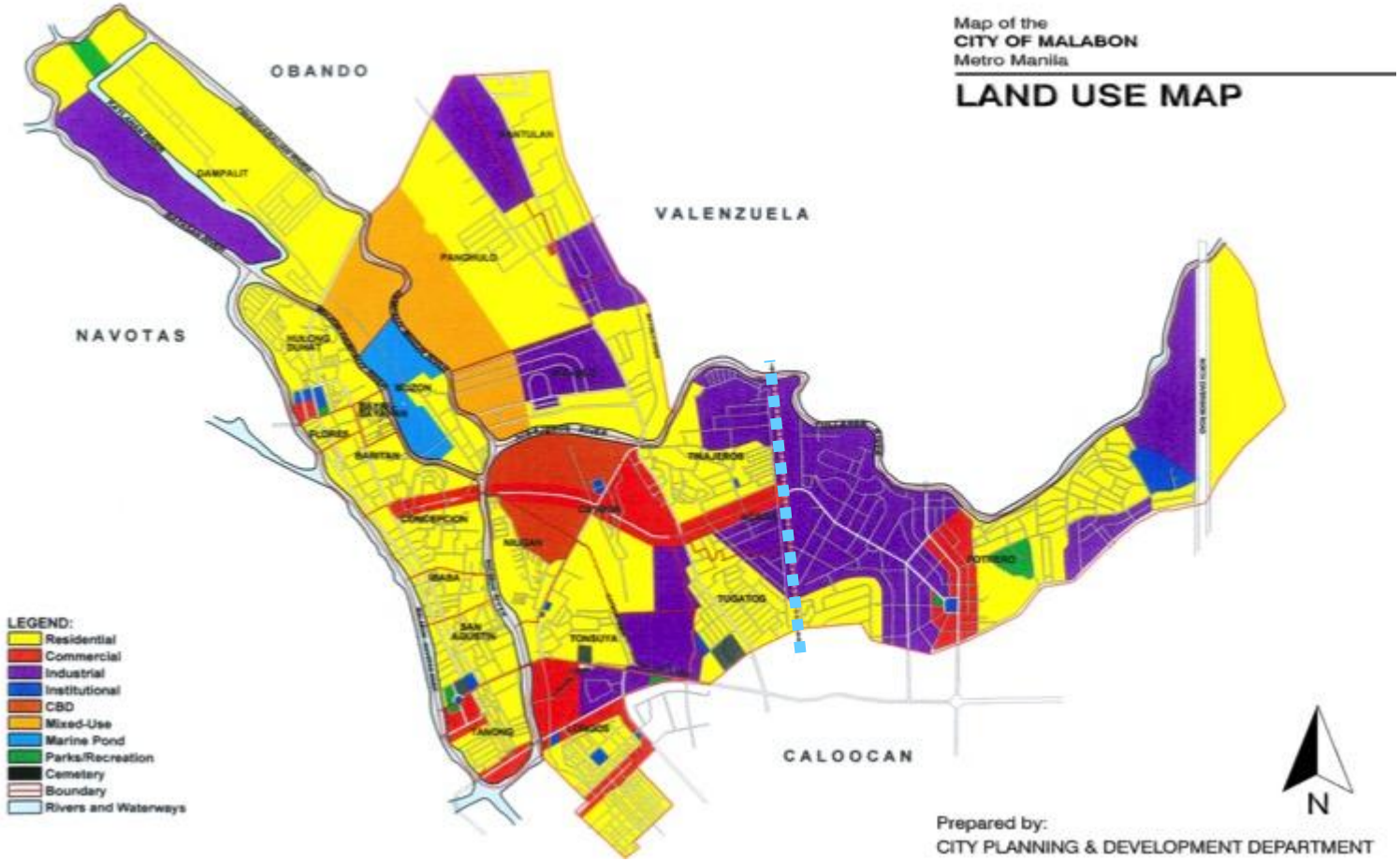
Manila

The railway corridor passes through the town of Tondo in District II, Manila, after it traverses Maypajo, Caloocan (Figure 2.11). The area is characterized by high density residential mixed-use zone and medium intensity commercial mixed-use areas. The alignment ends at the PNR Solis Station. The same site is proposed as the train station for this project. Gregoria de Jesus Elementary School is located right at the back of the PNR Solis Station.



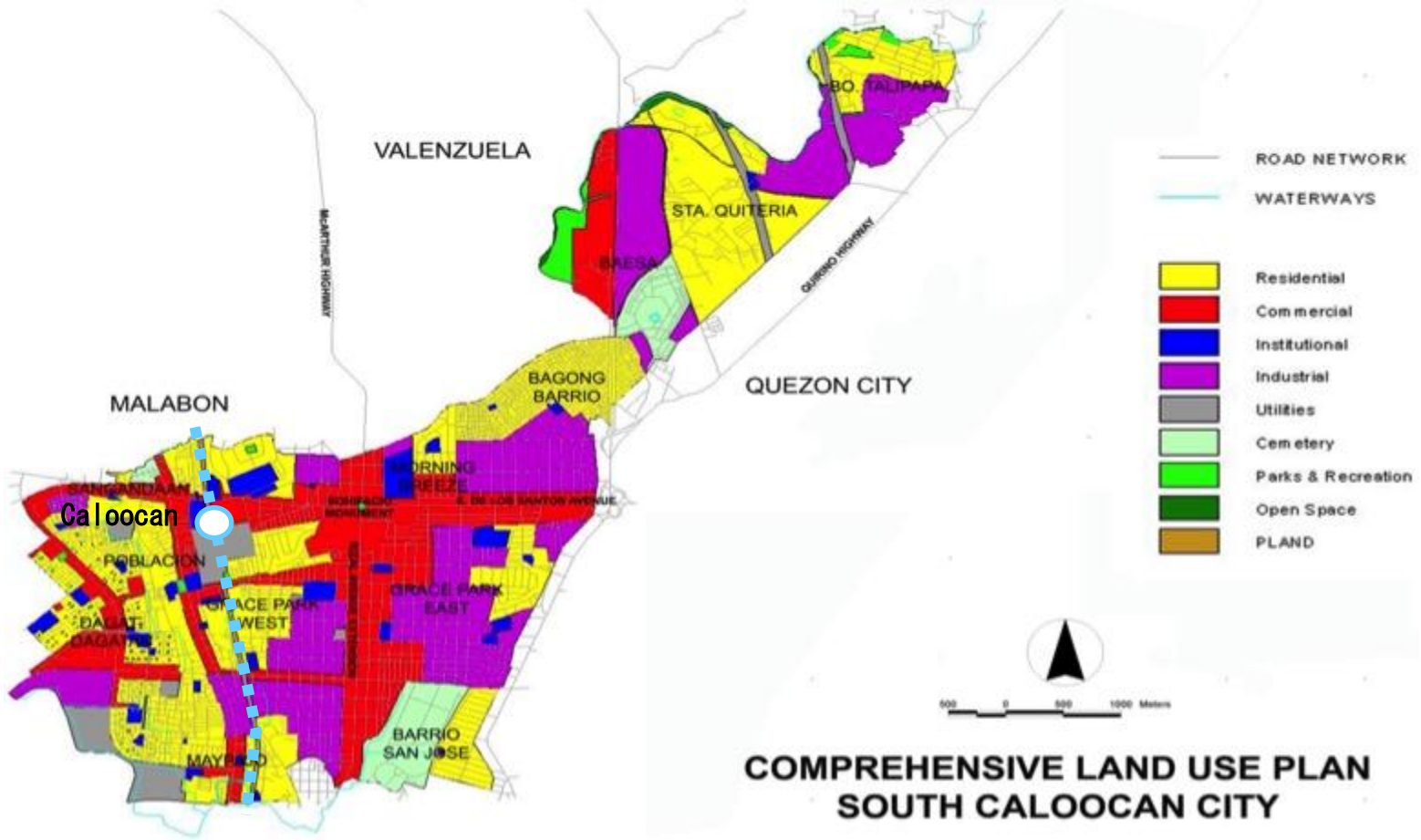
Source: Valenzuela City CLUP

Figure 2.8 Valenzuela City Land Use Map Showing NSCR Alignment



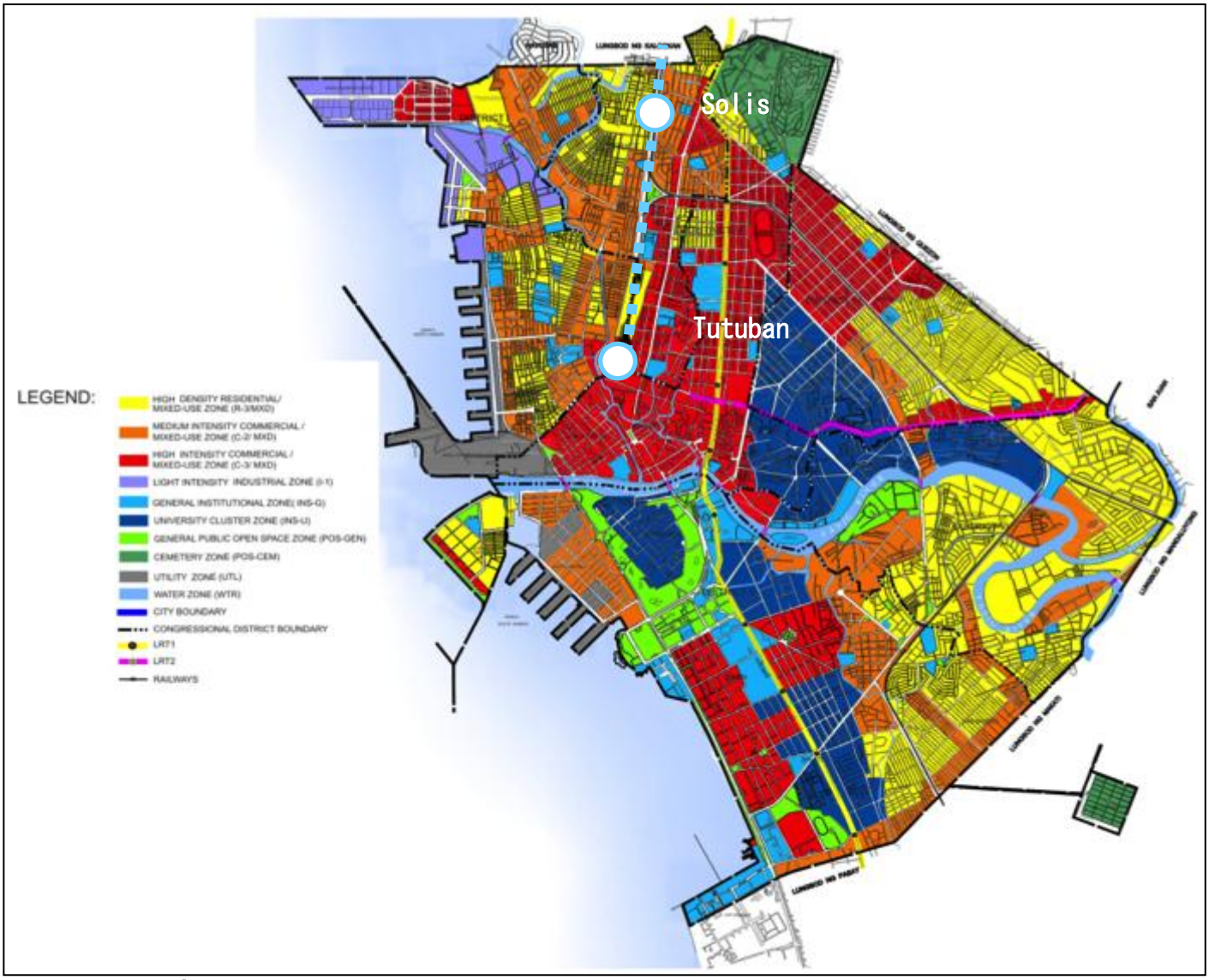
Source: City of Malabon CLUP

Figure 2.9 City of Malabon Land Use Map Showing NSCR Alignment



Source: Caloocan City CLUP

Figure 2.10 City of Caloocan Land Use Map Showing NSCR Alignment



Source: Manila City CLUP

Figure 2.11 City of Manila Land Use Map Showing NSCR Alignment

Land Use Impacts Identification, Prediction and Assessment, and Mitigation

Pre-Construction and Construction Phase

The NSCR project will utilize existing rail corridors along the PNR ROW. As a result, no direct major influences in land use are anticipated during pre-construction and construction phases. The direct impact on land use and development would be a function of the plans, zoning ordinances, and economic development programs of the affected local government.

Overall, the proposed railway project is compatible with local government plans that support rail systems and transit-oriented development. Existing land use policies and zoning ordinances support the development of the proposed railway. Majority of the affected municipalities/cities have adopted their CLUP to accommodate its implementation.

Operation Phase

In the long-term, beneficial land use impacts are expected to occur as a result of railway operation. The project is anticipated to provide a more efficient and safer transportation facility due to reduced travel time, reduced traffic congestion, improved traveler safety and reduced energy consumption. As a result of this improvement, land development would be expected to increase along or near the corridor through conversion of low density residential areas to higher density residential and commercial uses.

1.1.2 Environmentally Critical Areas (ECAs)

The following matrix (Table 2.2) shows the list of ECAs and the cities and municipalities where the NSCR will pass through. In all, only the following ECAs are present in the route of the NSCR:

1. Area of bird habitat at a portion (pond) of the Valenzuela depot area. This will be mitigated by identifying an adjacent offset area for wetland development in order to provide an alternative area for the birds to roost. Discussion of the bird habitat is in Section on Terrestrial Ecology under Avifauna.

2. Areas of historic interest along the route are the old PNR stations, which will not be demolished but rather rehabilitated in accordance with NHCP guidance during construction in order to provide historic interest to the project. Discussion of the old PNR Stations is found in Section 4.4 (Physical Cultural Resources).

3. Areas of flooding and typhoons. Discussion of flooding and typhoons is in Section 2.1.1 Drainage morphology/ Flood History. Along the alignment, there will be portions prone to periodic flooding during the rainy season, and the corresponding mitigation measures are listed in the impact management matrix.

4. Prime agricultural areas are present in portions of Malolos, Balagtas, Bocaue and Meycauayan (see Table 2.2 on specific barangays), and these will not be touched by the project., hence they will not be affected They will remain as such even with the construction and operation of NSCR.

5. Water bodies along the route include the following rivers: Guiguinto River, Balagtas River, Bocaue River, Marilao River, Meycauayan River, Malabon River, and Estero de Maypajo. However, none of these rivers are used for drinking water. The pollution in these rivers are extreme, and will be subject to regular water quality monitoring at the identified monitoring stations. Discussion of the rivers is in Section 2.1 Hydrology.

1.1.3 Land Use Tenure

The entire PNR alignment and ROW is the property of the Philippine National Railway, which is an attached agency of the Department of Transportation and Communications. Hence there are no tenurial issues with regard to ownership of the alignment. There are portions that still have encroachments by informal settlements (see discussion in socio-economic section, (d) Involuntary Resettlement, page 120), and these are addressed in the Resettlement Action Plan for land acquisition and relocation of informal settlers.

1.1.4 Visual Aesthetics

While the entire NSCR will be different from the occurring landscape along the alignment, the structures (viaducts and stations) will be well designed. The architecture of the structures will be complimentary to the urban landscape and will not be unpleasing to the visual aesthetics of the natural rural landscape. Placement of commercial billboards will be discouraged.

1.1.5 Land Values

The accessibility to be provided by NSCR will enhance the land values of the surrounding communities. However the contaminated areas mentioned in the Meycauayan areas (former city waste disposal site and the RAMCAR battery site) will be of lesser value, although the RAMCAR site has been remediated and the remediation report is still under review by EMB DENR Region 3. Remediation Report is in Annex G. Discussio of contaminated areas is in Section 1.11, pages 28 and 29.

Table 2.2 Environmentally Critical Areas in Cities and Municipalities covered by NSCR

ENVIRONMENTALLY CRITICAL AREAS	MALOLOS	GUIGUINTO	BALAGTAS	BOCAUE	MARILAO	MEYCAUA-YAN	VALENZUELA	MALABON	CALOOCAN	MANILA
1. Areas declared by law as national parks, watershed reserves, wildlife preserves, sanctuaries	None	None	None	None	None	None	None	None	None	None
2. Areas set aside as aesthetic potential tourist spots	None	None	None	None	None	None	None	None	None	None
3. Areas which constitute the habitat for any endangered or threatened species of Philippine wildlife (flora and fauna)	None	None	None	None	None	None	Proposed depot area	None	None	None
4. Areas of unique historic, archeological, geological or scientific interests	Old PNR station	Old PNR station	Old PNR station	Old PNR station	Old PNR station	Old PNR station	Old PNR station	Old PNR station	Old PNR station	Old Tutuban Station
5. Areas which are traditionally occupied by cultural communities or tribes	None	None	None	None	None	None	None	None	None	None
6. Areas frequently visited and or hard-hit by natural calamities										
-geologic hazards	None	None	None	None	None	None	None	None	None	None
-floods	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
-typhoons	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
-volcanic activities	None	None	None	None	None	None	None	None	None	None
7. Areas with critical slopes	None	None	None	None	None	None	None	None	None	None
8. Areas classified as prime agricultural areas	Portions of Brgy Dakila and San Pablo	None	Portions of Brgy Longos	Portions of Brgy Bundukan	None	Portions of Brgy Tugatog	None	None	None	None
9. Recharge areas of aquifers	None	None	None	None	None	None	None	None	None	None
10. Water bodies	None	Guiguinto River	Balagtas River	Bocaue River	Marilao River	Meycauayan River	None	Malabon River	None	Estero de Maypajo
11. Mangrove areas	None	None	None	None	None	None	None	None	None	None
12. Coral reefs	None	None	None	None	None	None	None	None	None	None

Source: JICA Study Team

1.2 Geology and Geomorphology

1.2.1 Topography and Geomorphology

The corridor from Malolos to Caloocan and Manila is relatively flat terrain, with slopes ranging from 0 to 3%. The elevation descends gently and gradually southwards towards Manila Bay. Due to this topography active and tidal flats and alluvial plains comprise the major landforms in the vicinity of the alignment.

1.2.2 Sub-surface Geology (Lithology and Stratigraphy)

The corridor from Malolos to Caloocan to Solis belongs to the Central Luzon Basin – East Side stratigraphic grouping. The stratigraphic column for Central Luzon Basin – East Side is shown in Figure 2.2. The corresponding lithology and stratigraphic relations are provided in Table 2.3.

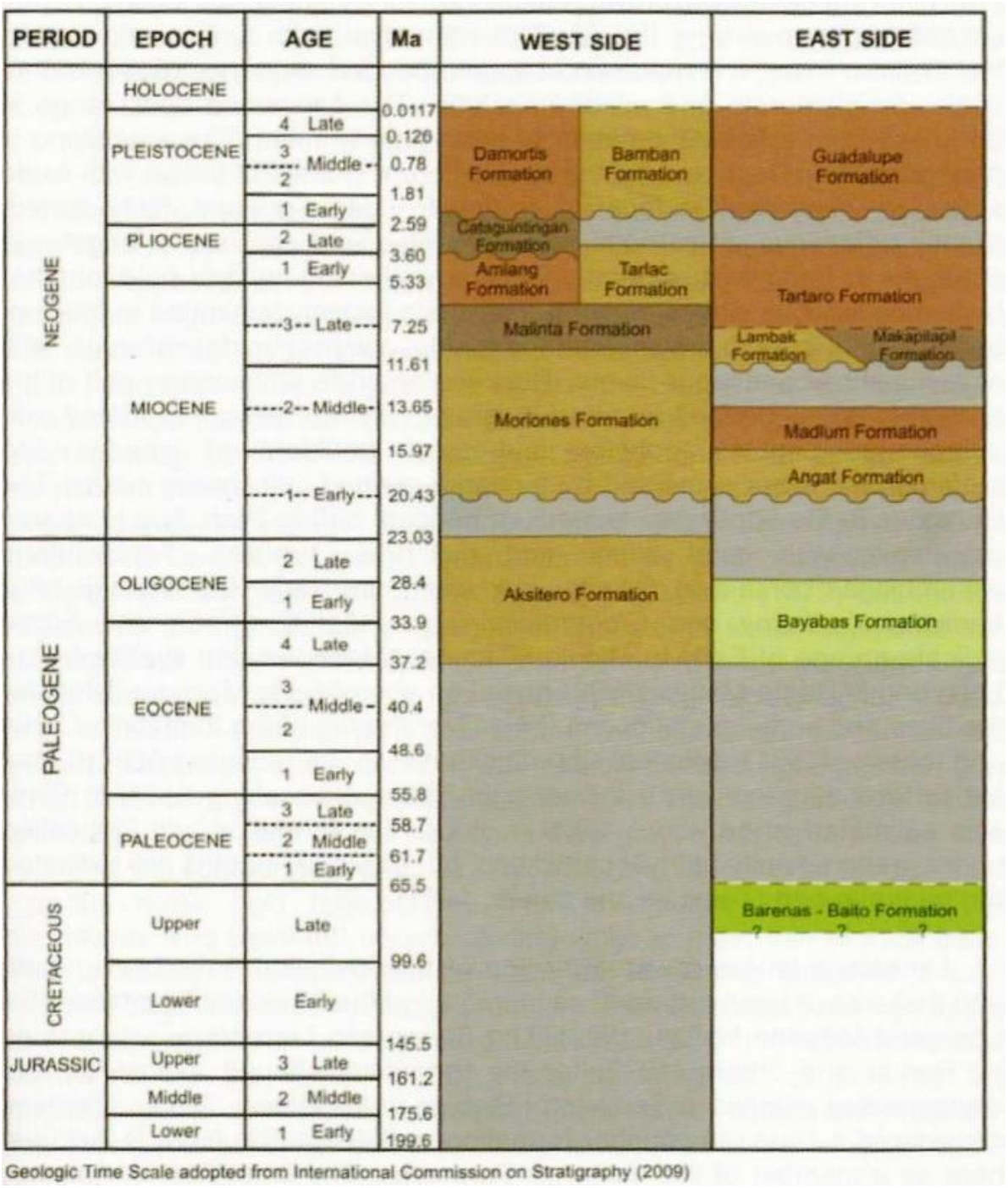
Alluvial formation resulting from the deposition of weathered rock materials by rivers, creeks and streams on low-level areas is the most recent geological structure covering the landmass along the alignment.

The project site in Caloocan and Manila is underlain by the Guadalupe Tuff Formation, which underlie most of Metro Manila. It consists of well-laid rock formation of tuffaceous sandstone, tuffaceous siltstone and shale being the weakest member.

Table 2.3 Stratigraphy of Central Luzon Basin - East

Formation	Lithology	Stratigraphic relations	Thickness
Guadalupe Formation	Conglomerate, sandstone, mudstone, tuff, pyroclastic breccias, tuffaceous sandstone	Unconformable over the Tartaro Formation	1,500 m – 2,200 m
Tartaro Formation	Mudstone, sandstone	Not reported	
Makapilapil Formation	Tuffaceous sandstone, mudstone	Unconformable over the Madlum Formation	500 – 800 m
Lambak Formation	Tuffaceous shale, sandstone, conglomerate	Unconformable over the Madlum Formation	>1,000 m
Madlum Formation	Sandstone, silty shale, andesite flow, pyroclastic breccias, tuffs, greywacke, argillite, limestone	Conformable over the Angat Formation	>1,000 m
Angat Formation	Lower calcareous shale and sandstone member; upper limestone member	Unconformable over the Bayabas Formation; overlies diorite	1,950 m
Bayabas Formation	Andesite flows, pyroclastic rocks, siltstone, sandstones, conglomerates with limestone lenses	Overlies the Barenas-Baito Formation	
Barenas-Baito Formation	Spilitic and basic to intermediate volcanic flows and breccias with intercalated metasedimentary roacks	Overlain by the Bayabas Formation	

Source: Mines and Geosciences Bureau, 2010



Source*: Geology of the Philippines, 2nd ed., Mines and Geosciences Bureau, 2010*

Figure 2.11 Stratigraphic Column for Central Luzon Basin

For the Caloocan to Manila segment, Metropolitan Manila is a composed of six geomorphic zones, namely: Manila Bay, the Coastal Margin, the Guadalupe Plateau, the Marikina Valley, the Laguna Lowlands and Laguna de Bay (Figure 2.13).

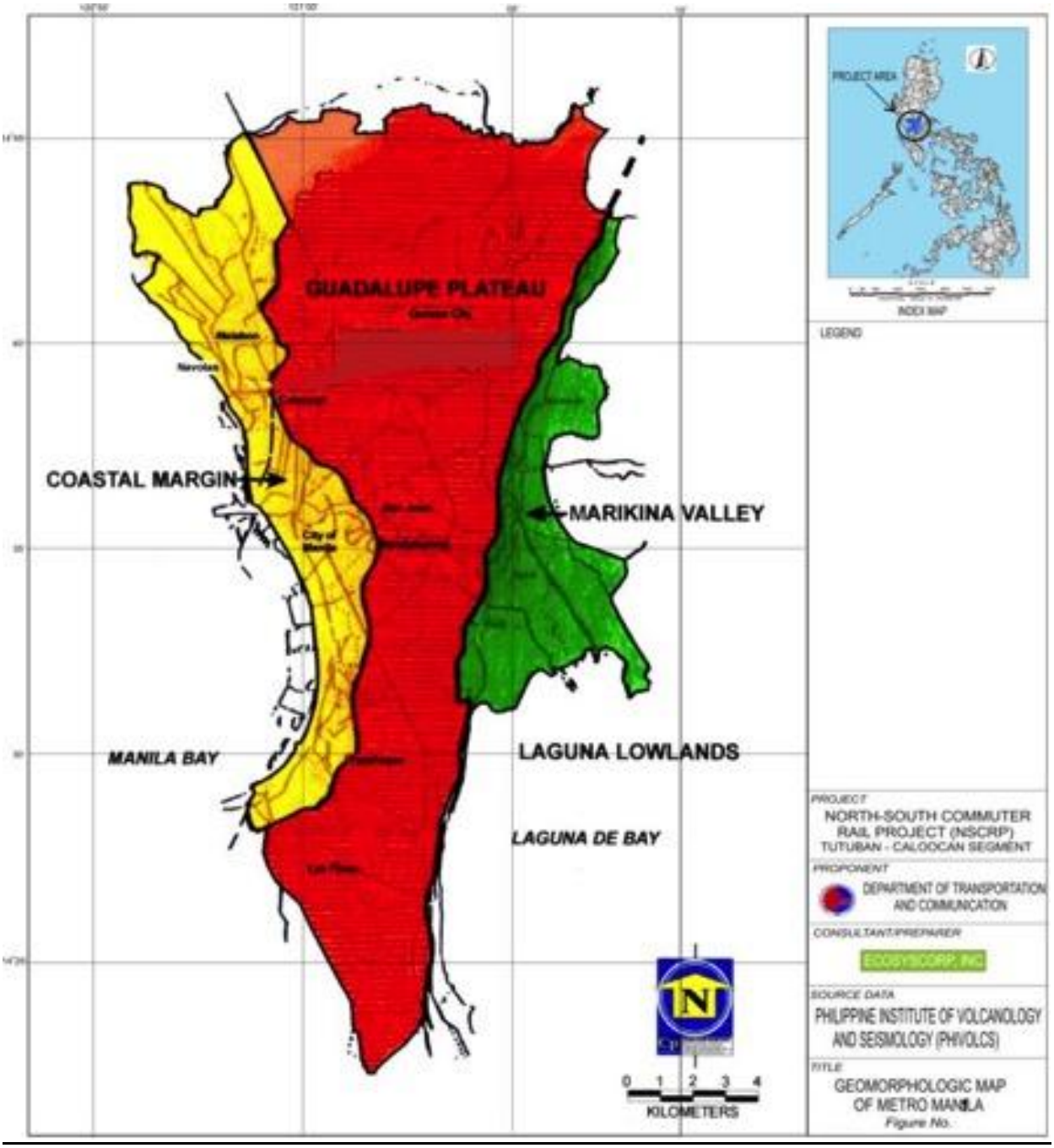
Manila Bay is a body of water west of Metro Manila with coastlines of about 90 km spanning an area of about 1,800 sq. km. The Coastal Margin is the low-lying flat strip of land east of Manila Bay with an elevation of less than 5 meters above sea level. This zone covers portions

of Valenzuela, Malabon, Caloocan, Navotas, Manila, Pasay, Paranaque, Las Piñas and the reclaimed portion of Manila Bay.

The Guadalupe Plateau constitutes about 62% of the entire Metro Manila with a total area of 395 sq. km and an elevation of about 5-70 m above mean sea level.

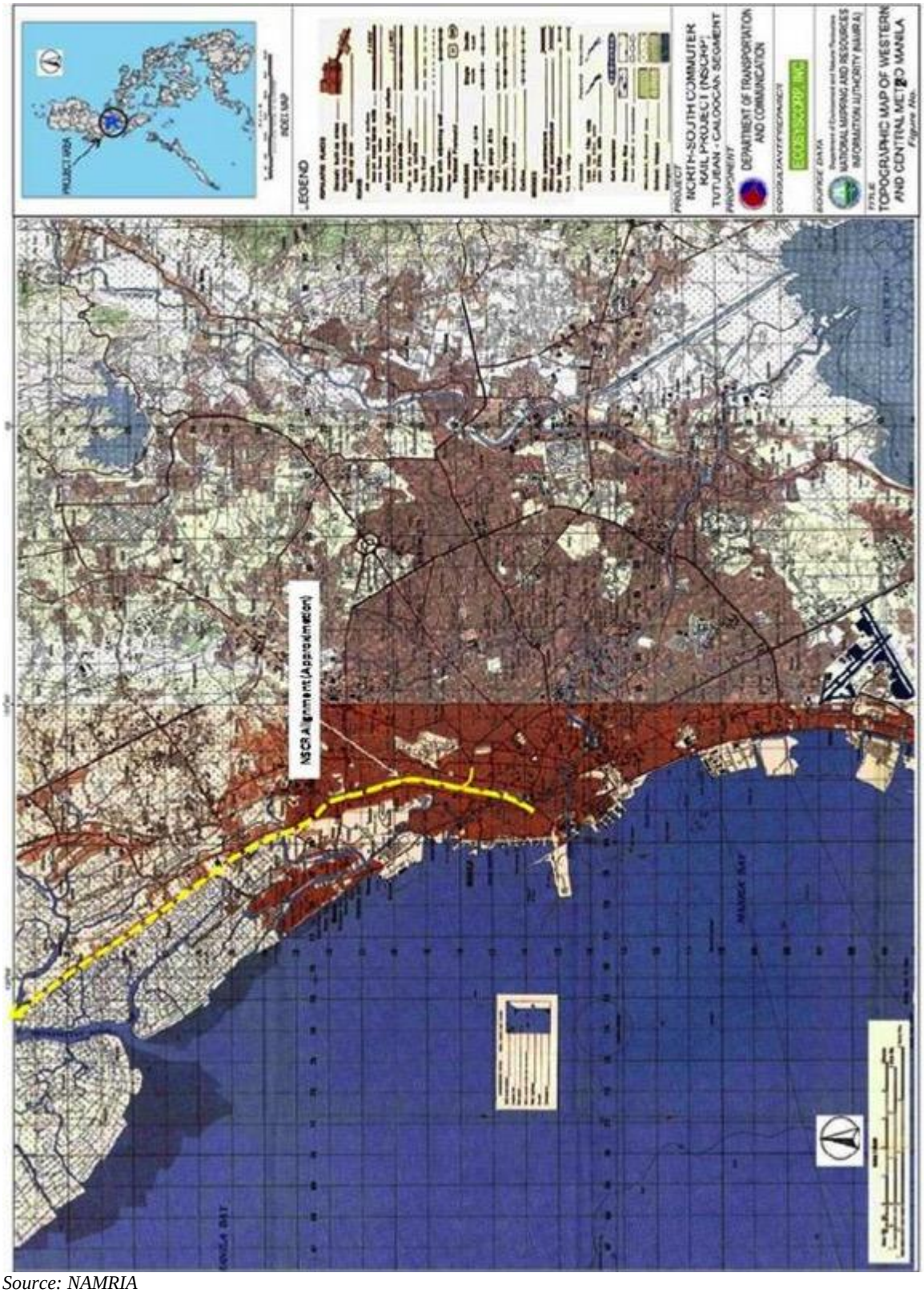
Marikina Valley is the low-lying floodplain area east of the Guadalupe Plateau and constitutes 18.5% of the metropolis land area. The Laguna Lowlands and Laguna de Bay are located south of Marikina Valley. These areas form a landlocked lake of 200km shoreline with narrow inland coastal zone.

The Caloocan to Tutuban segment of NSCR extends from the coastal margin setting to the Guadalupe Plateau. In general, the topography of the subject segment is relatively flat and low-lying. Going north, the elevation slightly becomes higher (Figure 2.14).



Source: PHIVOLCS

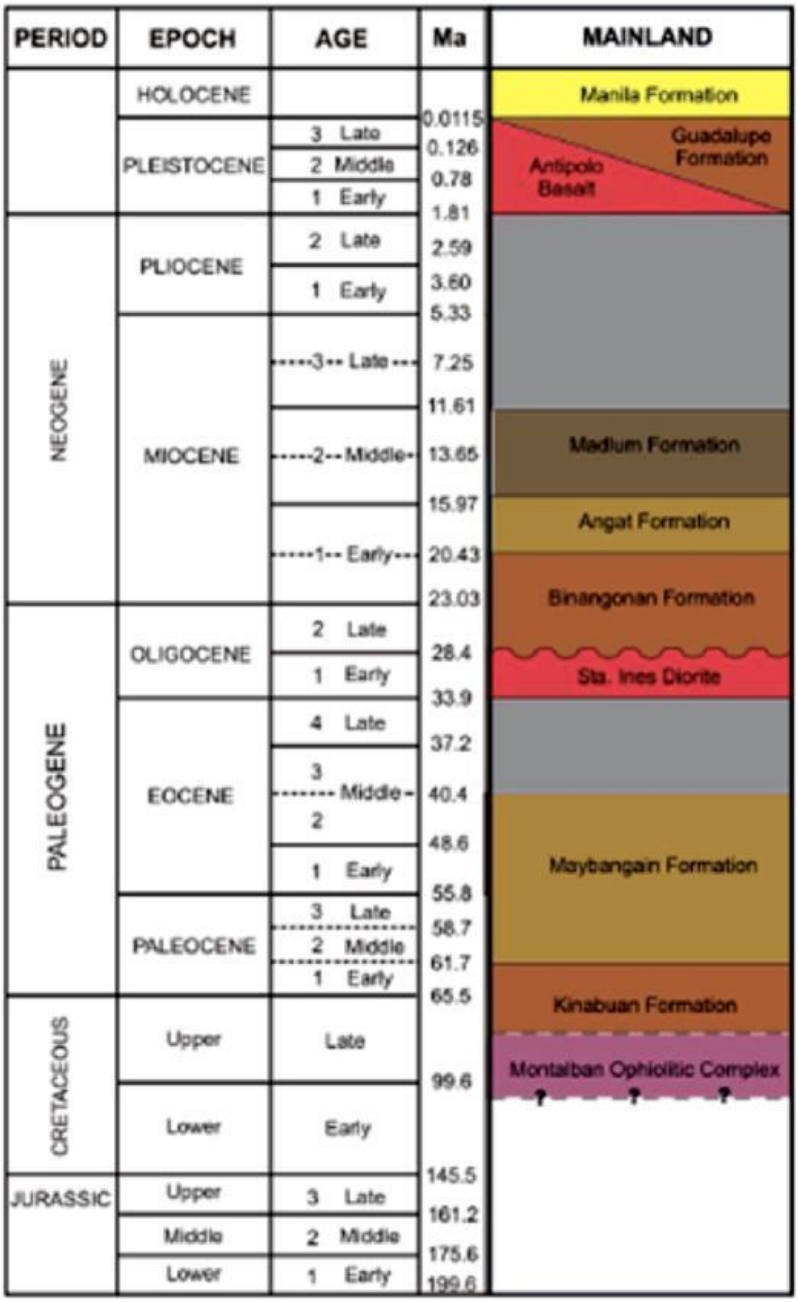
Figure 2.12 Geomorphologic Map of Metro Manila



Source: NAMRIA

Figure 2.13 Topographic Map of Western and Central Metro Manila

Figure 2.15 shows the stratigraphic column for the Southern Sierra Madre, which encompasses Metropolitan Manila and vicinities.



Source: Geology of the Philippines, 2nd ed., Mines and Geosciences Bureau, 2010

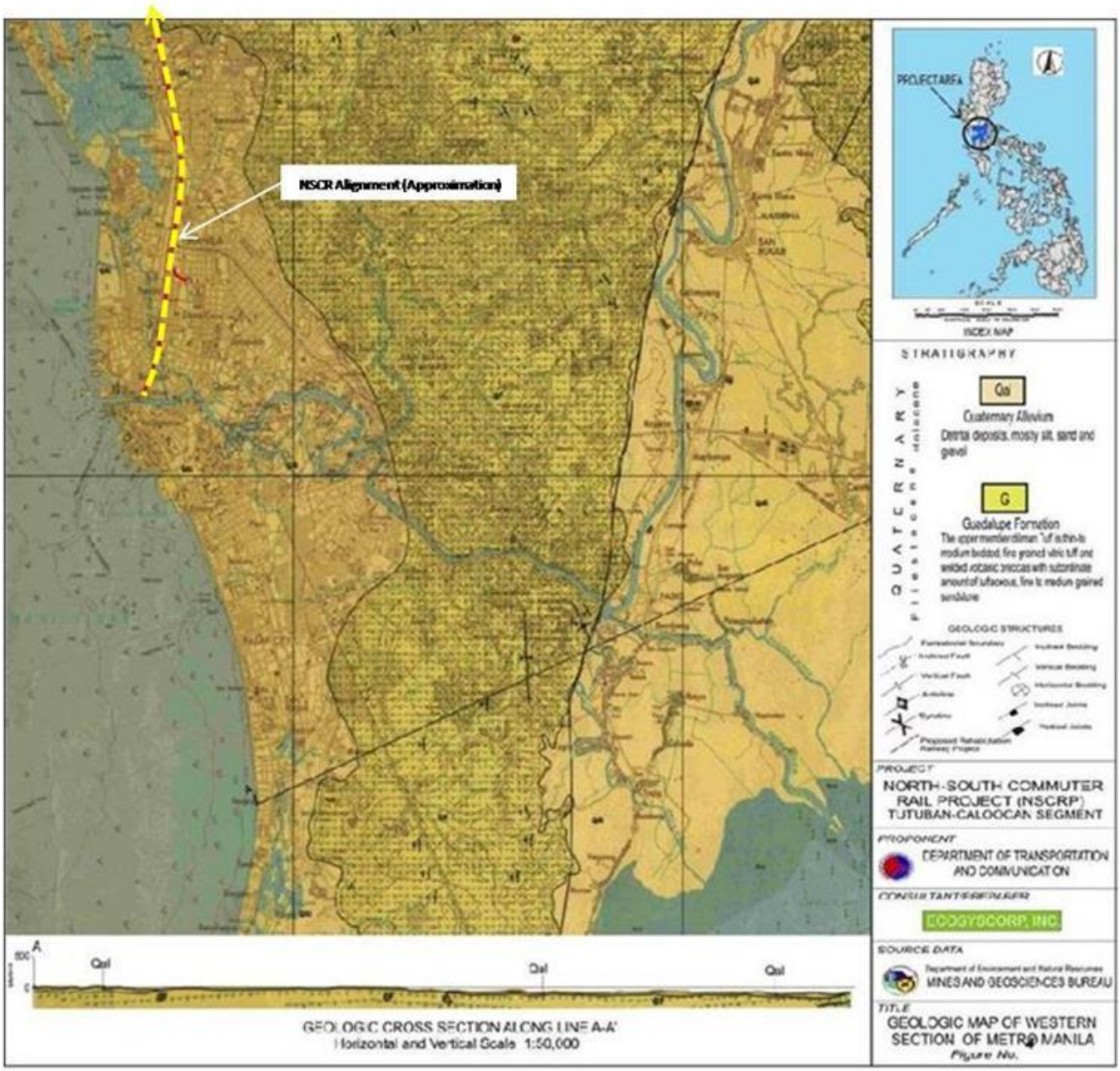
Figure 2.15 Stratigraphic Column for Southern Sierra Madre

The distribution of the lithologic formations for the western section of Metropolitan Manila is presented in Figure 2.16. Two formations are observed to underlie Metropolitan Manila, namely, Guadalupe Formation and Quaternary Alluvium/Manila Formation.

The Guadalupe Formation is made up of extensive volcaniclastic deposits. This formation has two (2) stratigraphic members; the lower conglomeratic member, Alat Conglomerate – consisting of conglomerate, silty mudstone and tuffaceous sandstone and the upper main tuffaceous member, Diliman Tuff – consisting of vitric tuff, ignimbrite and volcanic breccia. Based on the presence of *Stegodon* fossils and other vertebrate remains, leaf imprints and artifacts, the Guadalupe Formation is assigned a Pleistocene age. Maximum thickness is believed to be approximately 1,500 to The Manila

Formation is a sequence of unconsolidated fluvial, deltaic and marine deposits. The age of this formation is Holocene. Maximum thickness obtained from core drilling along the Light Rail Transit 2 (LRT2) route from Santolan, Pasig to Recto Manila is about 800m (*Aurelio and Peña 2004*). Older works refer to this sequence as Quaternary Alluvium.

Alluvial formation resulting from the deposition of weathered rock materials by rivers, creeks and streams on low-level areas is the most recent geological structure covering the landmass along the alignment.



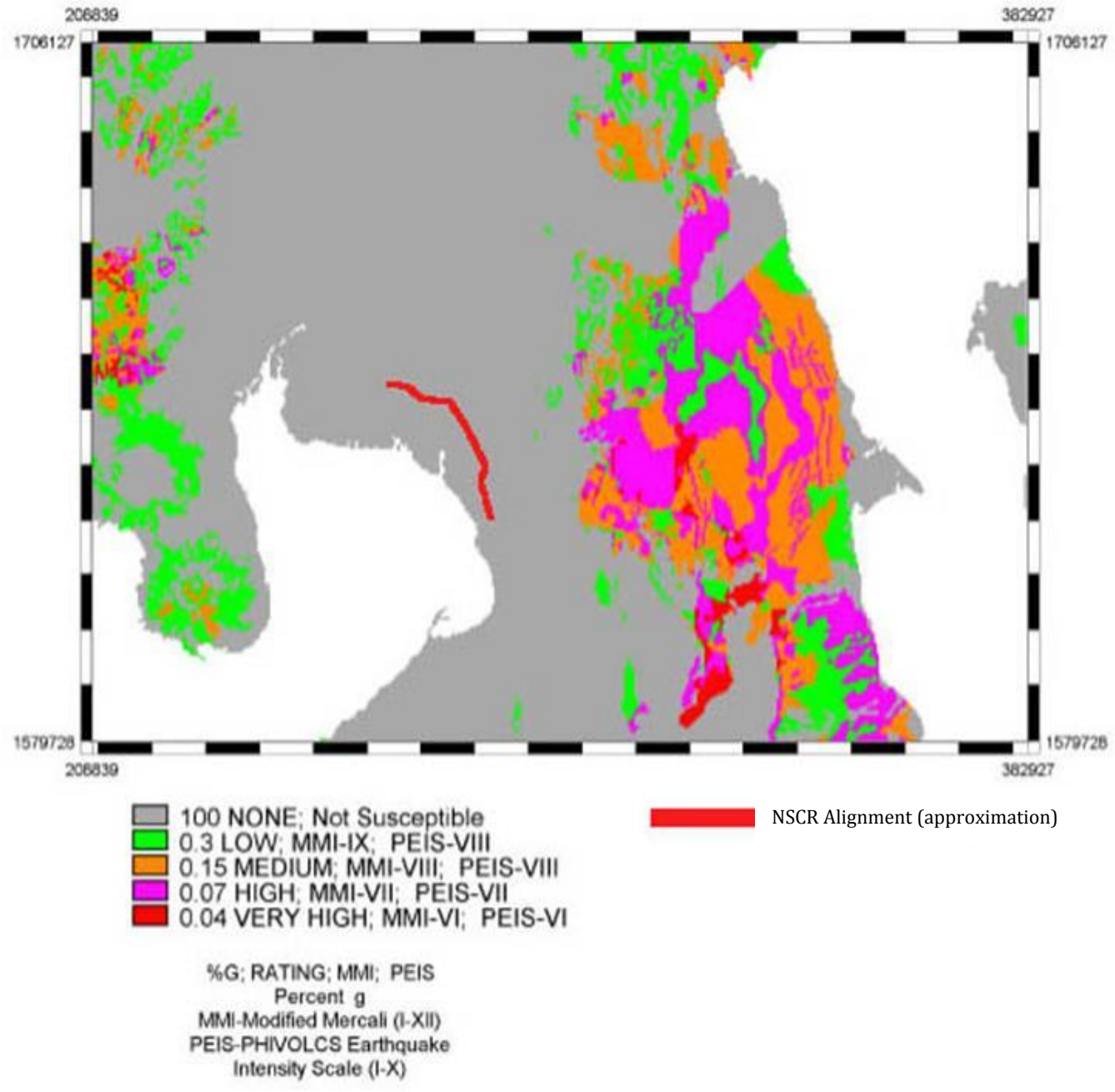
Source: Mines and Geosciences Bureau

Figure 2.16 Geologic Map of Western Section of Metro Manila

1.2.3 Geologic and Other Natural Hazards (subsidence, liquefaction, landslides, etc.)

Landslide

In terms of earthquake-induced landslide hazard, the study corridor is not vulnerable to landslide based on DOST-PHIVOLCS-generated map, as shown in Figure 2.17. The Map was produced by simulating the largest possible earthquake magnitude occurring in the area.



Source: PHIVOLCS-DOST

Figure 2.17 Earthquake-triggered landslide susceptibility map based on Critical Acceleration Values and Earthquake Intensities

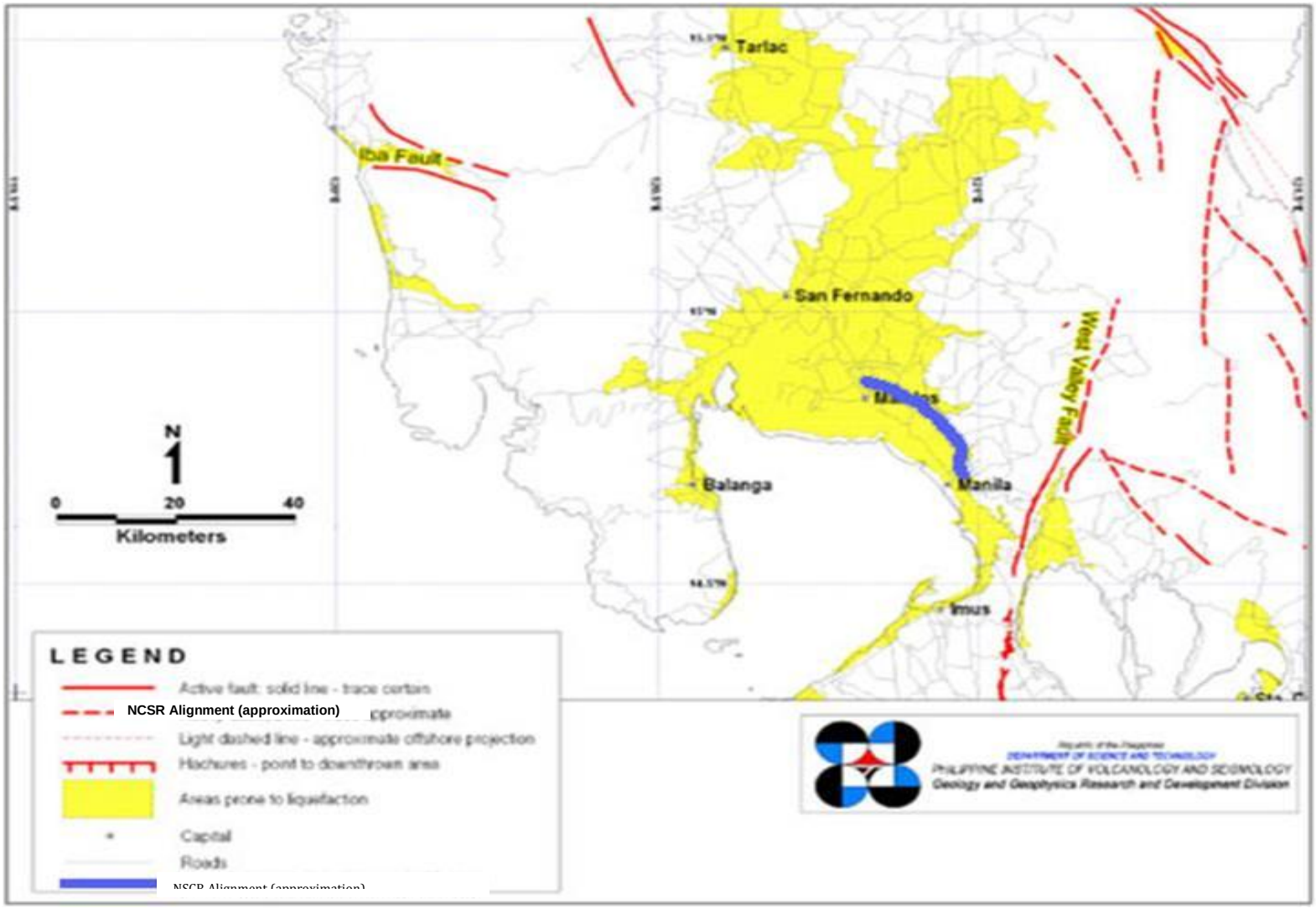
The map shows that possible landslide initiation zones at varying degrees of susceptibility from low to very high, are located in the far eastern part of the alignment from Malolos to Caloocan and Caloocan to (Tutuban), which have relatively higher elevations or slopes as compared with the relatively flat terrain of the proposed alignment. Hence, the alignment will not likely be affected by landslide.

Liquefaction

Liquefaction hazard is the failure of the ground to support the weight of structures as a result of a phenomenon whereby an area composed of loosely compacted grains and saturated with water is hit by seismic waves. The waves cause the grains to pull slightly apart, allowing water to fill the voids and leading to a loss of overburden support.

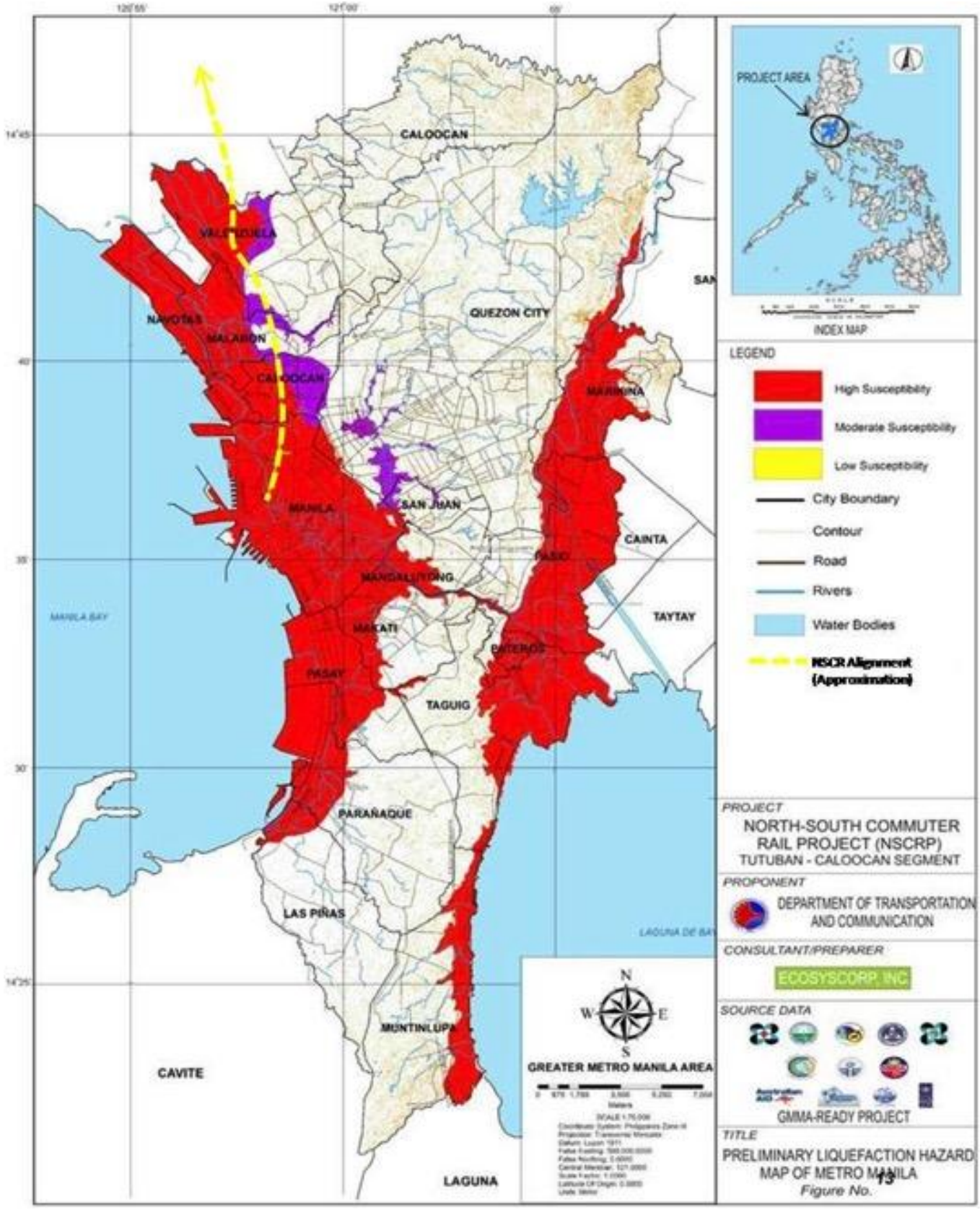
The liquefaction hazard map for Region III and Metro Manila, shown in Figure 2.18 indicates that the areas in the proposed alignment from Malolos to Caloocan are generally rated as prone to liquefaction. One of the major factors causing potentially liquefiable areas along the alignment is the presence of alluvial soils, underlying the flat low-lying areas. In addition, since liquefaction only occurs in saturated soil, areas along the alignment that is expected to be liquefaction-prone are those near bodies of water such as areas along the Guiguinto River, Bigaa River, Bocaue River, Marilao River and Meycauayan River in Bulacan, and Tullahan River in Malabon.

For the Caloocan to Tutuban Section, the ground underneath the subject segment will be generally highly susceptible to liquefaction (Figure 2.9). The lithologies underlying the subject area, including its geomorphic and hydrologic setting, make it more susceptible to liquefaction hazard. A major part of the segment lies on highly liquefiable terrain. The northern 15% portion lies on moderately liquefiable ground.



Source: JICA Study Team

Figure 2.18 Liquefaction Susceptibility Map



Source: PHIVOLCS

Figure 2.19 Preliminary Liquefaction Hazard Map of Metro Manila

Ground Subsidence

Ground subsidence due to groundwater extraction has been reported by Siringan and Rodolfo (2003) to occur in some parts of Bulacan like Malolos, Bocaue, Marilao and Meycauayan, as well as in the CAMANAVA (Caloocan, Malabon, Navotas, Valenzuela) area. Ground subsidence was measured at an alarming rate of 3 to 9 cm/year, as compared to the relatively small sea level rise of 7 to 8 mm/year due to global warming.

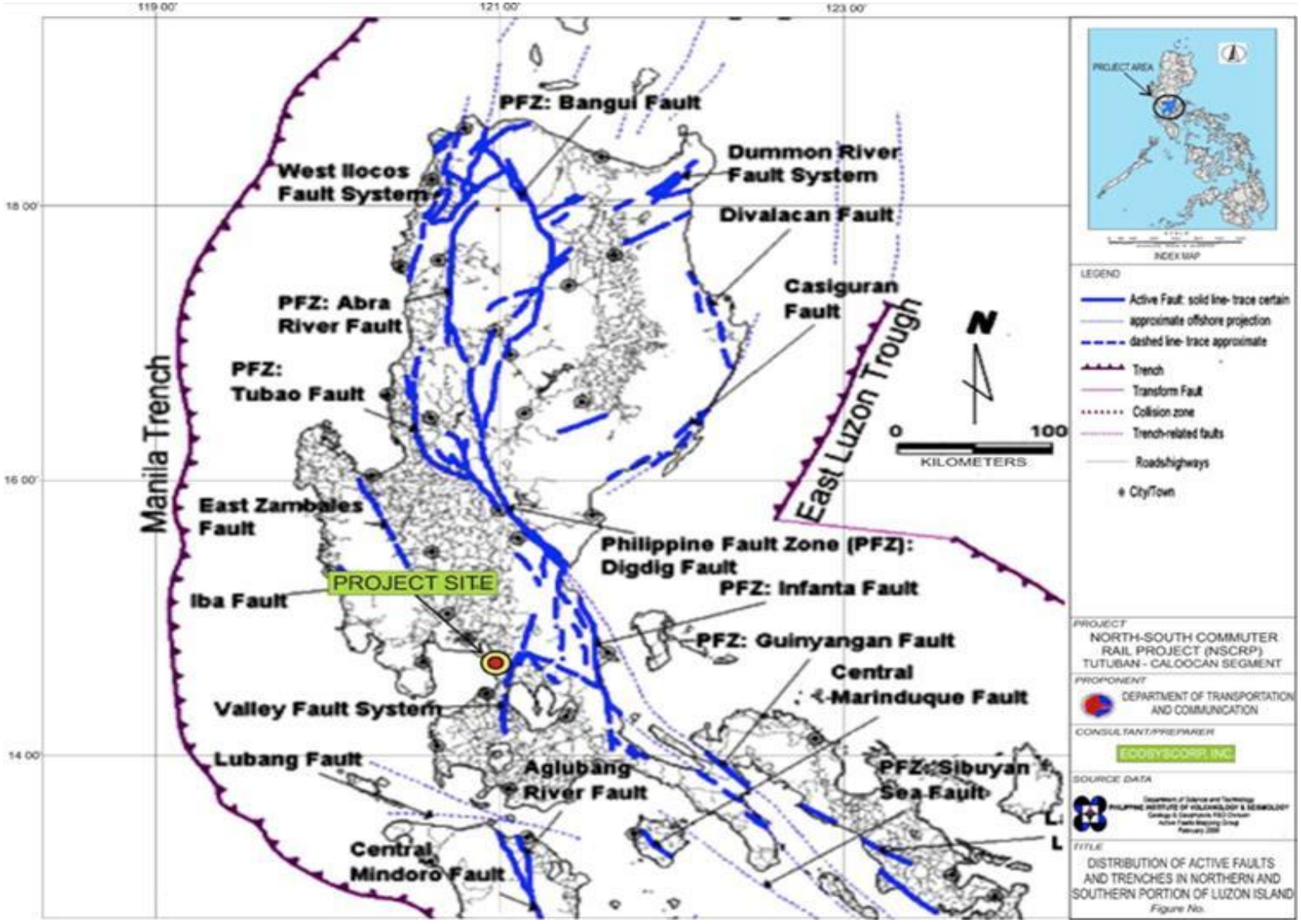
Subsidence due to groundwater extraction has been established based on the strong correlation of sea level rise in Manila Bay and the rate of groundwater withdrawal in Metro Manila. In addition, Siringan's study showed that flood-prone areas are also those with high groundwater extraction rates, where the water table has lowered about 100 meters. The over extraction of groundwater that contributes to ground subsidence is mainly attributed to agriculture (particularly rice production) and fishpond operation.

Active Faults

The structural elements around the island of Luzon are presented in Figure 2.20. Arranged from the nearest to the farthest, the structures that are likely to exert impacts to the project area and vicinities are shown in the map, and described in the following paragraphs. Faulting is considered only moderate in the study corridor.

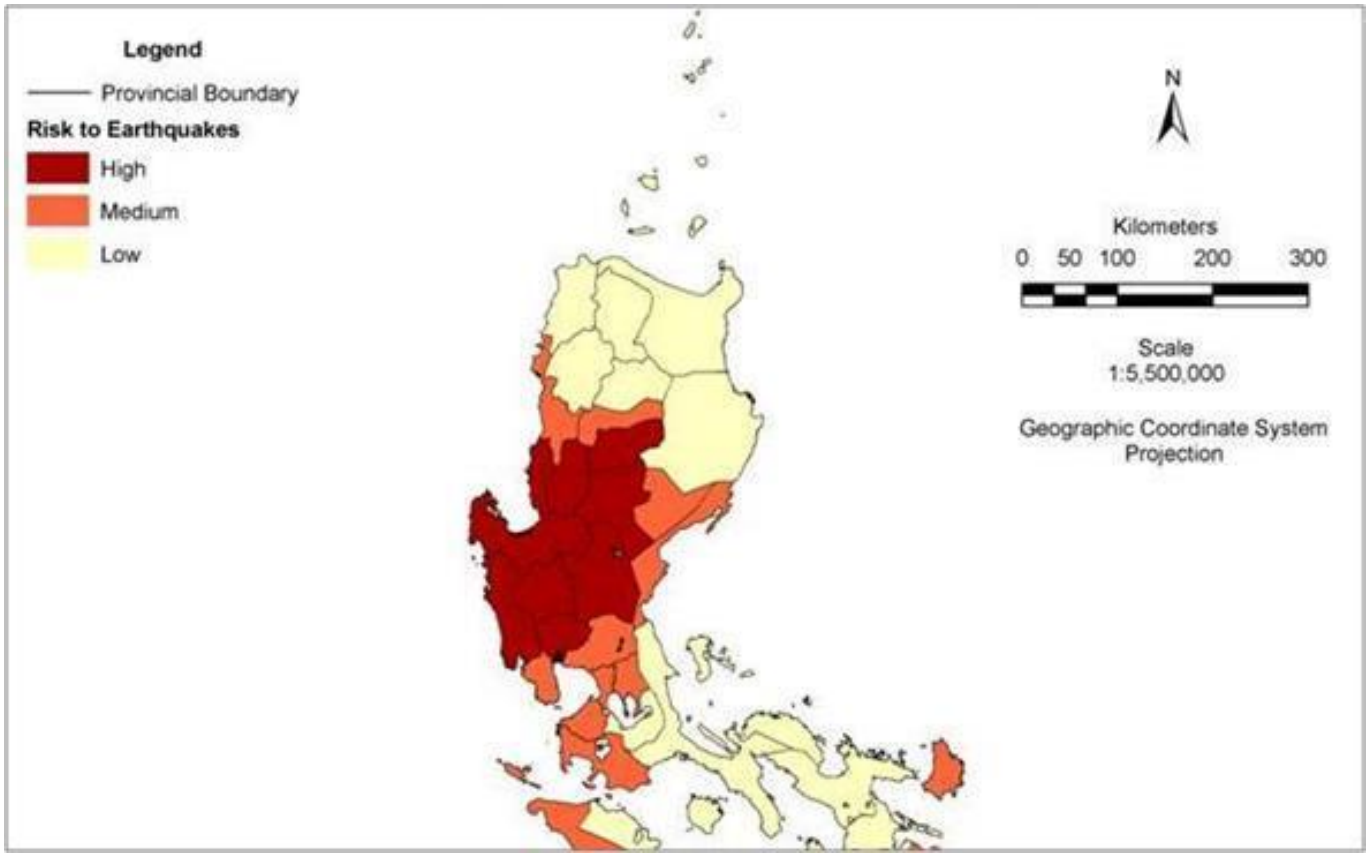
Other active faults within the region are Casiguran Fault located offshore of Casiguran, Aurora; Lubang-Verde Passage Fault System located offshore between Batangas and Mindoro Island; and the East Zambales Fault.

An estimate of the vulnerability to earthquake based on the seismicity data of the Philippines shows that areas along the alignment is rated as medium-risk to earthquake, as mapped in Figure 2.21.



Source: PHIVOLCS

Figure 2.20 Distribution of Active Faults and Trenches in Northern, Central and Southern Portion of Luzon Island



Source: National Geophysical Data (Earthquake Data); NAMRIA (Base Map)

Figure 2.21 Risk to Earthquakes Map

Valley Fault System

One potential earthquake generator near the alignment is the Marikina Valley Fault System, consisting of the Western and Eastern Valley Faults, and transects parts of eastern Metro Manila. No recent seismic activity can yet be directly related to this fault but its proximity to the center of Metro Manila makes it a very significant tectonic feature.

The Valley Fault System (VFS), originally named "Marikina Valley Fault System", consists of two NE-trending faults: the Western and Eastern Valley Faults. The VFS transects parts of eastern Metro Manila and possibly extend southwards to Tagaytay Ridge (*Aurelio and Peña 2004*).

Paleoseismic investigations indicate that there could be up to four surface-rupturing earthquake events associated with the VFS during the past 1,300 to 1,700 years with a recurrence interval of 400 to 600 years (*Wong et al 2008*). *Nelson et al (2000)* infer the most recent event to have occurred during the historical period to correlate with one of the earthquakes that affected the area between A.D.1599 and 1863.

Philippine Fault Zone

Another potential earthquake generator near the study area is the Philippine Fault, with its branches traversing the Province of Nueva Ecija. Historically, the most recent activity is the Ms 7.8 earthquake of Luzon in July 16, 1990, caused by the movement of a northern segment of the fault in the vicinity of Cabanatuan, Nueva Ecija, which is around 70 to 90 km away from the alignment.

The Philippine Fault Zone is a left-lateral fault that extends for more than 1,200km from Luzon to Mindanao. Pleistocene to Holocene activity along the Philippine Fault has been deduced by *Allen (1962)* from displacement of drainage patterns from Digdig, Masbate and Leyte.

Three relatively recent earthquakes have been attributed to the movement of the Philippine Fault. The most destructive of these earthquakes is the July 16, 1990 earthquake. This magnitude 7.8 earthquake was caused by movement of a splay of the Philippine Fault, called the Digdig Fault. The ground rupture ran for over 90km with left-lateral displacements of as much as 5m.

On March 17, 1973, a magnitude 7.3 earthquake struck southern Luzon. Left-lateral displacements of 2 to 3 m were observed. Movement along the Leyte branch of the Philippine Fault caused a magnitude 5.8 earthquake on May 6, 1991. However, due to the relatively weak magnitude only cent metric left-lateral displacements were observed along a 1-km rupture (*Aurelio and Peña 2004*).

Other active faults within the region are Casiguran Fault located offshore of Casiguran, Aurora; Lubang-Verde Passage Fault System located offshore between Batangas and Mindoro Island; East Zambales Fault; Manila Trench; East Luzon Trough; and the Philippine Trench.

Lubang Fault

The Lubang Fault is a 180km long, WNW-ESE trending active fault that passes in the offshore areas between Batangas Province and Mindoro Island. Its nearest trace is located about 120 km south of the project site. *Daligdig and Besana (1993)* noted that among the strong earthquakes attributed to the Lubang Fault are those of 1852 (Intensity IX) and 1972 (Intensity VII) earthquakes.

Manila Trench

The Manila Trench is an elongated east-dipping zone of subduction west of Luzon Island that reaches depths of 5,100m and extends from 13°N to 22°N Latitude. The nearest segment of the trench lies approximately 200km west of the study area.

Historically, the Manila Trench has had few large magnitude earthquakes. Only two earthquakes greater than magnitude 7 have occurred west of Luzon during the past 100 years, in 1934 and 1948 (*Wong et al 2008*).

East Luzon Trough

The East Luzon Trough is a poorly understood westward-dipping structural feature east of Luzon Island observed from 16°N to 18°N Latitude. Based on seismic and bathymetric data, *Lewis and Hayes (1983)* have proposed that this is a northward propagating nascent subduction zone. The nearest segment of this structural element is more than 500km northeast of the project site.

Philippine Trench

The Philippine Trench is a NNW trending westward-dipping subduction zone east of the Philippines. It extends from the southeast of southern Mindanao to about 14°30”N Latitude and reaches depths of 5,000 to 6,000m. The East Luzon Trough and the Philippine trench are

connected to each other by a NW-trending left lateral transform fault. The nearest segment of the Philippine Trench is more than 400km northeast of the project site.

Other Natural Hazards for Caloocan to Tutuban Section

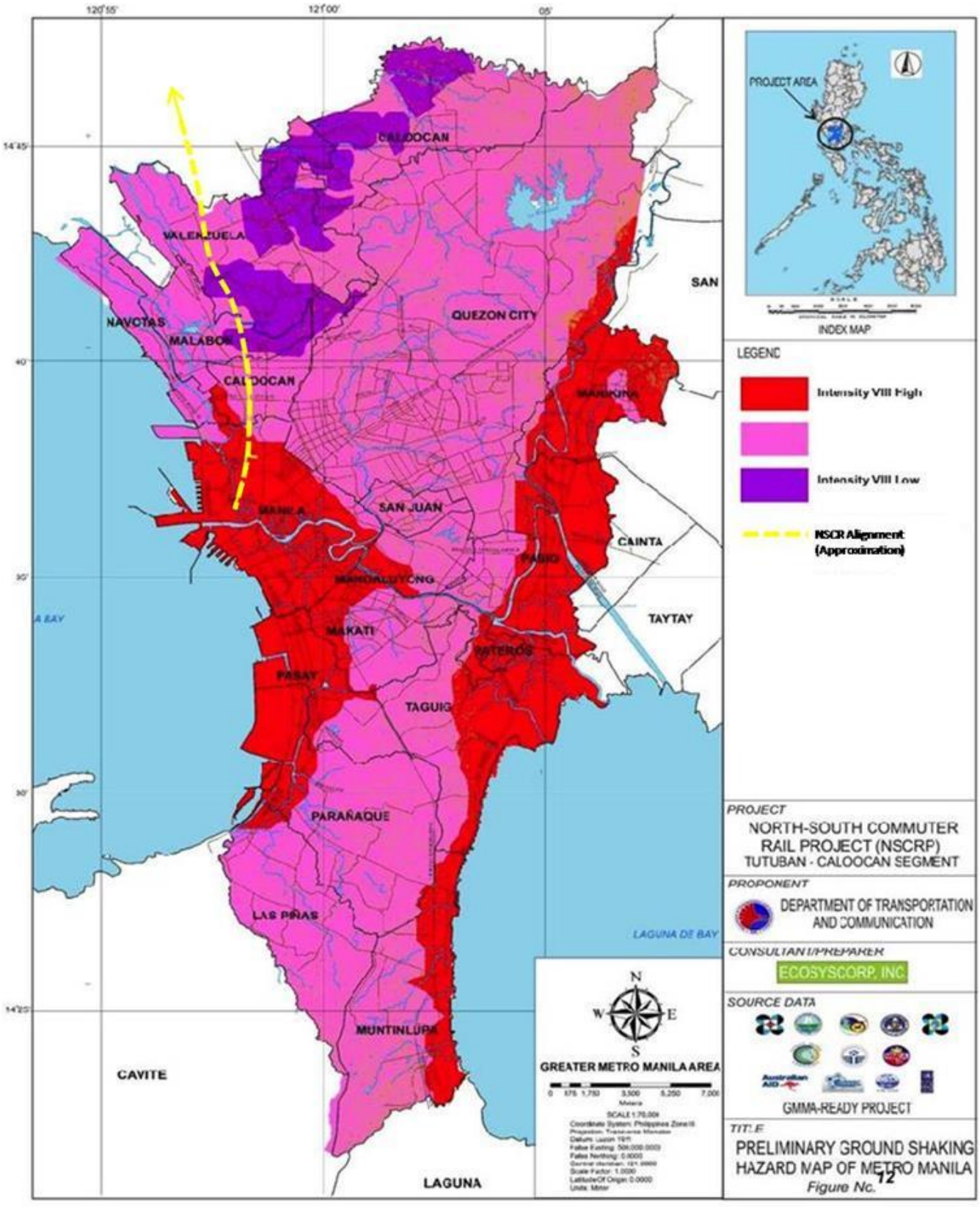
Ground-shaking

Figure 2.22 presents the ground shaking hazard map of Metropolitan Manila. The major assumption taken into consideration for the map is a magnitude 7.2 earthquake from the West Valley Fault, which is the worst-case scenario that could cause the most damage. The whole metropolis will experience very intense ground shaking.

Owing to the nature of the lithologies underlying the subject area, the intensity of the ground shaking expected will be Intensity VIII, based on the Philippine Earthquake Intensity Scale (PEIS). The intensity is expected to increase from Intensity VIII Low to Intensity VIII High going southwards into the more unconsolidated alluvium underlying Manila.

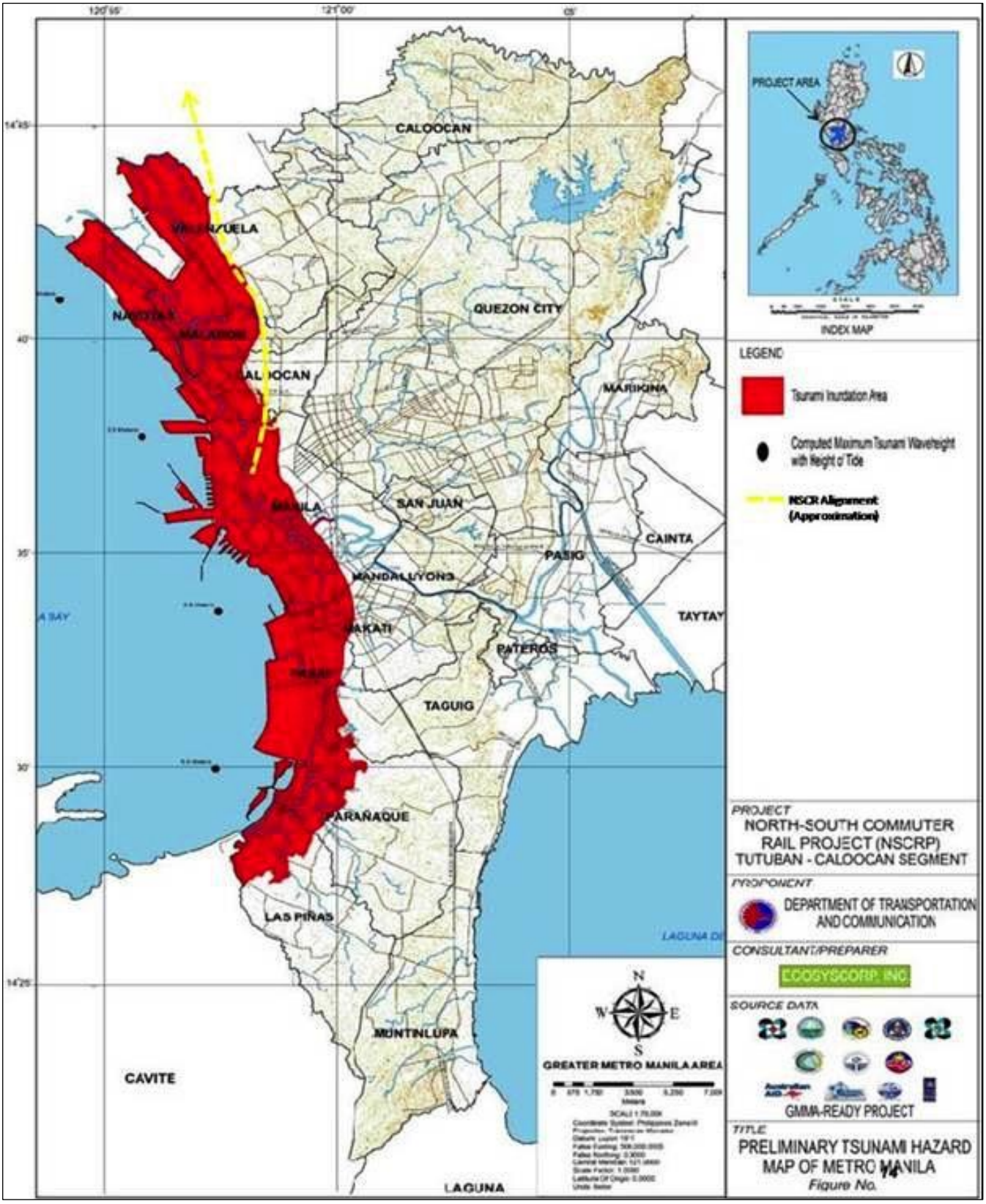
Tsunami

Figure 2.23 shows the tsunami inundation hazard map of Metropolitan Manila. The tsunami generator considered for hazard is a segment of the Manila Trench. A projected magnitude 8.2 earthquake will generate a tsunami as high as 5.5m, assuming the tsunami occurs during high tide, and inundate the southern half of the subject segment.



Source: GMMA-READY Project

Figure 2.22 Preliminary Ground Shaking Hazard Map of Metro Manila



Source: GMMA-READY Project

Figure 2.23 Preliminary Tsunami Hazard Map of Metro Manila

Geology / Geomorphology Impact Identification, Prediction and Assessment, and Mitigation

a) Pre-Construction and Construction Phase

Topography

Because majority of the railway corridor will be elevated and due to the relatively flat terrain along the alignment, the amount of fill or cut during railway construction will have minimal impact on topography. Should there be cuts or fills, such areas must be re-graded to match the original topography after they are no longer needed to avoid permanent impacts.

Liquefaction

As reported in the baseline environmental conditions, the alignment will pass through many liquefiable areas. Liquefaction is of particular concern because it has often been the cause of damage to structures during earthquakes. Consequences of liquefaction include the loss of strength and settlement of soil, thereby resulting in lateral spreading, bearing failures, or floatation of structures embedded in liquefied soil. The railway foundation must be designed such that liquefaction hazards must be considered.

Ground Subsidence

While the ground subsidence attributed to over-extraction of ground water, the project is not expected to extract large amounts of ground water during construction and operation. Rather, ground subsidence could result more from the soft soil particularly in the Valenzuela Depot area, which was formerly rice paddies. Hence the depot facilities must be designed such that liquefaction hazards must be considered.

Ground Shaking/ Ground Rupture

The alignment can be affected by earthquakes from known earthquake generators discussed in the previous section. An earthquake could lead to strong ground shaking, liquefaction or ground settlement. The major impact if an earthquake were to occur during construction is the additional efforts that have to be made to repair damaged components of the work.

During final design of the railway structures, the 0.4g value of acceleration speed of peak value for seismic force shall be adopted such that seismic risk is considered in the design of the railway structures.

b) Operation Phase

Liquefaction

The severity of damage to railway structures due to liquefaction of foundation ground would heavily rely on the design and construction under which the influence of soil liquefaction had been considered. The damage will be less adverse if the railway structures will be designed and constructed to cope with liquefaction, to be based on a more detailed geotechnical investigation and soil tests during the Detailed Engineering Design stage.

Ground Subsidence

The level of settling of soil should be measured regularly to determine ground subsidence.

Ground Shaking/ Ground Rupture

Similar to the impacts of other geo-hazards discussed previously, the extent of impacts of ground shaking and ground rupture in an event of an earthquake during the operation phase can be mitigated through characterization of seismic risks and incorporation of this geotechnical study in the design stage so that railway structures could be designed for both the seismic ground shaking level and the consequences from ground shaking, including liquefaction. A summary of the potential impacts, assessment of impacts and mitigating measures to address the identified impacts is provided in Table 2.11.

1.3 Pedology

Based on the soil mapping survey conducted by the Bureau of Soils and Water Management (BSWM), the major landform within the Bulacan segment is alluvial, predominantly underlain by the Bantog, San Fernando, Tagulod and Bigaa soil series.

Soil types in Valenzuela to Caloocan is underlain by the Obando and Prensa series, corresponding to soil types of coastal and piedmont landscapes, respectively. The Obando fine sandy loam is characterized by low plasticity, while the Prensa clay loam is loose and gravelly clay. Characteristics of the different soil types found in the study corridor are listed in Table 2.4.

Table 2.4 Physical and Other Related Characteristics of Predominant Soil Types

Soil series	Texture	% Clay content (0-100 cm)	Abundance of coarse fragments	Estimated permeability	Soil depth, cm[1]	Depth to dry season water table	Soil drainage	Organic matter, %
Malolos to Meycauayan segment								
Bantog	Clay	79.2 – 82.1	None	Extremely slow to slow	100-150	30-90	Poor	0.8
San Fernando	clay, silty clay loam	57.6 - 58.6	None	Slow	100-200	90-150	Very poor to poor	1.2
Tagulod	clay loam, clay, clay, silty clay loam, sandy clay loam	53.2 - 53.5	None	Very slow to slow	90-150	90-150	Somewhat poor	1.7
Bigaa	Clay	79.6 – 91.6	None	Extremely slow to slow	100-150	90-150	Poor	1.4
Valenzuela to Caloocan segment								
Obando	loam, fine sandy loam	9.9 – 18.8	None	Moderately rapid	50-100	90-150	Well to moderate	0.7
Prensa	clay loam, clay, silty clay loam	46.0 – 48.3	Few to common	Slow to very slow	100-150	Not encountered	Somewhat poor	0.7

Source: Soil Survey and Classification, BSWM, 1987
Note: 1)Depth to hard impermeable layer of rocks, stones, clay, sand, cobbles or to a high water table

The clayey texture allows soil to hold more water, making soil types of this character suitable for paddy rice production. Clay also binds soil particles together into structural aggregates, making it less prone to erosion. The predominant soil types shown in Table 2.3 also indicates that soils along the study corridor have relatively low organic matter content, rendering low infiltration rates, slow permeability and therefore reduced ability to decrease amount of runoff.

Analysis result of borehole sample collected near the proposed Caloocan station last October 23-24, 2013, presented in Table 2.4, shows that the underlying soil is predominantly composed

of silts and silty sand, covered with residual soil. Hard strata was observed at depths of about 17 m from the ground. During drilling of the specific borehole at this section, water depth was observed at 1 m.

Table 2.5 Soil Profile of Borehole Sample in the Proposed Caloocan Station

Depth, m	Soil Classification	N-value	Relative Condition
0.00 – 4.50	MH/SC	13 – 25	Medium dense
4.50 – 7.50	SC	38 – 40	Dense
7.50 – 19.40	ML/MH/SC	32 – refusal	Dense to very dense

Source: AMH Philippines, Incorporated, 2014

The major landform in the Manila segment was essentially formed by a ridge of volcanic tuff to the west, bounded by fluvial deposits of sand, gravel and clay. The soil along the Manila segment is predominantly underlain by Eutropepts and Dystropepts. Eutropepts are deep to very deep well-drained dark yellowish brown, dark brown, yellowish brown, brown alluvial soils with loam, silt loam, clay loam, silty clay loam or sandy loam textures. These occur on level to gentle slopes having a high base saturation. The moisture control section is not dry for 90 cumulative days in most years.

These soils have moderate to high inherent fertility. Base saturation is greater than 35% and cation exchange capacity (CEC) is moderate to high. Soil pH is medium acid to neutral. These soils are most suitable for short seasonal diversified and vegetable crops. The performance of corn, tomatoes, beans, cucumber, and melons and other annual crops are usually good.

On the other hand, Dystropepts are brownish or reddish acid Tropepts that are formed from acid rocks and/or under high rainfall, which have fine clayey texture. Base Saturation is low or very low (less than 5%). These soils have nearly level to steep slopes. The mean annual soil temperature difference between coldest months and hottest months does not exceed 5° C. The soils have low inherent fertility. Soil reaction is acidic with pH values lower than 5.0. (CPDO, 2003)

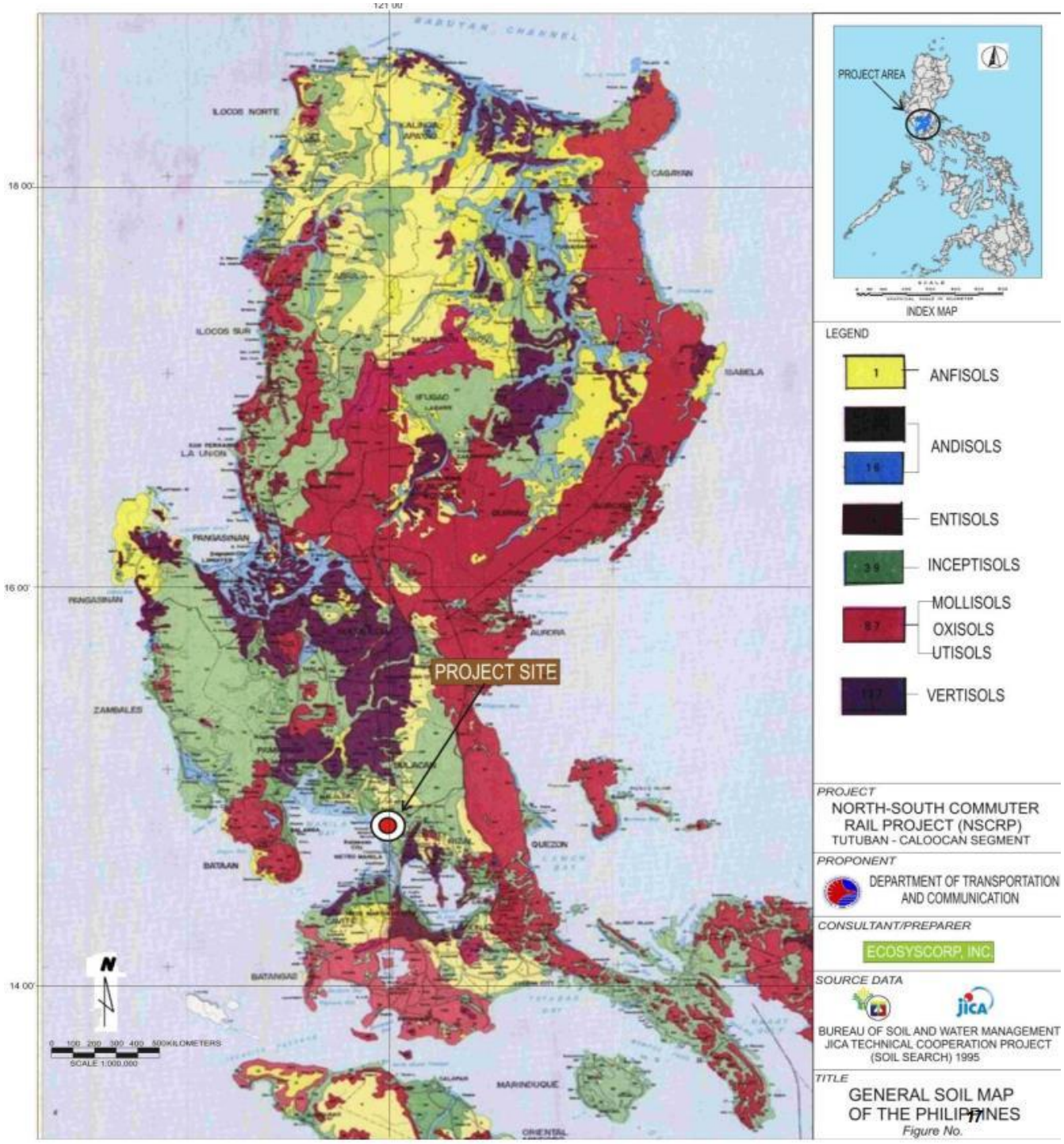
The soil map of Luzon, where the project is located is presented in Figure 2.14. The soil suborders occurring in the subject area are Eutropepts and Dystropepts, belonging to the major soil order Inceptisols (CPDO, 2003).

1.3.1 Soil Erosion

The area along the alignment is relatively flat with a 0 to 3% slope ratio. As discussed in Section 2.1.1.2, the soil types underlying Malolos to Caloocan renders the area along the alignment not susceptible to landslide and soil erosion. However, this relatively flat topography makes some parts of the alignment prone to flooding during prolonged and extensive rainfall (to be discussed in more detail in Section 2.2.1.1)

1.3.2 Soil quality / fertility

Only the portions in Meycauayan that have been contaminated, have been subjected to soil sample analyses. The report on the RAMCAR site sampling results and remediation are found in Annex G. The brief discussions on these contaminated sites are in Sections 1.1.1 and 1.1.5.



Source: Bureau of Soil and Water Management

Figure 2.24 General Soil Map of Luzon

Pedology Impact Identification, Prediction and Assessment, and Mitigation

a) Pre-Construction and Construction Phase

Soil erosion

Construction activities that could lead to soil erosion brought about by rainfall and runoff include clearing vegetation, placing fill, soil removal and stockpiling spoils. The severity of erosion is a function of the area of exposed soil, rainfall intensity and duration, soil characteristics and the volume and configuration of stockpiled soil.

Most of the construction works will take place on a relatively flat terrain. Therefore, it is anticipated that there is no significant risk of erosion, particularly during rainy days. Still, uncontrolled runoff from the site can potentially lead to soil erosion. Best management practices that could minimize exposure to erosion are:

- Use of fences or cover over exposed earth
- Provision of surface water runoff drainage systems
- Limit stockpile height up to 2 m high only
- Plan earthwork activities (e.g. excavation, cutting and filling) while considering weather conditions (rainy season)

Soil contamination

According to land use history, the site along the PNR ROW in Brgy. Tugatog, Meycauayan, used to be a dumpsite for domestic wastes. Results of soil sampling analyses in the old dumpsite showed no significant land contamination. However, further site investigation is needed to confirm these initial findings.

Disturbance of soil in the former dumpsite can provide an exposure pathway for contaminants to workers and the surrounding community. Mitigation measures would include the establishment and implementation of specifications for worker safety, and proper disposal of excavated materials.

Aside from pre-existing land contamination, soils may become contaminated during construction works due to leaks and accidental spills of fuels and lubricants from construction vehicles and machineries. Releases due to leaks may result in relatively insignificant amount of contaminants in the soil. However, given proper spill prevention measures, this event is more unlikely to cause negative adverse effects. The contractors must be required to establish and implement an emergency and contingency plan in case of spills as well as health and safety management plan

Exact locations of land areas to be excavated during construction in the areas mentioned must be identified so that soil quality from these sites can be investigated in more detail.

With regard to the area near the abandoned RAMCAR Battery Manufacturing Facilities located in Brgy. Bangkal, Meycauayan, the area needs to be monitored during construction as the land had already been covered and remediated; and might be excavated that traces of lead might again be detected. Hence the following actions should be taken by the proponent before the selection of the contractor in order to ensure that the contaminated site has been completely remediated by the RAMCAR.

1) Confirm that the DENR EMB's evaluation of effectiveness of remediation by the begging of detailed engineering design stage;
2) If the remediation is deemed insufficient, the proponent will request DENR EMB and RAMCAR to conduct further remediation;
3) Even if the remediation is deemed sufficient, the heavy metal (Pb) in excavated soil shall be monitored during construction. If the testing result indicates any contamination, the proponent shall stop excavation/civil work and discuss with DENR EMB and RAMCAR how to remediate contaminated soil.

Solid Waste Generation

Pre-construction activities that will result in solid waste generation include the demolition of existing railway structures and rail tracks that were constructed during the Northrail Phase 1 Project. Recycling of wastes will be implemented, as much as possible, through sorting, stockpiling and containing recyclable wastes. Where appropriate, leftover concrete and metals will be used for suitable alternative projects. If waste is inevitable, it will be sorted for disposal and temporary storage area shall be designated. Non-recyclable wastes will be disposed of by a licensed contractor to a designated landfill.

During construction phase, excess soil from earthwork activities such as excavation, backfilling and embankment may be generated. If not managed properly, soil wastes may be discharged to water bodies through run-off and could cause increased sedimentation in nearby rivers. Based on the construction plan, a total of around 1,035,272 m^3 of soil will be for disposal as a result of the balance between soil excavation and backfilling operations for the construction of stations, elevated structures, earthworks for construction workability, drainage and box culvert at the Depot. However, the Valenzuela Depot with an area of 140,000 m^2 will be constructed with a 3 meter high embankment and will require 420,000 m^3 of soil. Hence, surplus soil of 615,272 $m^3$is expected to be generated for the entire construction. The only impact that will be of concern would be potential soil erosion from the temporary stockpiling of soil and designation of proper stockpile area. This impact will be addressed under the soil erosion section. Soil that will be excavated from the former Meycauayan dumpsite, if not properly managed will cause soil contamination, and should therefore, be disposed of properly in a registered landfill.

The construction workforce, will likewise, generate solid wastes such as industrial waste packaging materials from construction materials and general wastes from workers such as food scraps, putrescible wastes, toiletries and recyclable and non-recyclable packaging materials. If such wastes will not be handled properly, these would cause land and potential surface water contamination and negative impacts to aesthetics. Mitigation measures to address solid waste impacts include:

- Submission and implementation of Solid Waste Management Plan as part of contractors' engagement
- Placement of waste bins to avoid dispersal of litter and regular site maintenance duties
- Regular collection, transportation and disposal of wastes to minimize the attraction of vermin, insects and pests

b) Operation Phase

Soil Erosion

Post-construction erosion processes could mainly be expected in areas where the railway will run on the side of exposed large soil surfaces of nude soils. Since the railway will run on relatively flat terrain, soil erosion during operation is not likely to occur.

Soil contamination

Soil contamination during operation phase could result from leaks of lubricants agents and used oil. Releases of such chemicals will be of more concern in the proposed Valenzuela Depot stockyard, where train maintenance activities will take place.

- Provide proper machines and equipment and maintain them properly
- Store bulk waste oils and lubricants in impermeable area and with appropriate secondary containment
- Prepare a procedure manual for workers at the depot to prevent oil and chemical spills and also provide regular training to workers to keep working and surrounding environment in good condition
- Emergency and contingency plan in case of spills and health and safety management plan must be in place

Solid waste generation

The project will require onsite personnel during operation and consequently generate general domestic solid wastes. Likewise, railway patrons are also expected to generate general refuse. Improper management of solid wastes may result to land contamination as well as aesthetic impacts. Management measures should include proper segregation of wastes, provision of waste bins that will allow proper waste segregation, use of sealable waste bins to avoid attraction of vermin, insects and pests, regular collection and transportation of wastes for recycling or disposal at licensed facilities, and formulation and implementation of policies on solid waste minimization and solid waste management for patrons and staff.

Hazardous solid wastes to be generated from the use of oil, lubricants, grease and cleaning agents for maintenance activities are discussed under the soil contamination section.

1.4 Terrestrial Ecology

1.4.1 Vegetation

The proposed NSCR railway traversing through Tutuban, Solis, Caloocan, Valenzuela, Marilao, Meycauayan, Bocaue, Guiguinto and Malolos in Bulacan province is the areas in relatively flat terrain and are heavily built up and populated. Much of the vegetation now established in these areas is planted by residents alongside escaped exotic weeds, which have a pantropic distribution.

Field surveys to assess terrestrial vegetation were undertaken on September 17-19, 2013 on four pre-identified sites along the NSCR Project. The sites covered by the study include the NSCR alignment from Caloocan to Malolos with more focused on the proposed NSCR stations in Marilao, Bocaue and Guiguinto in Bulacan, and the proposed depot site in Valenzuela City, as shown in Figure 2.15. The vegetation assessment for the Caloocan to Tutuban segment was conducted on December 26-29, 2014.

The benchmark floristic survey was done to establish baseline information on the vegetation of these sites, identify and locate species of conservation value and enumerate potential impacts and mitigation measures needed to address these impacts.

All vascular plants including trees, herbs, shrubs, grasses, ferns and aquatic plants were enumerated from each site thru direct visual observation. A running checklist was created for each of these sites with special attention given to ascertain the occurrence and exact locations of threatened species. GPS coordinates of all threatened species that are likely to be affected by the proposed development were recorded and their locations plotted on a map.

Taxa Counts

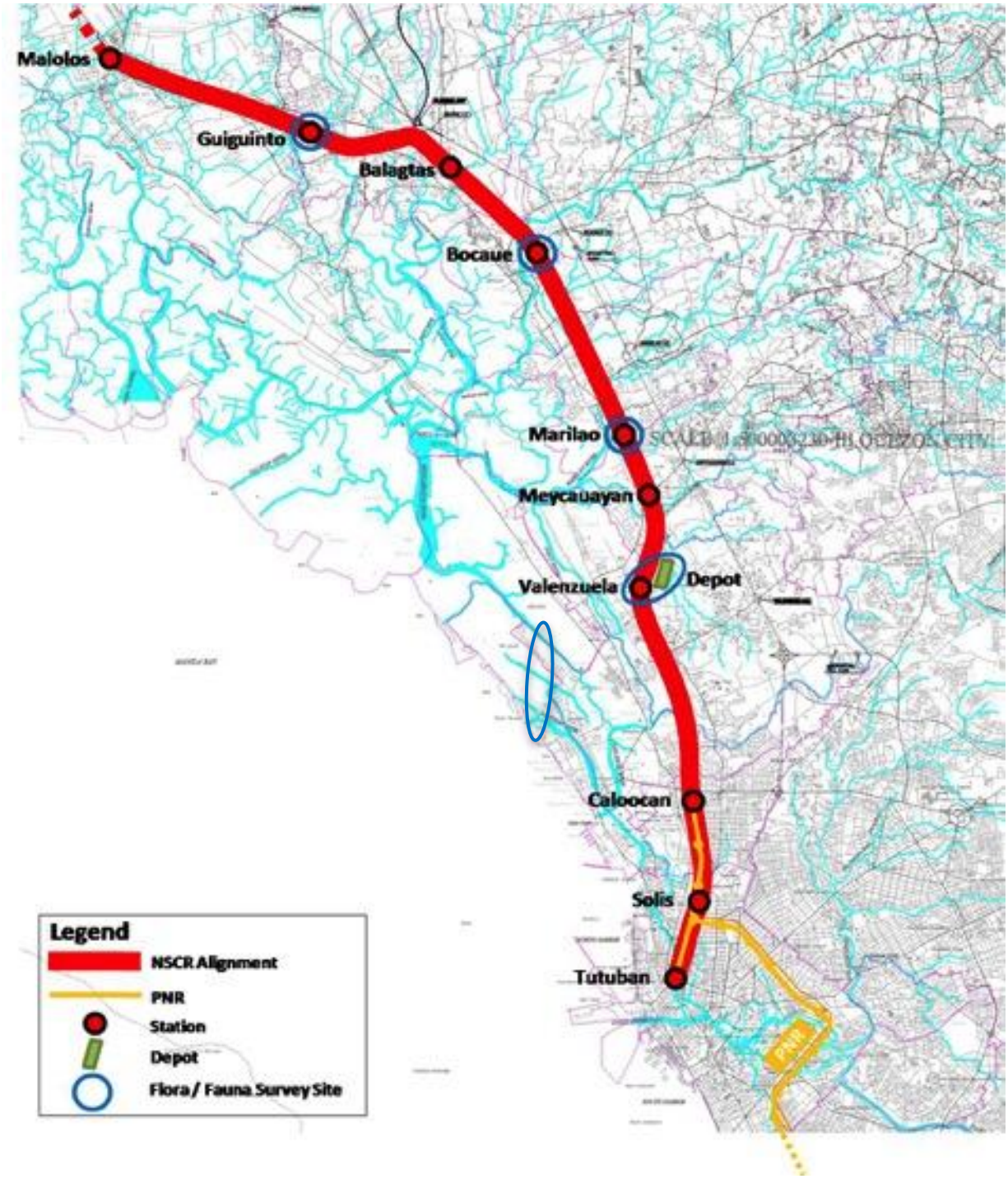
A total of 116 morpho-species were enumerated from all six sites belonging to 104 genera and 43 families. The most speciose families include Gramineae/Poaceae with 17 species followed by Fabaceae/Leguminosae with 11 species and Malvaceae with 9 species. (See Annex F for Checklist of Floral Species for Malolos to Caloocan, and Caloocan to Tutuban).

Endemicity

A great majority of the plants (71%) enumerated from the sites are exotics or plants originating from other countries. Only 33 out of 116 plants are indigenous (28%) or native to the country.

Threatened Plants

One species designated as threatened under the DAO 2007-1 and IUCN 2007 Red Lists, shown in Table 2.5, was recorded from the field survey in Valenzuela. The *Pterocarpus indicus*, locally known as *narra*, are located in Valenzuela (28 individuals), as shown in Figure 2.16. Occurrence of some juvenile Pterocarpus indicus (narra) was recorded also along the edges of the PNR ROW in the Caloocan to Tutuban segment. So far, no species that falls under the CITES I, II and III threatened species lists were recorded. No threatened species were recorded from Guiguinto, Marilao and Bocaue Stations.



Source: JICA Study Team

Figure 2.25 Sites for Flora and Fauna Survey

Table 2.6 List of Threatened species under DAO 2007-1 and IUCN 2007

Family	Scientific Name	Common Name	English Name	DAO 2007-1	IUCN 2007
ARECACEAE/ PALMAE	*Adonidia merrillii* (Becc.) Becc.	Bunga de Jolo	Manila palm	EN A1c, B1+2cd	LR/nt ver 2.3 (1994)
FABACEAE/ LEGUMINOSAE	*Pterocarpus indicus* Willd.	Narra	Amboina wood; Burmese rosewood; Red sandalwood	CR A1cd	VU A1d ver 2.3 (1994)
LAMIACEAE	*Vitex parviflora* Juss.	Molawin	Molave	EN A1cd, B2bc	VU A1cd ver 2.3 (1994)
MORACEAE	*Artocarpus blancoi* (Elm.) Merr.	Antipolo		Not assessed	VU A1d ver 2.3 (1994)

Source: JICA Study Team
Legend:
LR=Low risk EN=Endangered DD=Data Deficient
VU=Vulnerable CR=Critically Endangered

Source: JICA Study Team

Figure 2.26 Valenzuela area showing locations of Pterocarpus indicus Willd or Narra

A discussion of the vegetation in the proposed NSCR stations and the rights of way is presented below.

Vegetation Description

Marilao Station

The area for the proposed Marilao Station in front of SM Marilao is a well maintained lawn composed mainly of *Axonopus compressus* locally known as carabao grass interspersed with weeds such as *Commelina benghalensis, Achyranthes aspera, Tridax procumbens* and other grasses such as *Chrysopogon aciculatus* or amor seko. In some areas, hedges of *Pedilanthus tithymaloides* locally known as Luhang Dalaga are planted.

The right of way from Marilao station going to Bocaue station is planted with an assortment of fruit trees such as *Chrysophyllum cainito* or star apple, *Averrhoa bilimbi* or kamias, *Tamarindus indica* or sampaloc, *Moringa oleiifera or* malunggay and Muntingi *calabura* or *aratiles.* These trees are planted by informal settlers who still occupy some portions of the right of way.

Bocaue Station

The proposed Bocaue station is a vacant lot overgrown with *Urochloa mutica* or what is commonly known as Paragrass. This grass is well adapted to grow in soil that is too wet for other plants and has been introduced in the country from South America at the turn of the century. It is an important fodder grass and has become widely established under local conditions. In some areas, *Saccharum spontaneum* locally known as talahib can be seen growing in isolated clumps. Some trees that were observed from this site include *Terminalia catappa* locally known as talisay and *Muntingia calabura* locally known as aratiles.

The NSCR right of way from Bocaue Station to Guiguinto station is likewise vacant and overgrown with *Urochloa mutica* and some patches of *Saccharum spontaneum* or talahib.

(Photo Nr. 46 – Annex E)

Guiguinto Station

The Proposed Guigiuinto station is another vacant lot overgrown primarily with *Urochloa mutica* or Paragrass. The soil is predominantly waterlogged with few trees of *Leucaena leucocephala* locally known as Ipil-ipil, *Samanea saman* or akasya and *Cananga odorata* or ylang-ylang. Some of the shrubs observed in this site include *Ricinus communis* or castor oil plant and *Senna alata* or akapulko. In some areas, *Colocasia esculenta* or gabi is planted (Photo Nr. 47 – Annex E).

Valenzuela

The proposed Valenzuela depot is predominantly covered with grasses. In waterlogged areas, *Urochloa mutica* or Paragrass are well established. In places with better drainage, *Panicum maxium* or Guinea grass can be observed to dominate these areas. In the periphery, *Pterocarpus indicus* or narra were planted by National Food Authority (NFA) personnel alongside with *Samanea saman* or akasya, *Leucaena leucocephala* or ipil-ipil, *Azadirachta indica* or neem, *Delonix regia* or fire tree. The compound is likewise planted with these species alongside other ornamental shrubs such as *Duranta repens* or yellow duranta. Fruit bearing trees such as *Mangifera indica* or mango can also be seen as well as *Carica papaya* or papaya (Photo Nr. 48-Annex E).

Annex F presents photos of plants surveyed along the NSCR alignment form Malolos to Caloocan, while Appendix G present the Checklist of Species in the proposed stations, in Valenzuela, and along the NSCR alignment.

Caloocan to Tutuban

Ocular survey along the PNR railway tracks was undertaken and to identify the existing vegetation cover. Identification of the species was primarily through visual observation of the external morphology or outward appearance (shape, structure, color, and pattern) ofthe plants. The identified species are then compared and validated using flora field guidebooks and other reference materials such as Pictorial Cyclopedia of the Philippines Ornamental Plants by Domingo A. Madulid.

As listed in Annex F, a total of 113 plant species belonging to 53 families were identified in the study area. Of the species identified, four (4) are endemic, three (3) are native, 13 are indigenous, and the rest are introduced to the country. The endemic species include *Canarium luzonicum* (pili), *Ficus odorata* (isis), *Veitchia merrillii* (Bunga de China), and *Livistona rotundifolia* (anahaw), while the native species include *Basella alba* (alugbati), *Citrus aurantium* (dalandan), and *Citrus microcarpa* (kalamansi).

The flora community in the study area is characterized by a high number of introduced species, well-represented by ornamental plants and trees typical of a built-up vegetation type. Some notable ornamental plants identified are *Canna indica* (Bandera Española), *Bougainvillea spectabilis* (bougainvillea), *Impatiens balsamina* (kamantigue), *Dieffenbachia exotica* (diffenbachia), and Asparagus densiflorus (garden asparagus).

Among the trees, *Ficus septica* (hauili) an indigenous species of the Morceae family is the most commonly observed along the entire stretch of the alignment. Other trees widely propagated are *Sesbania grandolia* (katuray), *Mangifera indica* (manga), and *Annona squamosa* (atis).

Occurrence of some juvenile *Pterocarpus indicus* (narra) was recorded, usually along the edges of the PNR ROW. This species is critically endangered under theDAO 2007-01 (The National List of Threatened Philippine Plant Their Categories and The List of Other Wildlife Species).

Two (2) herb species from different families dominate the ground layer of the study area--*Altemanthera amabilits* (kucharitas) from family Amaranthaceae and Commelina benghalensis from family Commilinaceae.

Ocular survey along the PNR railway tracks was undertaken and to identify the existing vegetation cover. Identification of the species was primarily through visual observation of the external morphology or outward appearance (shape, structure, color, and pattern) ofthe plants. The identified species are then compared and validated using flora field guidebooks and other reference materials such as Pictorial Cyclopedia of the Philippines Ornamental Plants by Domingo A. Madulid.

The list of flora identified in the Caloocan to Tutuban segment is in Annex F.

1.4.2 Threats to Important Local Species of Fauna

Based on DAO No. 2004-15 or the National List of Threatened Fauna, there are four (4) species of mammals, five (5) species of birds and three (3) species of reptiles in and around the Bulacan Region are included in the list, as presented in Table 2.7.

Table 2.7 National List of Threatened Fauna in and around Bulacan Region

Taxonomy	Scientific Name	Common Name	Conservation Status	Distribution Area
Mammals	*Macaca fascicularis*	Philippine Monkey	OTS	Throughout the Philippines
	Cervus mariannus	Philippine brown deer	VU	
	Pteropus vampyrus	Giant flying fox	OTS	
	Acerodon jubatus	Golden-crowned fruit bat	EN	
Birds	*Erythrura viridifacies*	Green-faced parrotfinch	VU	Sierra Madre Mountain Range, Norzagaray, Bulacan
	Grus antigone	Sarus crane	CR	Candaba Swamp
	Tringa guttifer	Nordmann's greenshank	EN	Obando, Bulacan
	Sterna bernsteini	Chinese crested tern	CR	Luzon
	Zoothera cinerea	Ashy thrush	VU	Bulacan
Reptile	*Hydrosaurus postulates*	Philippine sailfin lizard	OTS	Throughout the Philippines
	Python reticulates	Reticulated python	OTS	
	Crocodylus mindorensis	Philippine crocodile	CR	

Source: 2004 Statistics of Philippine Protected Areas and Wildlife Resources
Conservation Status: CR - Critically Endangered EN - Endangered VU - Vulnerable OTS - Other Threatened Species OWS - Other Wildlife Species

The threatened species listed in Table 2.7 are endemic to the Philippines and are now usually found in the forested areas, more probably in protected areas or landscape.

The project site is located along commercial, industrial or residential areas. Thus, no protected habitat of listed endangered species will be affected. On the contrary, much of the fauna established in the area are domesticated animals, most of which are tended by residents along the area. A listing of the fauna species encountered during the site survey as well as identified through interviews is presented in Table 2.8.A listing of the fauna species encountered in the Malolos to Caloocan segment during the site survey as well as identified through interviews is presented in Table 2.8.

Table 2.8 List of Fauna Encountered during the Site Survey

Common Name	Scientific Name
Domesticated Animals	
Cats	*Felis domesticuc*
Chicken	*Gallus Domestics*
Cow	*Bos sp.*
Dogs	*Canis sp.*
Goat	*Capra sp.*
Pigs	*Sus sp.*
Insects	
black soldier fly	*Hermetia illuscens*
bush brown butterfly	*Mycalesis cf. mineus*
Dragonfly	*Diplacodes trivialis*

Common Name	Scientific Name
	Orthetrum Sabina
	Acisoma panorpoides
Flesh fly	*Sarcophaga sp.*
Flower fly/ syrphid fly	*cf. Eristalinus*
	Mesembrius
Ladybird beetle	*cf. Micraspis sp.*
Lynx spider	*cf. Oxyopes*
Narrow-winged damselfy	*cf. Pseudagrion cf. pilidorsum*
	cf. Agriocnemis
	cf. Ischnura senegalensis
Grasshopper	*N/A*
Katydid	*N/A*
Shield bug	*N/A*
True bugs	*N/A*

Source: JICA Study Team

For the Caloocan to Tutuban segment, a number of domesticated animals were recorded in the study area among others *Columba livia domestica* (city pigeons/kalapati), *Canis lupus familiaris* (dog), *Felis catus domesticus* (cat), *Capra aegagrus hircus* (goat), and *Gallus gallus domesticus* (chicken/game fowl).

C. domestica is usually bred for leisurely purpose, while *G. domesticus* (game fowl) are either for gaming purpose or as food supplement. Backyard growing of *C. hircus* in the area based on local accounts is simply practiced as a small-scale business to augment finances.

Avifauna

A bird survey was conducted last October 19, 2013 at the proposed Valenzuela stabling yard and Guiguinto station, where these areas are predominantly covered with grasses with waterlogged sections of land. The survey was done through visual inspection and interviews among local residents around the NSCR alignment at Valenzuela and Guiguinto area. Table 2.9 shows a list of bird species encountered during the survey.

Table 2.9 List of Bird Species Encountered in Valenzuela and Guiguinto

Common Name	Scientific Name	Residency Status
VALENZUELA		
Philippine Pygmy Woodpecker	*Dendrocopos maculatus*	E
Cattle Egret	*Bubulcus ibis*	R
Cinnamon Bittern	*Ixobrychus cinnamomeus*	R
Common Moorhen	*Gallinula chloropus*	R
Great Egret	*Egretta alba*	R
Golden-bellied Flyeater	*Gerygone sulphurea*	R
Pied Triller	*Lalage nigra*	R
Pied Fantail	*Rhipidura javanica*	R
Scaly-breasted Munia	*Lonchura punctulata*	R
Striated Grassbird	*Megalurus palustris*	R
Yellow-vented Bulbul	*Pycnonotus goiavier*	R
Blue-tailed Bee-eater	*Merops philippinus*	R

Common Name	Scientific Name	Residency Status
Chestnut Munia	*Lonchura malacca*	R
Eurasian Tree Sparrow	*Passer montanus*	R
Pacific Swallow	*Hirundo tahitica*	R
Red Turtle-Dove	*Streptopelia tranquebarica*	R
White-breasted Waterhen	*Amaurornis phoenicurus*	R
Yellow Bittern	*Ixobrychus sinensis*	R
Zebra Dove	*Geopelia striata*	R
Intermediate Egret	*Egretta intermedia*	M
Little Egret	*Egretta garzetta*	M
Barn Swallow	*Hirundo rustica*	M
Black-crowned Night-heron	*Nycticorax nycticorax*	M
Brown Shrike	*Lanius cristatus lucionensis*	M
Common Kingfisher	*Alcedo atthis*	M
Whiskered Tern	*Chlidonias hybridus*	M
BULACAN		
Blue-tailed Bee-eater	*Merops philippinus*	R
Cattle Egret	*Bubulcus ibis*	R
Chestnut Munia	*Lonchura malacca*	R
Cinnamon Bittern	*Ixobrychus cinnamomeus*	R
Eurasian Tree Sparrow	*Passer montanus*	R
Glossy Swiftlet	*Collocalia esculenta*	R
Greater Painted Snipe	*Rostratula benghalensis*	R
Pacific Swallow	*Hirundo tahitica*	R
Pied Fantail	*Rhipidura javanica*	R
Scaly-breasted Munia	*Lonchura punctulata*	R
Striated Grassbird	*Megalurus palustris*	R
Tawny Grassbird	*Megalurus timoriensis*	R
White-collared Kingfisher	*Halcyon chloris collaris*	R
Yellow-vented Bulbul	*Pycnonotus goiavier*	R
Zebra Dove	*Geopelia striata*	R
Brown Shrike	*Lanius cristatus*	M
Barn Swallow	*Hirundo rustica*	M
Snipe sp.	*Gallinago* sp.	M

Source: JICA Study Team

Residency Status: E = Endemic R = Resident M = Migrant

Based on observation, the birds come to the areas along the NSCR alignment, specifically in waterlogged areas and areas covered with grasses, mainly for feeding. It flies back towards the north direction, where it's roosting is located, after feeding.

The habitat area in the proposed depot area that will be cleared are small and do not constitute important stopover sites for migratory bird species. Only six migrant species out of 26 birds were recorded at Valenzuela and only three of 18 at Bulacan and none of these migrant species appear in the Convention on Migratory Species (CMS) list.

Some of the migrants are widely distributed terrestrial species able to thrive in disturbed and fragmented habitats e.g. Brown Shrike Lanius cristatus and Barn Swallow Hirundo rustica

while others were observed flying very high over the area, e.g. Intermediate Egret Egretta intermedia and Whiskered Tern Chlidonias hybridus. Resident graminivores or seed-eating birds that feed on grass inflorescence and use tall grasses as nesting material i.e. munias and sparrows were the most abundant and occurred in big flocks. Resident insectivores. i.e. Grassbirds which are also widely distributed in grassland and marsh habitats made up the rest of the species observed in the survey. Widely distributed species are those highly tolerant of disturbance and able to take advantage of resources in human-altered landscapes.

The species that would potentially be affected by the proposed habitat clearance/conversion are the resident waterbirds i.e. the bitterns and rails. However, there are similar and larger grassland-marsh habitats in Valenzuela and Bulacan that can support resident and migrant birds passing through the area.

Since 2004, the Protected Areas and Wildlife Bureau of the Department of Environment and Natural Resources in partnership with the Wild Bird Club of the Philippines (www.birdwatch.ph) has conducted regular surveys of waterbirds in Valenzuela and other wetland areas throughout the country. The survey team of the Club covered the adjoining areas of Arkong Bato, Villa Encarnacion, Incuman and St. Elsewhere in Malanday, Valenzuela, which are near the NSCR alignment. Ten species were listed including the resident Barred Rail Gallirallus torquatus and Purple Swamphen Porphyrio porphyria, which were not encountered during the survey for NSCR Project at Valenzuela and Bulacan. An important record from Valenzuela is the presence of a breeding colony of hundreds of Black-crowned Night-heron Nycticorax nycticorax, which used to be entirely migratory. Another frequently surveyed site in proximity to the NSCR alignment is the Tanza, Navotas coast, which is the habitat or stopover site for many migratory waders during winter migration starting in September and spring migration in March-April. Availability of stopover habitat for migratory birds is therefore not limited in the area.

For the Caloocan to Tutuban segment, Table 2.9, shows the birds diversity was observed in the study area in the duration of the survey, totaling to only seven (7) species belonging to seven (7) families. The encountered species are those usually found in urban areas, and are generally adapted to lowland and residential areas.

Of the identified individuals, *Passer montanus* (Eurasian tree sparrow), an introduced species from China in the 1930's was the most frequently encountered species in the study site. *Collocalia esculenta* (Glossy swiflet/langay-langayan) was also commonly sighted. These two (2) species are widely distributed in the country, normally inhabiting lowland areas and residential communities.

Based on the International Union for Conservation of Nature (IUCN) Redlist 2014, all the bird species observed belongs to the least concern category. It was not established whether the significant bird activities such as nesting, roosting, and mating are performed in the area. The low species diversity in the project area is expected as it is located in a highly disturbed environment in terms of habitat availability.

Table 2.10 Residency and Conservation Status of Bird Species Encountered in the Caloocan to Tutuban segment

Family Name	Species Name	Common Name	Residency Status	IUCN Redlist (2014)
Apodidae	*Collocalia esculenta*	Glossy Swiftlet	Resident	Least Concern
Columbidae	*Geopelia striata*	Zebra Dove	Resident	Least Concern
Muscicapidae	*Rhipidura javanica*	Pied Fantail	Resident	Least Concern
Ploceidae	*Passer montanus*	Eurasian Tree Sparrow	Resident	Least Concern
Pycnonotidae	*Pycnonotus goiavier*	Yellow-vented Bulbul	Resident	Least Concern
Sturnidae	*Acridotheres cristatellus*	Crested Myna	Resident	Least Concern
Sylviidae	*Megalurus palustris*	Striated Grassbird	Resident	Least Concern

Source: JICA Study Team

1.4.3 Threats to abundance of important species

The project structures will be elevated so there will be no restrictions to movement or access of fauna.

As to GHG emissions, please see discussion in section on Air Quality. In essence, since the project will use electricity and not fossil fuels, there will be reductions in overall GHG emissions, and hence there will be no necessity for carbon sequestration.

Terrestrial Ecology Impact Identification, Prediction and Assessment, and Mitigation

a) Pre-Construction and Construction Phase

Clearing and removal of trees

Nineteen (19) narra trees located at the side of the NSCR alignment (Figure 2.16) in the proposed Valenzuela stabling yard will be affected and removed from the site. These narra trees may be relocated through balling and transplantation. The DENR Region 3 office will be requested to identify a site where they will be replanted and other tree planting activities will be conducted to replace trees will be removed by site clearing. For every tree removed, an equivalent 10 tree seedlings will be planted, in accordance with DENR Administrative Order (DAO) 58 series of 1993 (Regulations Governing the Extraction, Assessment, Processing and Transport of Narra Resources).

Other trees, such as fruit bearing trees, along the alignment will be removed, and these will be subject to compensation if they belong to PAPs. Discussion of compensation of non-timber trees such as fruit trees will be fully discussed in the Resettlement Action Plan

Loss of wetland habitat and displacement of birds

The proposed areas or habitats to be cleared or developed are small and do not constitute important stopover sites for migratory bird species. Only six migrant species out of 26 birds

were recorded at Valenzuela and only three of 18 at Bulacan and none of these migrant species appear in the Convention on Migratory Species (CMS) list.

In order to offset the loss of habitat, even if small and unimportant, the proponent will seek assistance from the Society for the Conservation of Philippine Wetlands (SCPW) to identify an adjacent wetland area that the proponent will conserve and enhance so that this area will attract the birds and stay here instead. The proponent will conduct annual bird count to monitor the bird population in the surrogate wetland area established.

Table 2.11 Impact Identification, Assessment and Mitigating Measures for Land

Environmental aspect	Environmental Component Likely to be affected	Potential impact	Assessment of Impacts	Mitigating measure
PRE-CONSTRUCTION AND CONSTRUCTION				
Earthworks (excavations for foundations; cut and fill; land grading, etc.)	Topography	Alteration of topography	Low adverse	Depot area must be re-graded to match the original topography
	Soil	Soil erosion	Low adverse	• Use of silt fences and sediment traps, cover exposed earth especially before heavy rains are expected, benching of cuts, use of sediment basins • Provision of surface water runoff drainage systems • Limit stockpile height up to 2 m high only • Minimize removal of vegetation cover as much as possible • Plan earthwork activities (e.g. excavation, cutting and filling) while considering weather conditions (rainy season)
	Soil	Soil contamination due to oil or lubricant spills	Low adverse	• Provide proper construction machines and heavy vehicles and maintain them properly • Oil and grease traps in the drainage system • Establish and implement health and safety management plan and emergency and contingency plan in case of spills
	People (Health and Safety of Workers and nearby communities)	Worker and community exposure to health and safety hazards due to working in areas with contaminated soils and/or excavation of such soils (Meycauayan dumpsite and RAMCAR battery site)	Moderate adverse	• Establish and implement specifications for worker safety, and proper disposal of excavated materials • Further study of soil to verify extent of contamination based on evaluation by DENR EMB (RAMCAR battery site) • Disposal of excavated soil (from Meycauayan dumpsite and RAMCAR battery site) in a registered landfill operator
Excess soil for disposal from earthwork activities	Solid Waste	Generation of solid waste	Moderate adverse	• Submission and implementa tion of Solid Waste

Environmental aspect	Environmental Component Likely to be affected	Potential impact	Assessment of Impacts	Mitigating measure
Demolition of existing railway structures				Management Plan as part of contractors' engagement • Recycling of wastes including soil, as much as possible • Use of leftover concrete and metals for suitable alternative projects • Proper sorting of waste for disposal and designation of appropriate temporary storage area • Disposal of non-recyclable wastes by a licensed contractor
Construction / Civil Works Liquefaction Ground subsidence Ground shaking/ground rupture	• Solid Waste • People (Health and Safety)	Generation of solid waste; Land and water contamination; aesthetic impacts; spread of diseases	Moderate adverse	• Submission and implementation of Solid Waste Management Plan as part of contractors' engagement • Provision of waste bins to avoid dispersal of litter and regular site maintenance duties • Regular collection, transportation and disposal of wastes to minimize the attraction of vermin, insects and pests
	Liquefaction	Loss of soil strength, settlement of soil, lateral spreading, bearing failures, floatation of embedded structures, damage to overlying structures, in the event of an earthquake	High adverse impact	• Consider liquefaction hazards in the final design of the structures
	Ground subsidence	Subsidence due to soft soil at depot area	Moderate adverse impact	• Design of structures and facilities to withstand ground subsidence
	Ground shaking/ground rupture	Damage to components of the construction work	Moderate adverse impact	• Undertake site-specific seismic risk characterization and estimates of how the ground beneath the structure will move

Environmental aspect	Environmental Component Likely to be affected	Potential impact	Assessment of Impacts	Mitigating measure
				• Design and construct structures that will address seismic hazards (adopt 0.4 g value of acceleration speed of peak value for seismic force)
Removal of trees and other vegetation	Flora	• Narra trees along the alignment form Caloocan to Tutuban and at the Valenzuela depot site may be affected and removed during the clearing operation •Other trees, such as fruit bearing trees, along the alignment will be removed	Moderate adverse impact	• Coordination with concerned agencies or groups for relocation sites of earth-balled trees. • Provision of corresponding number of tree seedlings will be provided by the proponent in replacement of trees to be cut. • Monitoring of survival of trees planted • Provision of compensation to owners of non-timber species such as fruit trees that are removed (to be included in the RAP)
Development of Depot site	Wetland Habitat	• Loss of small swampy area used for a few migratory and resident birds	Low adverse impact	• To offset the lost wetland, the proponent will seek assistance from the Society for the Conservation of Philippine Wetlands (SCPW) to identify an adjacent wetland area that the proponent will conserve and enhance so that this area will attract the birds and stay here instead. • Conduct seasonal bird count to monitor the bird population in the surrogate wetland area established.
OPERATION				
Use of railway transportation	Land Use	• More efficient and safer transportation facility due to reduced travel time, reduced traffic congestion, improved traveler safety and	Beneficial	Identification of future land use of surrounding areas that will result to a significant increase in commercial activities especially near train stations, to guide urban planners of the LGUs to adapt future development plans accordingly.

Environmental aspect	Environmental Component Likely to be affected	Potential impact	Assessment of Impacts	Mitigating measure
		reduced energy consumption. • Increase in land development along or near the corridor		
Maintenance Works at the Depot site	Soil	Soil contamination resulting from leaks of lubricants agents and used oil.	Moderate adverse impact	• Provide proper machines and equipment and maintain them properly. • Store bulk waste oils and lubricants in impermeable area and with appropriate secondary containment. • Prepare a procedure manual for workers at the depot to prevent oil and chemical spills and also provide regular training to workers to keep working and surrounding environment in good condition. • Emergency and contingency plan in case of spills and health and safety management plan must be in place.
Passengers Movement	Solid wastes from staff and patrons	Land and water contamination; aesthetic impacts; spread of diseases	Moderate adverse	• Proper segregation of wastes • Provision of waste bins that will allow proper waste segregation • Use of sealable waste bins to avoid attraction of vermin, insects and pests, • Regular collection and transportation of wastes for recycling or disposal at licensed facilities • Formulation and implementation of policies on solid waste minimization and solid waste management for patrons and staff
Movement of trains	Ground subsidence	Soft soil at depot area	Moderate adverse	• Regular monitoring and measurement of level of ground subsidence
	Liquefaction	Loss of soil strength, settlement of soil, lateral spreading, bearing	High adverse impact	• Consider liquefaction hazards in the final design of the structures

Environmental aspect	Environmental Component Likely to be affected	Potential impact	Assessment of Impacts	Mitigating measure
		failures, floatation of embedded structures, damage to overlying structures, in the event of an earthquake		
	Ground shaking/ground rupture	Damage to infrastructure in the event of an earthquake	Moderate adverse	• Conduct regular check on integrity of structures; reinforce, if necessary

Source: JICA Study Team

2. THE WATER

2.1 Hydrology

2.1.1 Drainage morphology/flood history

The hydrological characteristics of the area are defined by two major river basins, the Pampanga River Basin (Figure 2.27) and Pasig-Laguna de Bay River Basin (Figure 2.28).

A big portion of the province of Bulacan is covered by the basin of the Pampanga River. The Pampanga River basin system is the 4th largest basin in the Philippines. It is broadly divided into three sub-basins: Pampanga Main River basin, Pasac River basin (or alternatively known as the Pasac-Guagua Allied river basin) and the Angat River basin. The headwaters of these three basins originate from different mountain areas with separate river channels draining into the Manila Bay. These channels are interconnected and their water resources management works are closely related.

The Pampanga River has a channel length of around 265 km, originating in the Caraballo Mountains north of the basin, and flows into Pantabangan Dam. From the dam it further flows southward meeting with several tributaries until emptying into Manila Bay. The river's main tributaries are the Rio Chico River from the northwest side and the Coronel-Santor and Peñaranda Rivers on the eastern side of the basin.

The Pasac-Guagua River system includes various channels running on the eastern slope of Mt. Pinatubo, such as the Abacan-San Fernando, Pasig-Potrero and Porac-Gumain Rivers, which all flow into Manila Bay. In the lower reaches, the river system is connected with Main Pampanga River by the Bebe-San Esteban Cut-off Channel.

The Angat River system originates in the Sierra Madre Mountains and flows into the Angat storage dam. From the dam the river flows westward and finally empties into the Manila Bay through Labangan Floodway. The Angat River joins the Pampanga River at Calumpit, Bulacan via a connecting waterway, the Bagbag River. Southeast of the Pampanga River is the Candaba Swamp, which covers an area of some 250 square kilometers. The Candaba Swamp absorbs most of the flood flows from the western slopes portion of the Sierra Madre and the overflows of the Pampanga River via the Cabiao Floodway. This area is submerged during the rainy season but is relatively dry during summer.

There are the two major hydraulic structures within the Pampanga River Basin, the Pantabangan Dam located upstream of the upper main Pampanga River and Angat Dam, located on the eastern lower portion. Both operate as a hydropower and as an irrigation reservoir. Within the province of Bulacan are two other dams, the Ipo and Bustos Dams. Ipo Dam, located about 7 km downstream of Angat Dam, is primarily a diversion dam and active reservoir for water supply requirements of Metro Manila. With a capacity of only around 7.5 million (M) m^3 compared to Angat Dam, which has a reservoir capacity of around 850M m^3, it supports and minimally regulates releases coming from the Angat Dam. If the impounded water exceeds this volume, water starts to overflow the radial gates. On the other hand, Bustos Dam located around 38 km downstream of Ipo serves mainly as an irrigation reservoir.

The Pasig-Marikina-Laguna de Bay Basin covers the National Capital Region in the west, portions of the Region III province of Bulacan in the northwest, and the Region IV provinces of Rizal in the northeast, Laguna and portions of Cavite and Batangas in the south. This basin is composed of 29 sub-basins of which 22 sub-basins collectively known as Laguna de Bay

basin drains to the Laguna Lake, while runoffs from the other seven Metro Manila river sub-basins flow to the Manila Bay. Another important body of water the Pasig River bisects Metro Manila and serves as the outlet of Laguna de Bay to Manila Bay.

The Pasig River is the master drainage system that links Manila Bay with Laguna de Bay. The river has a total length of 25 km and cuts across most cities of Metropolitan Manila.

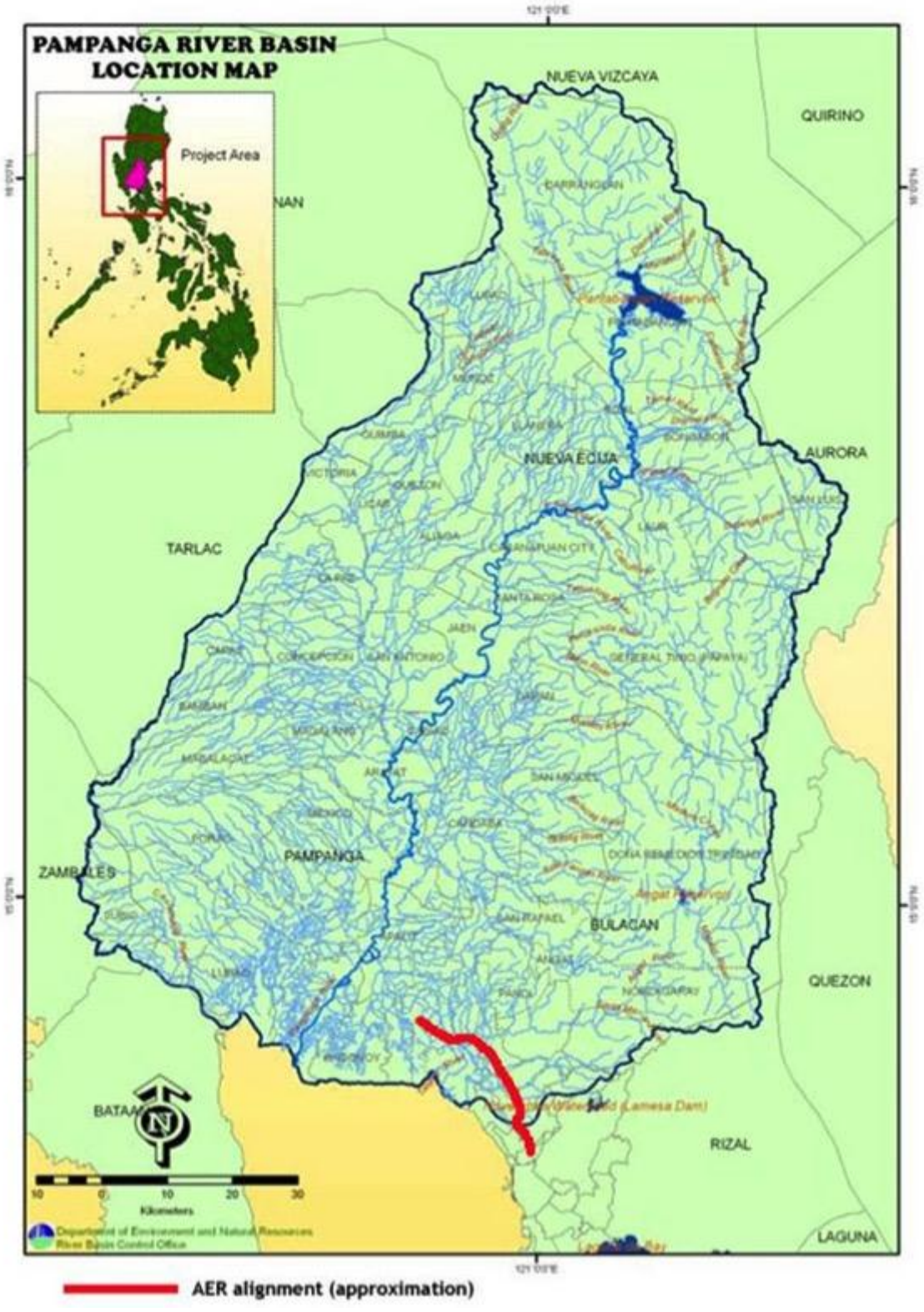
Draining into the Pasig River are creeks/esteros and large storm sewers which collect the run-off water from large areas of the metropolis. Seven creeks/esteros were crossed by the railroad tracks along the subject segment, three in Manila and four in Caloocan City (Table 2.12). From south to north, these are:

Table 2.12 List of Creeks/Esteros along Subject Segment

Name	Approximate geographic coordinate of crossing (WGS84)
Estero de Vitas, Manila	14° 36’ 21.91” N Lat, 120° 58’ 15.08” E Long
Estero de Kabulusan, Manila	14° 37’ 18.24” N Lat, 120° 58’ 29.49” E Long
Estero Sunog Apog, Manila	14° 38’ 06.79” N Lat, 120° 58’ 36.24” E Long
Makabalo Creek, Caloocan	14° 38’ 14.50” N Lat, 120° 58’ 37.38” E Long
Casili Creek, Caloocan	14° 38’ 28.39” N Lat, 120° 58’ 37.09” E Long
Unnamed Creek, Caloocan	14° 38’ 42.67” N Lat, 120° 58’ 34.21” E Long
Unnamed Creek, Caloocan	14° 39’ 01.57” N Lat, 120° 58’ 30.59” E Long

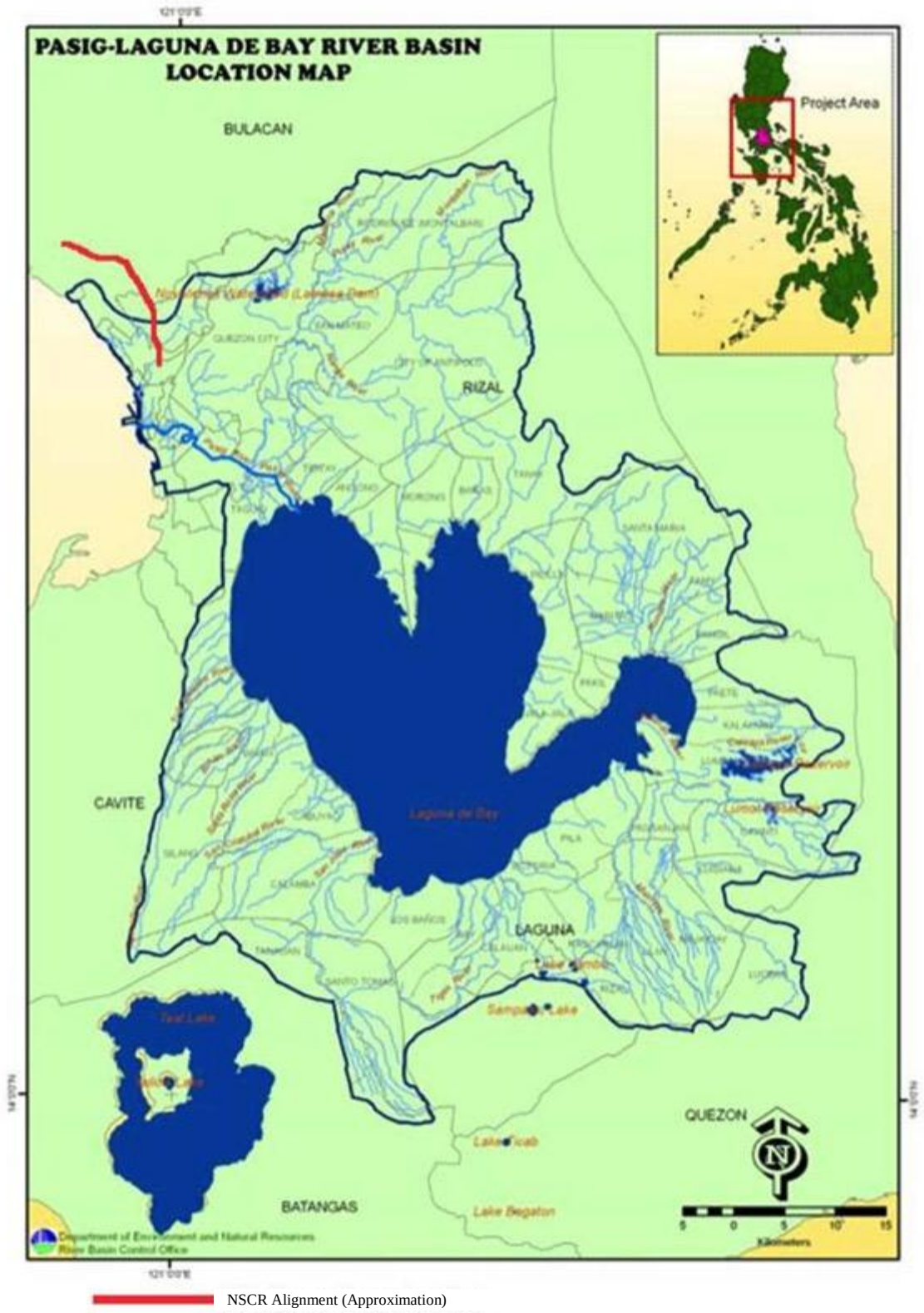
Source: JICA Study Team

Estero de Kabulusan is listed in the Manila Comprehensive Land Use Plan as a “non-existing” estero. Parts of Makabalo and Casili Creeks, as well as two unnamed creeks, in Caloocan are “missing” and have been covered by concrete.



Source: DENR River Basin Control Office

Figure 2.27 Pampanga River Basin Map



Source: DENR River Basin Control Office

Figure 2.28 Pasig-Laguna de Bay Basin Map

Flood History

The NSCR alignment lies mostly on the southern part of the Pampanga River Basin and portion of which is located northwest part of the Pasig-Laguna de Bay Basin. Geomorphologic setting of this part of the river basins makes the project area highly susceptible to flooding.

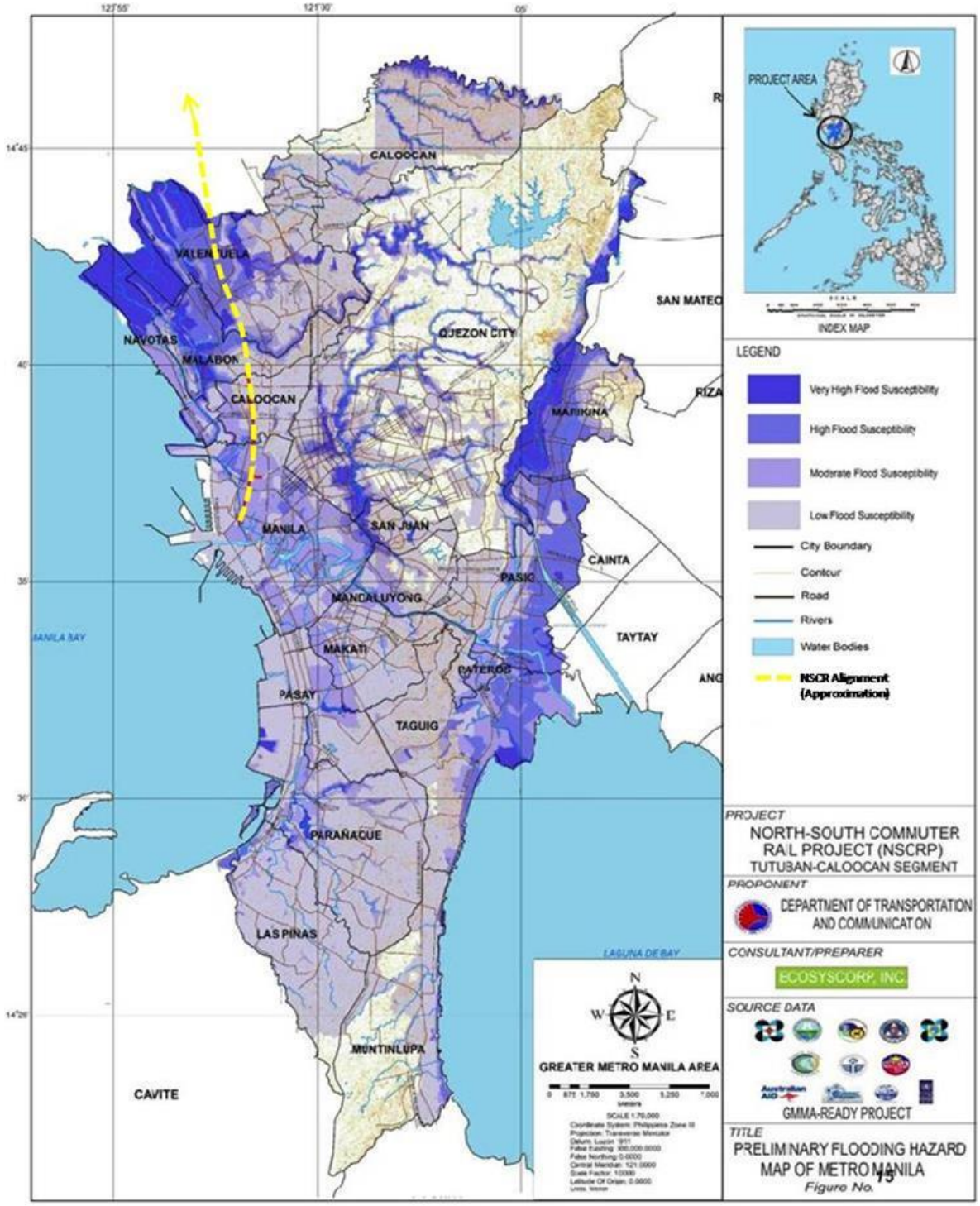
The Pampanga River basin is vulnerable to flooding, due to its relatively low elevation and flat terrain. Its narrow and silted waterways, attributed to the 1991 Mt. Pinatubo eruption, and proximity to Manila Bay, wherein tides impede river and creek flow, further contribute to the basin's flood susceptibility. The basin experiences an average of at least one flooding per year. The dry season generally occurs from December to May. The wettest months are from July to September. The basin could only handle between 100-130 millimeters (mm) of 24 hour Rainfall.

Historically, extensive flooding occurred at the Pampanga River Basin numerous times. This occurred in July 1962, May 1966 (during typhoon Irma), May and June 1976 (during typhoon Olga and Ruby), June, July and August 1972 (during typhoon Ora) October 1993, August 2003, August 2004, late September-October 2009 (during typhoon Ondoy), and the most recent southwest monsoon in August 2012. The flooding that occurred in September 2011, associated with typhoon Pedring nearly swallowed the Province of Pampanga and Southern parts of Bulacan. The flooding in the river basin that occurred in July and August 1972, severely affected almost all of the entire Province of Pampanga, Nueva Ecija, Tarlac and Bulacan.

Likewise, the northern part of Metro Manila, which includes Caloocan City, Malabon, Navotas City and Valenzuela City (CAMANAVA), is included among the flood-prone areas. The area has a low and flat topography with an elevation of up to 3 m above the mean sea level. Inundation takes place almost throughout the year and most frequently during May to September when high tide takes place simultaneously with heavy rains. The inundation in these areas was brought about by a combination of factors such as the overflowing of the Malabon-Tullahan River and an inadequate local drainage system.

Figure 2.29 shows the flood hazard areas simulated using rainfalls delivered by tropical storm Ondoy on 26 September 2009. The rainfall event is considered as an extreme event that can generate floods with a 100-150 year return period. It should be noted that data for Malolos were not yet available during the simulation of the said inundation maps. However, based on the stakeholders meeting conducted for this EIA, Malolos residents along the ROW has expressed that based on experience, some areas along the alignment in Malolos are flood-prone, which was allegedly due in part to the blockage of natural waterways during the Northrail project construction. The high hazard areas include neighboring municipalities of Balagtas, Bocaue, Marilao and Meycauayan in Bulacan. Moderate to high flooding may be experienced in Guiguinto, Valenzuela and Malabon.

A large part of Metropolitan Manila is susceptible to flooding as shown in Figure 2.20. Generally, the entire length of the study area is moderately susceptible to flooding, meaning the area is likely to experience flood heights of 0.5 to 1.0m and/or flood duration of 1 to 3 days. However, anecdotal accounts indicate that some portions of the railroad tracks in Manila and Caloocan have low flood susceptibility, experiencing flood heights less than 0.5m and/or flood duration of less than one day.



Source: GMMA-READY Project

Figure 2.29 Preliminary Flooding Hazard Map of Metro Manila

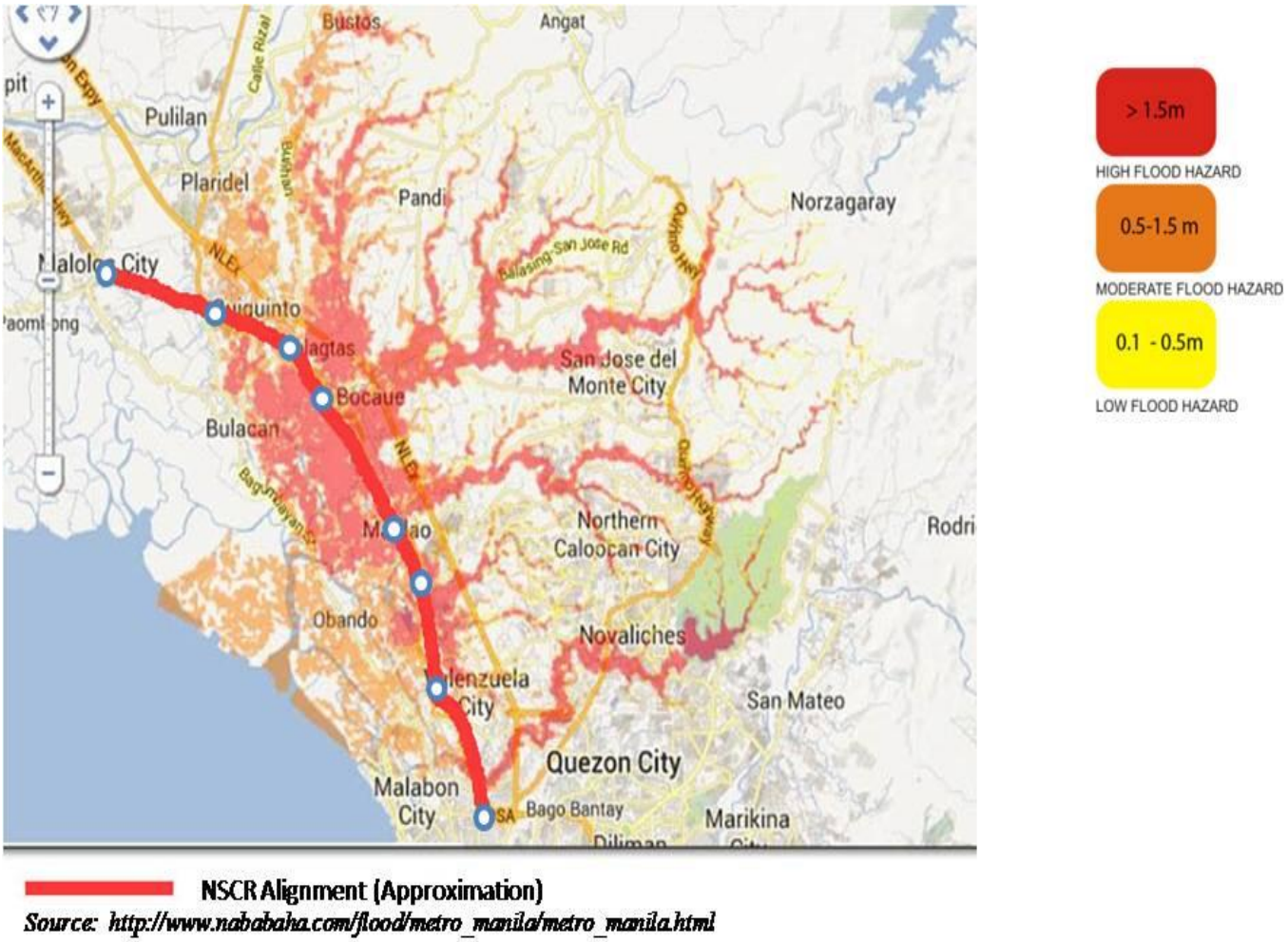


Figure 2.30 Flood Hazard Map of the Project Area

Hydrology Impact Identification, Assessment and Mitigation

a) Pre-Construction and Construction Phase

Flooding

The NSCR alignment goes through the flood prone zone of the Pampanga River Delta and the CAMANAVA area.

In addition to the flood history of the project alignment area, the project should also take into consideration the flood projections of PAGASA for 2020 and 2050 which predict that rainfall increase is likely during the southwest monsoon (June-July-August) season until the transition (September-October-November) season in most areas of Luzon and Visayas, and also, during the northeast monsoon (December-January-February) season, particularly, in provinces/areas characterized as Type II climate in 2020 and 2050.

Extreme rainfall events (heavy daily rainfall) will continue to become more frequent, extreme rainfall is projected to increase in Luzon and Visayas only, in 2020 and 2050. The projected seasonal rainfall change in 2020 and 2050 under the medium-range emission scenario in Bulacan and NCR are presented in Table 2.18 on page 104.

Pre-construction and construction activities may temporarily aggravate these flooding problems if not implemented properly. Improper handling, storage, and hauling of demolition debris/excavated materials, particularly along station location may clog existing drainage systems and block creeks, canals and other waterways. Due to the construction of impervious structures such as the viaducts, stormwater run-off may increase that would change the flood storage capacity of waterways and its floodplains. Filling up or raising of swampy areas such the proposed stabling yard in Valenzuela above the present elevation would result to a change in run-off pattern, aggravating flooding in the lower-lying areas.

Given that flooding is an existing environmental problem in the project area, the proponent shall ensure that appropriate measures are put in place and strictly complied with. The proponent shall execute a Contractor's Program indicating the contractor's commitment to proper disposal of demolition debris and construction spoils. These materials shall not be put anywhere near watercourses and areas where it could be carried away into low-lying areas of the project or into the drainage system. Upon the completion of the project, the contractor will take care of the disposal of all debris and waste materials into an appropriate designated area. The contractor shall initiate erosion control measures before major earthmoving works begin.

NSCR structures will be designed to have a clearance of above established flood level and discharges, which will be established and included in the detailed design. When necessary, sump pumps will be installed at the lowest points to pump out accumulated floodwater along the railway track.

Aside from being geo-morphologically a catch basin, another reason that aggravated the existing flooding problem of the affected areas is the filling up of wetlands and natural waterways. Such a case happened in the alignment along Bulacan during the construction of the previous North Rail project. To address this, improvement of canals/culverts and construction of new sufficient and effective drainage system shall also be incorporated. The proponent will also coordinate with DPWH how to integrate both parties' drainage plans along the project area.

2.1.2 Change in stream, lake water depth

While the project will pass through the rivers mentioned above, it will not pass through any lakes, since there are no lakes in the area. The elevation of the structures as viaducts will not in any way change the flows of water bodies like streams and the rives, nor affect the depth of these water bodies.

2.1.3 Depletion of water resources/ competition in water use

The project will not be utilizing water intensively. The only use of water will be for washing of the coaches at scheduled times, and for domestic use (for the toilets at the stations for passenger use and at the offices of the railway management, for employees use). Source of water will be through the regular water services providers (Maynilad, Manila Water, and the local water districts).

2.2 Water Quality

2.2.1 Ground Water Quality

The project will not utilize, nor affect groundwater since all the structures are above ground.

2.2.2 Surface Water quality

Philippine water quality is assessed based on the set beneficial use as defined in the Department of Environment and Natural Resources (DENR) Administrative Order (DAO) 34, Series of 1990. Under this DAO, a water body must meet all the parameters that define the desired water quality 100 percent of the time to maintain its designated water body classification.

In terms of environmental concerns, Region 3 is one of the most critical regions in terms of environmental concerns primarily because of the sprawling number of industries and settlements without the necessary land use and environmental planning. Based on the Green Framework of Innovative Strategy (GFIS) for Sustainable Consumption and Production Report (March 2008) prepared by the Environmental Management Bureau (EMB) of DENR and International Center for Environmental Technology Transfer (ICETT), of the 40 rivers surveyed in Central Luzon, 5 are biologically dead. These dead rivers are the Balagtas, Bocaue, Guiguinto, Marilao and Meycauayan rivers, all in Bulacan. According to the report, industrial wastes account for about 48% of the total pollution load of rivers and creeks. In terms of biochemical oxygen demand (BOD) loading, 51% is generated by domestic sources, 14% by the industrial sector, and 35% by the agricultural sector.

In the case of Metro Manila, massive population growth, infrastructure development and increased economic activities led to the deterioration of its water bodies. In 1990, the Pasig River was pronounced as dead and incapable of sustaining marine life. As of 2003, the DENR formally declared four more rivers as biologically dead; the Navotas-Malabon-Tenejeros-Tullahan (NMTT) River, Paranaque River, Marikina River and San Juan River.

To validate existing water quality data from secondary sources, actual water sampling was conducted along the NSCR alignment. Surface water samples were taken from Guiguinto River, Santol (Balagtas) River, Bocaue River, Marilao River, Meycauayan River, a water-logged area in the proposed stabling yard in Valenzuela, and Malabon (Tullahan) River, and the Estero de Maypajo bordering Caloocan and Manila, as seen on Figure 2.21.

Table 2.13 shows the surface water sampling stations coordinates, date and time of sampling and weather conditions during sampling. The activity was undertaken from 24-25 September 2013, 31 July 31 2014, 15 September 2014 and 14 January 2015. Standard water sample preparation and sampling procedure was followed. Field measurements of pH and temperature were also undertaken. The samples were then analyzed for physico-chemical and bacteriological parameters.

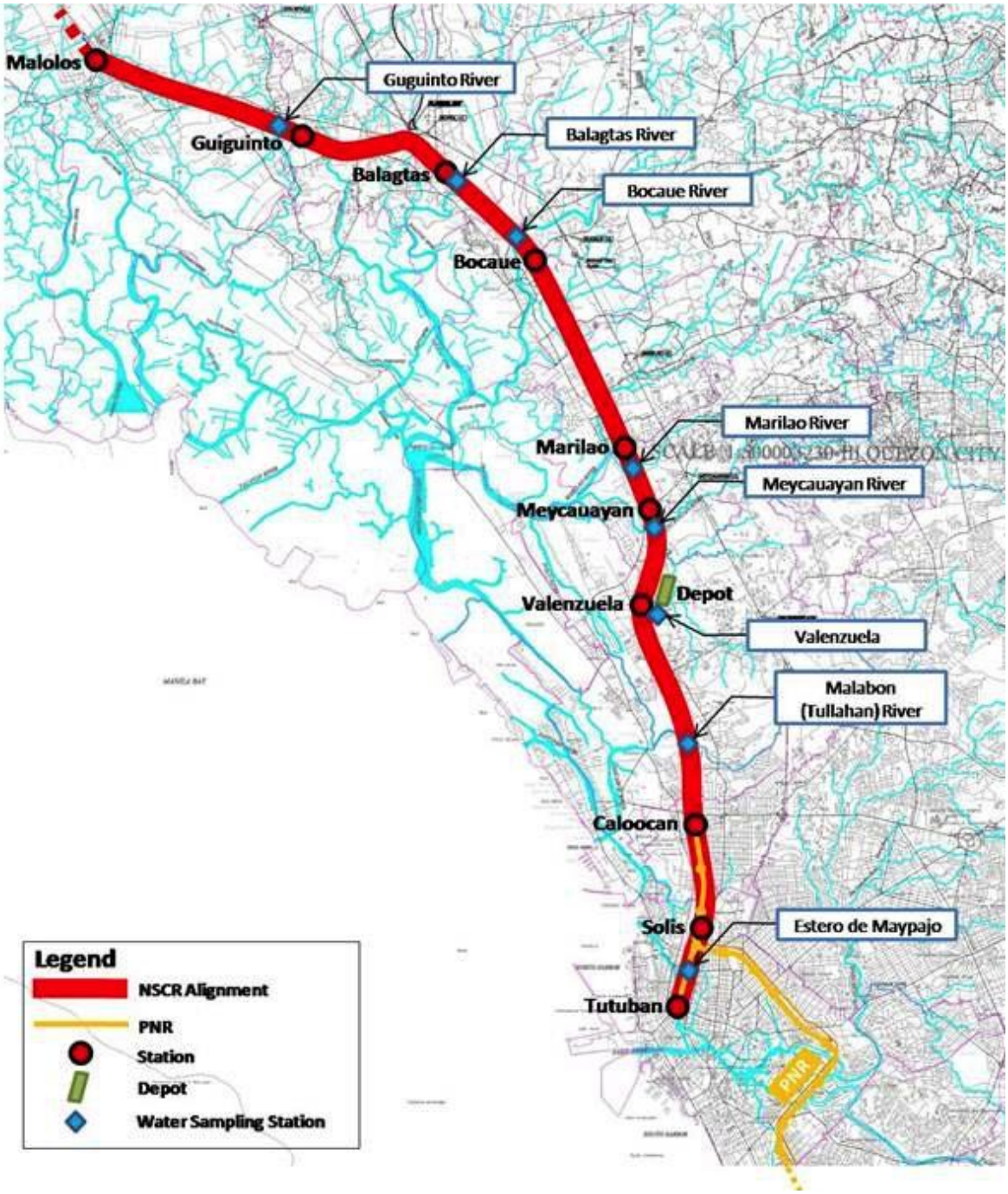
Results of the laboratory analyses are summarized in Table 2.14, while the certificates of Analysis are attached in Annex H.

Table 2.13 Surface Water Sampling Stations, Coordinates, Date and Time of Sampling and Weather Conditions during sampling

Sampling Stations	Coordinates	Date of Sampling	Time of Sampling	Weather Conditions
Guiguinto River	N - 14˚49’49.8” E - 120˚52’43.8”	September 24, 2013	1057 H	Sunny
Santol (Balagtas) River	N - 14˚49’07.4” E - 120˚54’46.7”		1210 H	Sunny
Bocaue River	N - 14˚47’55.4” E - 120˚55’39.8”		1400 H	Sunny
Marilao River	N - 14˚45’41.4” E - 120˚57’03.0”		1429 H	Sunny

Sampling Stations	Coordinates	Date of Sampling	Time of Sampling	Weather Conditions
Meycauayan River	N - 14˚43'50.6" E - 120˚57'49.4"		1518 H	Fair
Valenzuela	N - 14˚42'48.7" E - 120˚57'39.3"	September 25, 2013	0932 H	Rainy
Malabon (Tullahan) River	N - 14˚40'40.3" E - 120˚58'18.9"		1237 H	Fair
Estero de Maypajo	N- 14^0 38' 6.8" E- 120^0 58' 36.0"	July31, 2014 September 15, 2014 January 14, 2015	1010H 1105H 1125H	Rainy Rainy Sunny

Source: JICA Study Team



Source: JICA Study Team

Figure 2.31 Site of (River) Water Sampling Stations

Table 2.14 Summary of Test Results for Surface Water Samples

Parameters, units	Guiguinto River[1]	Balagtas River[1]	Bocaue River[1]	Marilao River[1]	Meycauayan River[1]	Valenzuela[1]	Malabon River[1]	Estero de Maypajo	DAO No. 34, Class C
pH	8.8	7.6	7.9	7.8	7.4	6.6	7.0	7.2* 7.0**	6.5-8.5
Temperature	26.7	27.0	27.5	28.2	27.7	26.7	27.7	25* 26.5***	3 °C Maximum rise
Color, PCU	170	170	85	85	50	50	40	75* 30**	(c)
DO, mg/L	2.3	4.5	8.2	7.1	<2.0	<2.0	<2.0	<0.5* 5.0**	5.0 minimum
BOD, mg/L	12	2	4	8	9	55	22	63.2* 33**	7(10)
TSS, mg/L	44	8.8	44	36	17	9.0	12	47.5* 21.2**	(g)
Surfactants, MBAS, mg/L	0.5	<0.02	<0.2	0.1	0.4	1.7	2.2	3.9* 2.7***	0.5
Oil and Grease, mg/L	0.8	0.6	0.7	0.8	0.6	0.7	0.4	3.7* 0.8*	2
Nitrate, mg/L	0.05	0.3	0.9	1.7	0.04	<0.2	0.05	21.8* 0.2***	10 [(j)]
Phosphate, mg/L	0.3	0.5	0.5	0.6	0.4	0.3	1.6	2.74* 0.5***	0.4 [(k)]
Phenols, mg/L	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006	<0.01* <0.0006***	0.02 [(l)]
Chloride, mg/L	24	3.6	8.4	14	22	14	27	40.3* 20***	350
Cr^{+6}, mg/L	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.001* <0.003***	0.05
Mercury, mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.001* <0.0001***	0.002
Dissolved Copper, mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.05* <0.01***	0.05
Free Cyanide, mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.01* <0.02***	0.05
Arsenic, mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.0014* <0.01***	0.05

Parameters, units	Guiguinto River[1]	Balagtas River[1]	Bocaue River[1]	Marilao River[1]	Meycauayan River[1]	Valenzuela[1]	Malabon River[1]	Estero de Maypajo	DAO No. 34, Class C
Cadmium, mg/L	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.01* <0.006***	0.01
Lead, mg/L	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.05* <0.05***	0.05
Total Coliforms, MPN/100 ml	>160,000	35,000	54,000	54,000	>160,000	>160,000	>160,000	9,200,000* 7,000,000**	5,000 (m)
Fecal Coliforms, MPN/100 ml	92,000	13,000	35,000	35,000	>160,000	>160,000	>160,000	5,400,000* 1,700,000**	-

Source: JICA Study Team

Note:

[1]Sampling Date – September 24-25, 2013

*Sampling Date – January 14, 2015

**Sampling Date – July 31, 2014

***Sampling Date – September 15, 2014

(c) No abnormal discoloration from unnatural causes

(g) Not more than 30 mg/L increase

(j) Applicable only to lakes or reservoirs and similarly impounded water

(k) When applied to lakes or reservoirs, the Phosphate as P concentration should not exceed an average of 0.05 mg/L nor a maximum of 0.1 mg/L

(l) Not present in concentrations to affect fish flavor/taste

(m) These values refer to the geometric mean of the most probable number of coliform organism during a 3-month period and that the limit indicated shall not exceeded in 20 percent of the samples taken during the same period

nil - Extremely low concentration and not detectable by existing equipment

() Values enclosed in parentheses are maximum value

Discussed below is the evaluation of the test results of surface water based on the standards set in the DENR Administrative Order (DAO) No. 34: Revised Water Usage and Classification of 1990 for Fresh Surface Water, Class C.

Guiguinto River

The sampling point is located along a residential area. Based on the Google map, some notable industries nearest the river sampling point are Oshima Tech and RIS Industrial Complex. The Flavors Manufacturing Company, on the other hand, is located near the proposed Guiguinto Station.

Based on the results for Guiguinto River, most of the measured parameters for the surface water stations do not conform to corresponding DAO No. 34, Class C standards. The pH range of 6.5 to 8.5 is optimal for surface water. Guiguinto River has a pH value of 8.8, which is higher than the maximum limit of 8.5. The Biochemical Oxygen Demand (BOD) of Guiguinto River is measured at 12 mg/L exceeding the maximum limit of 10 mg/L. Results also show low Dissolved Oxygen (DO) level and high coliform count. This can be attributed to sewage discharge by nearby industrial and residential households situated along the river. There are a total of 88 manufacturing industries in Guiguinto in 2001 that include garments, engineering works and machine shops, bakeries and bakeshops and noodles. Based on reports from the LGU, noodle factories and tanneries used to proliferate both sides of the river, but were shut down a few years ago. The factories had no wastewater treatment facilities and dumped their effluents into the river, contributing to its biological death (*Philstar.com, July 2006*).

Balagtas River

Based on the Balagtas CLUP, access to proper sewerage system is among the constraints of the municipality's environmental sector. Solid and liquid waste disposal is done on surface water areas. The final destination of the sewage in the municipality is still the water bodies in the community contributing to pollution particularly of the Balagtas River. Encroachment of public buildings and settlements result to siltation of rivers further aggravating the condition of already polluted bodies of water.

Based on the water sampling results, the non-conforming parameters for Balagtas River include pH, DO, Phosphate-P and Total coliform. Sources may include human and animal wastes, industrial discharges, soil erosion and fertilizers. The sampling point is located nearby vast agricultural area, which may explain notable high level of phosphates above the standards. Phosphates are basic elements in the metabolic reactions of plants and animals and they are essential nutrients to help plants grow. Excess amount of phosphate in surface water may cause extensive algal growth and may also lead to decreased oxygen levels in the water. As per observation, the water is thriving with water lilies and other crops that impede also the natural flow of water (Photo Nr. 38 – Annex E).

Bocaue River

Bocaue River is famous for its annual "Crus ng Wawa" River Festival, where huge decorated pagodas are built along the river.

Based on the Region 3 Water Quality Status Report (WQSR) prepared by the Environmental Management Bureau of DENR, Bocaue River is one of the country's water bodies that need immediate intervention. Results from the regularly monitoring of EMB of Bocaue River from 2002 to 2004 revealed that water quality criteria, DO and BOD, which are indicators for

aquatic life environment, are not being attained. The percentages of compliance to these criteria on both its upstream and downstream waters are among the lowest, ranging from 30 percent to less than 20 percent. Results show that the river failed to meet the DO criterion of not less than 5 mg/L, with values ranging from 3.3 to 3.5 mg/L. Similarly, BOD results exceeded the criteria of not more than 7 mg/L for Class C waters. BOD values ranged from 9.4 to 10.7 mg/L. Chromium, copper, and cadmium levels are within criteria, but lead concentrations are high. In addition, parameter values indicate water quality have been declining through time. This implies that the Bocaue River is deteriorating.

Similar with most rivers in the Province, Bocaue River suffers from household effluents as well as solid and industrial wastes. The Bocaue Public Market is in fact located at the easement of the said river. Compounding the problem is its close proximity to the Municipality of Sta. Maria, where more than 30 farms and livestock establishments are located. These industries generally do not have the appropriate wastewater treatment facilities and their discharges most probably are directed to nearby water bodies. With the Bocaue River located downstream of Sta. Maria River, the resulting contamination of the former from pollution discharges is inevitable.

The sampling point is located at the edge of grassland where a few residential houses are located. The water quality status presented in Table 2.14 shows non-conformance only in Phosphate and Total Coliform. The low level results for other parameters maybe attributed to the season, which is relatively wet, when the sampling was undertaken (Photo Nr. 39 – Annex E).

Marilao River

Marilao River is considered as one of the polluted rivers in the Region. The monitoring results conducted by the EMB Region 3 from 2002 to 2004, as indicated in the Region 3 WQSR, show that the river has been failing to meet the DO, BOD, and TSS criteria. In addition, the two-year averages show that the river exceeded the criterion for lead.

Annual average BOD results from 2002 to 2004 ranged from 13.3 mg/L to 35.7 mg/L exceeding the criteria of not more than 7 mg/L for Class C waters.

Marilao River is the site of a thriving aquaculture industry. However, it receives pollution from various domestic and industrial sources such as gold refineries, jewelry-making, tanneries, lead-utilizing, electroplating, pyrotechnics, garments and textile, piggeries, livestock and poultry, and other manufacturing establishments. The Tabing Ilog Talipapa Market is located right at the river easement. These industries generally do not have wastewater treatment facilities and are expectedly discharging to Marilao River. The exceedances for heavy metals, in particular, can be attributed to the number of metal-finishing industries that drains to Marilao River. Most exceedances occurred during the first quarter of the year (dry season) followed by an apparent decrease after the wet season. This decrease can be attributed to the dilution effect of heavy rains that hit the country during this period. This also explains the low values of some parameters analyzed during the actual water sampling. Values for Phosphate and Total Coliform, however, exceed standard values as shown in Table 2.14. This area of the river is surrounded by commercial and small industrial establishments that include a public market (Photo Nr. 40 – Annex E).

Meycauayan River

According to the Region 3 WQSR, the water quality in Meycauayan River has consistently failed to meet the DENR criteria for its intended beneficial use. The municipality of

Meycauayan is home to several establishments such as electroplating, beverage plants, gas stations, laundry and textile, jewelry-making, tanneries, pyrotechnics, piggeries, livestock and poultry, and other commercial and manufacturing firms. These establishments lack the appropriate wastewater treatment facilities. The Canumay Creek in Valenzuela is a tributary of Meycauayan River. This upstream section is considered a highly industrialized area. Discharges from the upstream tributaries of the river are also possible causes of pollution of Meycauayan River.

Based on the three-year average monitoring of EMB Region 3 from 2002-2004, DO, BOD, and TSS monitoring results failed to meet the respective criterion for Class C waters. DO results for Meycauayan River have values ranging from 1.5 to 3.7 mg/L. In fact, even the highest reading in 2003 did not meet the criterion, indicating the extremely poor water quality of the river. In addition, the river had several readings of zero or approaching zero. Similarly, BOD annual average monitoring results show that the river has been exceeding the criterion throughout the three-year period. In fact, even its lowest readings exceeded the limit of not more than 7 mg/L, with values ranging from 28.1 to 50.6 mg/L. The TSS annual average monitoring results indicate that the river generally had high TSS values especially in 2004 averaging to 106 mg/L. Significantly high values as much as 399 mg/L were recorded at the downstream station of the river in 2004. For heavy metals, annual average monitoring results show exceedances in chromium (2001), cadmium (2001), and lead (2004). Potential sources of chromium are the tanneries located in this area while electroplating and other metal-finishing facilities are the potential sources for cadmium and lead.

The water quality status results in Table 2.14 indicate non-conformance only in DO and Total Coliform. The low level results for other parameters maybe attributed to the season, where it was raining the previous days when the sampling was undertaken. The Region 3 WQSR report also cited that there is a considerable change in the salinity values in the river during the dry and wet seasons, implying that there is a big change in freshwater discharge from dry to wet seasons. The sampling point is located beside the old garbage dumpsite, which is also adjacent to a small tannery (Photo Nr. 41-Annex E).

Valenzuela

The sampling site is along a water-logged area near the proposed stabling yard for trains bounded by the First Valenzuela Industrial Company and Valenzuela Memorial Park. Presence of surfactants or methylene blue active substances (MBAS) is noted above the 0.5 mg/L limit. Surfactants enter surface waters mainly by discharge from soap manufacturers and other industries and private households. It is in this area where BOD is found the highest among all sampling sites at 55 mg/L. Results also reveal very low DO level below 2 mg/L.

Malabon (Tullahan) River

The Malabon River forms part of the Navotas-Malabon-Tenejeros-Tullahan (NMTT) river system, which is one of the most polluted rivers in the world. The polluted situation of the Malabon River can be attributed to the various types of solid and liquid wastes from industrial firms located along its banks. Accordingly, the waste generated from domestic usage including those from commercial establishments and industrial factories are discharged into septic tanks, drainage canal or directly to the rivers. Partly treated domestic sewage from general public are discharged into the river and adds to the worsening condition of the said water body. Visual appearance of the river itself would reveal its murky color and noticeable odor emanating from the water including the solid waste and to some extent human excreta which finds its way to the river (Navotas Ecological Profile Report, 2011).

The average DO level and average BOD loading of NMTT was 3.6 mg/l and 22.3 mg/l, respectively in 2003 (DOST CLEAR River Program Report). These levels could not sustain aquatic life. Levels of coliform bacteria in all rivers in Manila (NMTT River System included), as well as tributaries of Laguna de Bay, exceed DENR standards in some cases by several orders of magnitude.

As seen from Photo Nr. 43 of Annex E, a lot of commercial and industrial establishments are located along the bank where the point of sampling was done. The results of the actual surface water sampling as shown in Table 2.14 exceeds DAO 34 standard limits. Pollution levels in BOD, Phosphate and MBAs are measured at 22 mg/L, 1.6 mg/L, and 2.2 mg/L respectively. Total Coliform results is beyond 160,000 MPN/100 ml and DO below 2.0 mg/L.

Estero de Maypajo

The water samples were taken in July and September 2014, and January 2015. Results of water quality testing (Table 2.14) were compared to the corresponding DAO No. 34, Class C standards at the time of sampling.

The DO levels were below the minimum limit of 5 mg/L, especially below 0.5 at the sampling of in January 2015.The BOD measured 33 mg/L in July 2014 and at 63.2 mg/L in January2015exceeded the maximum limit of 10 mg/L. High coliform counts were also observed in both sampling, also exceeding the Class C standard. These results can be attributed to sewage and solid waste discharge by residential households situated along the estero. Likewise, the concentration of surfactants at 2.7 mg/L in September 2014 and 3.9 mg/L in January 2015 exceeded the 0.5 mg/L limits for Class C River. Surfactants are mainly discharged from private households through the release of wastewater containing laundry detergents. The concentrations of phosphate and nitrate were also noted to be above the limit for Class C River standards. Possible sources of phosphates and nitrate along the estero are human and household sewage, laundry detergents and soil run-off.

Low concentrations of toxic substances such as heavy metals, chloride, phenols and cyanide in the water sample, were observed and are below the limits for Class C standard. The estero is surrounded with mostly residential households. Industrial and agricultural activities, which may be potential sources of the abovementioned toxic substances, are not present within the vicinity of the creek.

Water Quality Impact Identification, Assessment and Mitigation

This section presents an assessment of potential environmental impacts of NSCR Project at different phases of the project on the water environment. How these potential impacts will be mitigated in order to reduce, if not eliminate, the adverse effects is also discussed.

a) Pre-Construction and Construction Phase

Water Pollution

There may be short-term adverse impact on water quality due to excavation activities. There may be slight increase in sediments and turbidity of rivers, creeks and other watercourses along the proposed alignment. This is a result of erosion of excavated soils and other unconsolidated materials particularly during rainy periods. Piling work for installation of bridge piers will disturb bottom sediments.

The same soil erosion control measures to mitigate flooding would also reduce the amount of suspended solids in water to permissible levels before discharging into the receiving water bodies.

Wastewater generated by the increased number of workers will cause aggravation of the existing water quality if enough portable toilets are not provided at the construction site. Fuel, lubricant and hydraulic oil discharges from poorly maintained construction equipment, machineries and heavy vehicles will also impact water quality. During repair of equipment and machinery, containers/drip trays shall be used to collect leakage. Any spilled or spent oil will be collected and disposed by accredited waste haulers.

b) Operation Phase

Water Pollution

During operations, wastewater from domestic and industrial activities in the stations and at the Depot may be source of pollution of nearby water bodies. These may include fuels, lubricants and other oil for maintenance and detergents for carriage washing.

Service areas are the most likely locations where such contamination occurs because of the concentration of parked vehicles and fuel stands. Valenzuela Depot should therefore be equipped with an interceptor tank to remove oil and fuel grease from surface water before discharge. A wastewater treatment facility with oil removal will be constructed at the Depot. Treatment facilities such as septic tanks designed to appropriate standards shall be installed from every station to treat domestic sewage. All kinds of wastewater with oil shall be stored and treated at Depot's wastewater treatment facility.

2.3 Freshwater ecology

Aquatic organisms such as fish, plankton, algae and macro-invertebrates/benthos are used as biological indicators of the ecological condition of the freshwater ecosystems such as rivers, streams, lakes, ponds and reservoirs. Table 2.15 lists the biological components observed in Guiguinto and Meycauayan Rivers.

River sediment samples were collected from Guiguinto and Meycauayan rivers to identify the biological population of the said rivers. The results of the physicochemical analysis discussed in Section 2.2.1.2 were consistent with the macro-invertebrate data obtained particularly in Guiguinto River, where the only organism observed was from the Family Chironomidae (Order Diptera). Chironomids or midge flies are mosquito-like insects and are considered pollution tolerant. Surprisingly, despite its diverse and widespread distribution (i.e. can live in a wide range of water qualities), there were only few *Chironomids* observed. Moreover, the fish population observed in the rivers is also known to be tolerant of pollution.

Table 2.15 Biological Components of Guiguinto and Meycauayan Rivers

River	Macroinvertebrates	Nekton
Guiguinto	*Chironomidae* (86 individuals/m^2)	• Giant mottled eel • Catfish • Tilapia • Mudfish/Striped snakehead
Meycauyan	None	

Source: JICA Study Team

Total coliform tests suggest presence of disease-causing bacteria while the fecal coliform test confirms the presence of these pathogenic bacteria. Notable amount of coliforms (total and fecal) measured across rivers indicated that the river systems had been contaminated with human and animal wastes.

Overall, these findings showed that the five rivers may not be able to protect aquatic life given their present physical and chemical conditions. The same observation can be also applied to Estero de Maypajo, which runs through the boundary of Caloocan and Manila, and heavily polluted by domestic wastewater and solid wastes.

Table 2.16 Impact Identification, Assessment and Mitigating Measures for Water

Environmental Aspect	Environmental Component Likely to be affected	Potential Impacts	Assessment of Impacts	Mitigating/Enhancement Measures
PRE-CONSTRUCTION AND CONSTRUCTION				
Land development, earthworks and civil works	Flooding	Aggravation of existing flooding problems	Moderate adverse impact	• Sufficient and effective drainage systems shall be incorporated in the designs. The proponent shall coordinate with DPWH and LGUs how to integrate the drainage systems into the existing canals/culverts. • NSCR structures will be designed to have a clearance of above established flood level and discharges which will be established and included in the detailed design.
Demolition, excavation and bore piling activities	Water Quality	Increase in suspended sediments in the receiving water	Moderate adverse impact	• Implementation of appropriate erosion control measures particularly during high precipitation periods. • Soil/sediments/debris and other excavated materials shall be hauled out from the site immediately and disposed by accredited waste handlers
Domestic wastewater generation		Pollution of receiving water bodies	Low adverse impact	• Portable sanitary facilities (portalets) will be installed to collect wastewater, which will be collected and disposed by accredited waste handles
Fuel and oil leaks from vehicles and other equipment		Pollution of receiving water bodies	Low adverse impact	• Equipment and machinery shall be regularly checked for fuel and oil leaks. • During repair of equipment and machinery, containers/drip trays shall be used to collect leakage. • Any spilled or spent oil will be collected, stored properly and disposed by accredited waste haulers.
OPERATIONS				
Maintenance activities in the railway stations and depot	Water Quality	Pollution of receiving waters bodies	Moderate adverse impact	• Wastewater with oil shall be separately collected and disposed for treatment. • A wastewater treatment facility with oil removal will be constructed at the Depot.

Environmental Aspect	Environmental Component Likely to be affected	Potential Impacts	Assessment of Impacts	Mitigating/Enhancement Measures
				• Draw up a Procedure Manual for Workers at the Depot to prevent oil spills in EMoP
Domestic wastewater generation	Water Quality	Pollution of receiving water bodies	Low adverse impact	• Sanitary facilities at the stations will be installed to collect wastewater, which will be collected and disposed by accredited waste handles

Source: JICA Study Team

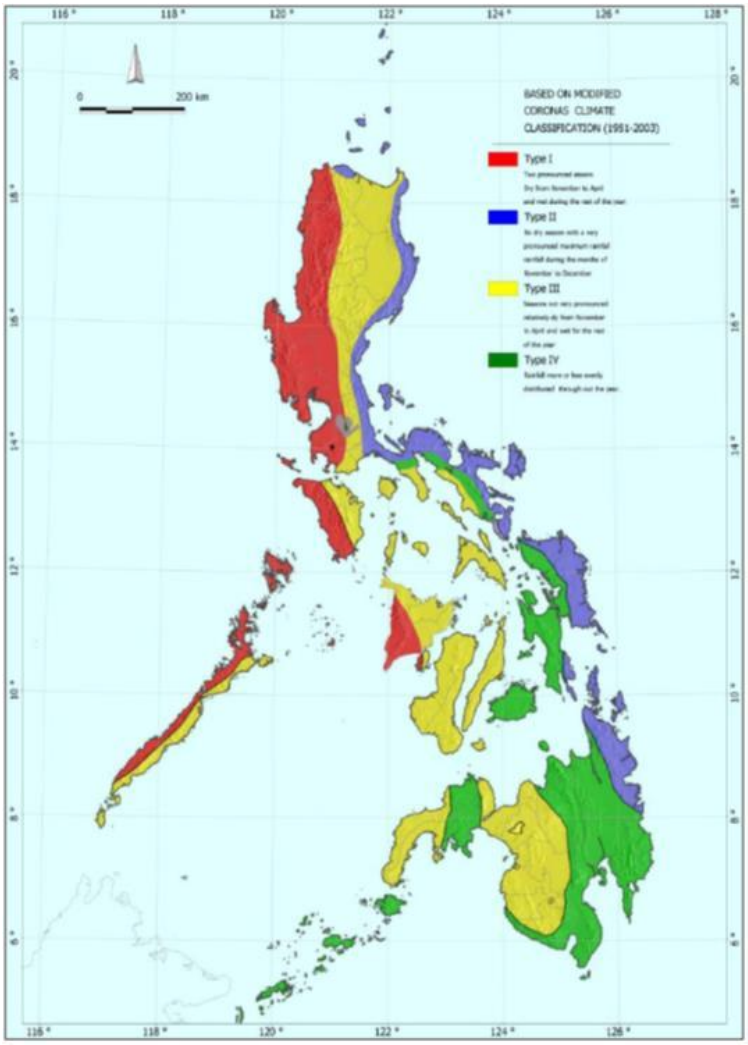
3. THE AIR

3.1 Meteorology/Climatology

Meteorological and climatological data (normal values) for a period of 1981-2010 were obtained from the three nearest PAGASA stations at NAIA (MIA) Pasay City, Port Area Manila and Science Garden Quezon City, which show the normal values of the climatological data.

3.1.1 Climate / temperature / rainfall / humidity / wind

The climate of Manila, Caloocan, Malabon, Valenzuela, Meycauayan, Marilao, Bocaue, Balagtas, Guiguinto and Malolos area are classified as Type I under the Coronas Climate Classification used by Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) depending on the rainfall pattern as shown in Figure 2.32. It is characterized by two pronounced seasons: dry season from November to April and wet season during the rest of the year.



Source: PAGASA

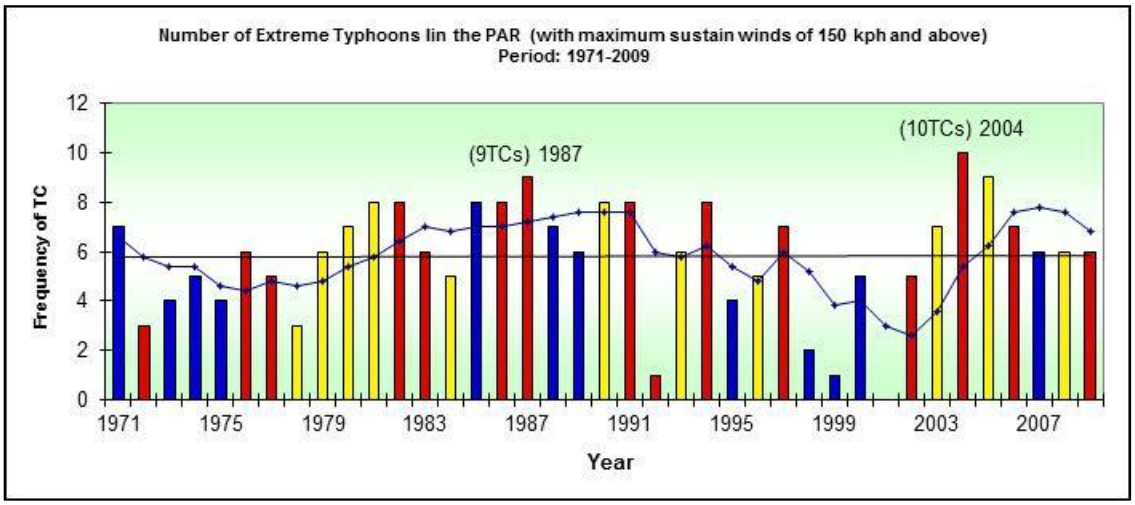
Figure 2.32 Coronas Classification of Climate in the Philippines

Based on the 2011 Report on Climate Change in the Philippines by PAGASA, trends of tropical cyclone occurrence within the Philippine Area of Responsibility (PAR) show an average of 20 cyclones per year. Although there is still no indication of increase in the number of frequency, a slight increase in the number of tropical cyclones with maximum sustained winds greater than 150 kilometer per hour (kph) is observed. Table 2.17 presents a list of recent tropical cyclones with maximum sustained winds above 150 kph while Figure 2.33 shows the trend on the number of extreme typhoons that entered the PAR, having a maximum sustained winds of 150 kph and above.

Table 2.17 List of Tropical Cyclone with Maximum Sustained Wind of Above 150 kph in the Philippines Area of Responsibility

Local Name of Tropical Cyclone	Period	Maximum Sustained Winds (kph)
Reming ("Durian)	November 2006	193
Frank ("Fengshen")	June 2008	165
Pablo ("Bopha")	December 2012	185
Yolanda ("Haiyan)	November 8, 2013	235

Source: PAGASA-DOST/Climate Monitoring and Prediction Center
Note: ( ) International Name



Source: PAGASA-DOST/Climate Monitoring and Prediction Center

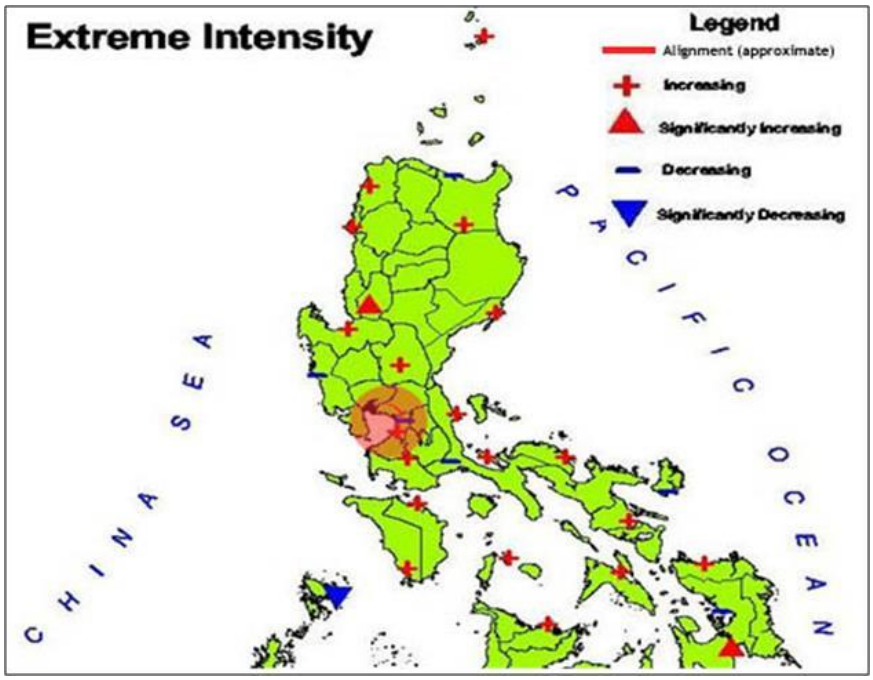
Figure 2.33 Number of Extreme Typhoons with Maximum Sustained Winds of Above 150 kph in the PAR

Rainfall

PAGASA stations in NAIA (MIA) Pasay City, Port Area Manila and Science Garden Quezon City recorded an annual rainfall amount of 1,767.8 millimeter (mm), 2,103.6 mm and 2,574.4 mm with a total of 101, 139 and 153 rainy days, respectively, during the period of 1981 – 2010. The rainy months of May to November indicated that in NAIA Pasay City, Port Area Manila and Science Garden Quezon City, the monthly rainy days range from 6 -19, 10-21 and 12-23 days, respectively. For Manila (Port Area Station), the months of July and August have the greatest number of rainy days with 21 days each, and mean monthly rainfall values of 420 mm and 432 mm, respectively.

Increase in rainfall is likely observed during the southwest monsoon (June, July and August) season until the transition month of September, October and November in most areas of Luzon. From the study of PAGASA on the climate projections in the Philippines there were varied trends in magnitude and direction of the rainfall wherein it is clear that performance of southwest and northeast monsoons will increase. Such that the usual wet seasons become wetter and dry seasons becomes drier all over the country.

Based on the trends in the extreme rainfall intensity of the Philippines (1951-2008 data from PAGASA), as shown in Figure 2.34, the intensity of rainfall along the NSCR alignment is increasing but statistically not significant. However, in the past five years, extreme rainfall events that caused severe flooding in the country there are recorded, as listed in Table 2.18. Situational reports provided by the National Disaster Risk Reduction Management Council (NDRRMC) website show available data on the flood level specifically for the city of Malolos. During Habagat 2013, the estimated range of flood depth observed in Malolos City was 0.3-1.2 meters.



Source: PAGASA-DOST/Climate Monitoring and Prediction Center

Figure 2.34 Trends in the Extreme Rainfall Intensity of the Philippines

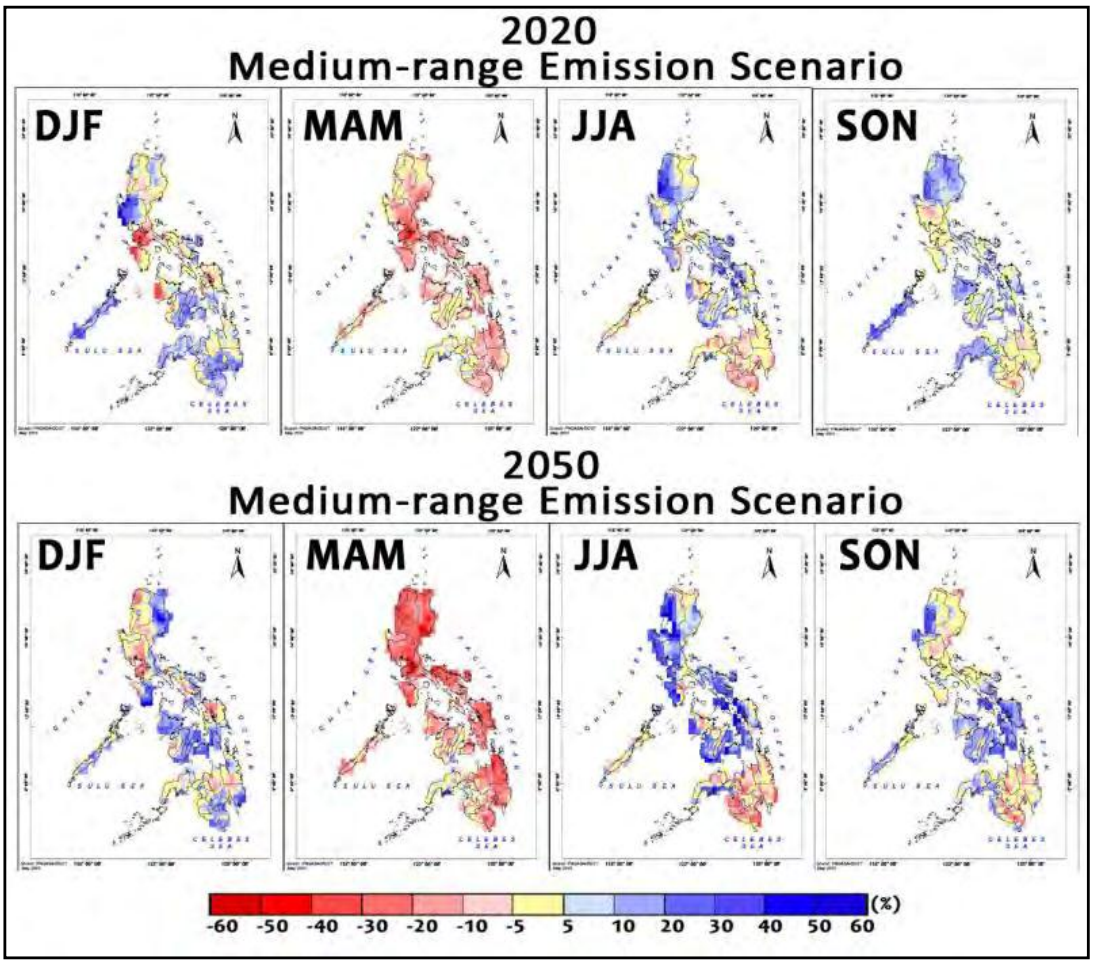
Table 2.18 List of Extreme Rainfall Events that Cause Severe Flooding

Event	Period	Highest Measured Accumulated Rainfall
Ondoy ("Ketsana")	Sept. 24-27, 2009	556.1 mm of rain (4-day period)
Habagat 2012 (enhanced by Typhoon Haiku)	August 6-8, 2012	1,0007.4 mm of rain (3-day period)
Habagat 2013 (enhanced by Tropical Storm Maring)	August 17-21, 2013	1,120.2 mm of rain (5-day period)

Source: www.rappler.com/newsbreak/39948-by-the-numbers-ondoy-habagat-2012-2013

Based on the Report of PAGASA on Climate Change in the Philippines (February 2011), the projected seasonal rainfall change will generally show that there is reduction in rainfall in most parts of the country during the summer (March –April- May) season. However, rainfall increase is likely during the southwest monsoon (June-July-August) season until the transition (September-October-November) season in most areas of Luzon and Visayas, and also, during the northeast monsoon (December-January-February) season, particularly, in provinces/areas characterized as Type II climate in 2020 and 2050.

There are varied trends in the magnitude and direction of the rainfall changes, both in 2020 and 2050. What the projections clearly indicate are the likely increase in the performance of the southwest and the northeast monsoons in the provinces exposed to these climate controls when they prevail over the country. Moreover, the usually wet seasons become wetter with the usually dry seasons becoming also drier; and these could lead to more occurrences of floods and dry spells/droughts, respectively.

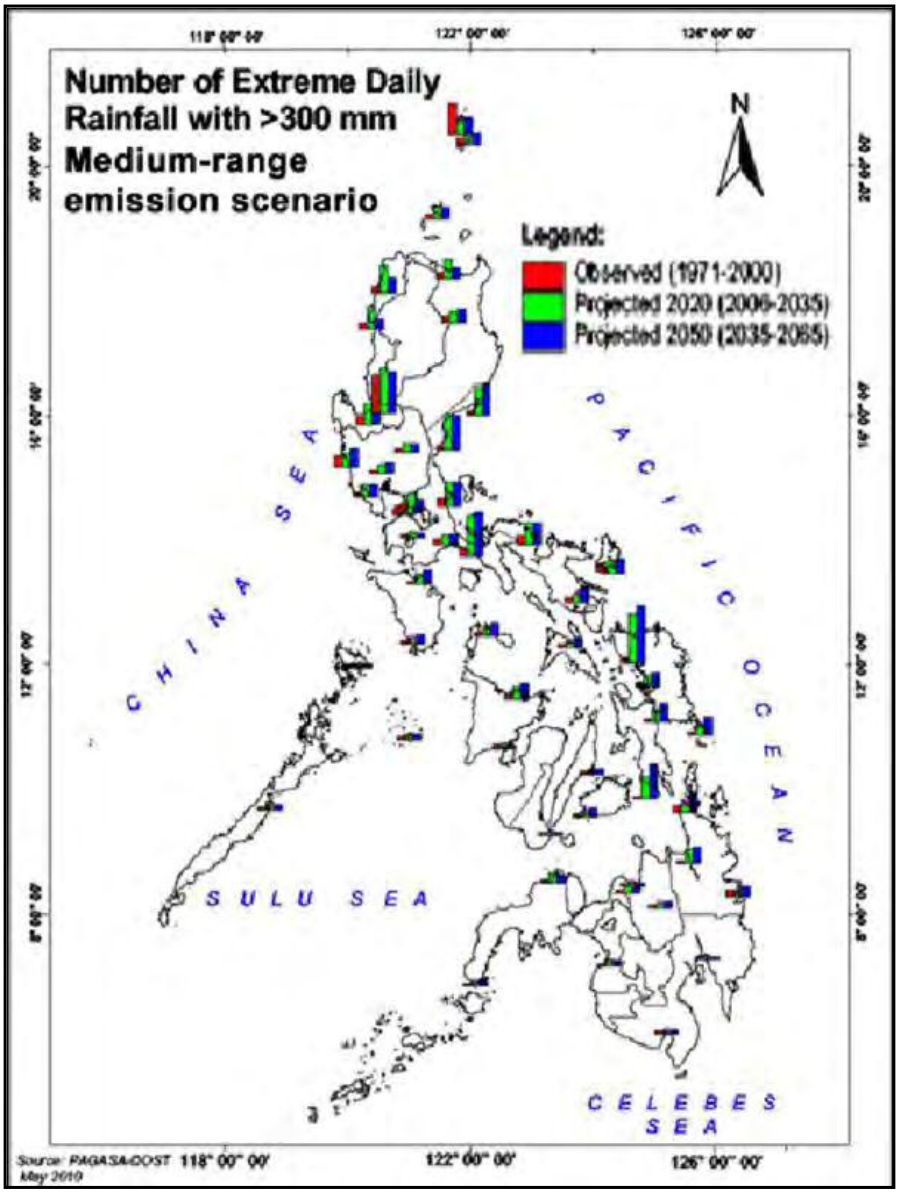


Source: PAGASA

Figure 2.35 Maps Showing the Projected Rainfall Change (increase/decrease) in % in 2020 and 2050 in the Philippines.

Extreme rainfall events (heavy daily rainfall) will continue to become more frequent, extreme rainfall is projected to increase in Luzon and Visayas only, in 2020 and 2050.

Figure 2.36 shows the projected increase in number of days with extreme rainfall (defined as daily rainfall exceeding 300 mm) compared with the observed (baseline) values.



Source: PAGASA

Figure 2.36 Current and Projected Extreme Rainfall in the Philippines in 2020 and 2050 under Midrange Scenario

The projected seasonal temperature increase, seasonal rainfall change in 2020 and 2050 under the medium-range emission scenario in Bulacan and NCR are presented in Table 2.19.

Table 2.19 Seasonal rainfall change (in %) in 2020 and 2050 under medium-range emission scenario in provinces in Region 4-A

		Metro Manila	Bulacan
Observed Baseline (1971-2000)	Dec-Jan-Feb	107.5	212.4
	Mar-Apr-May	198.5	288.9
	Jun-Jul-Aug	1170.2	1041.4
	Sep-Oct-Nov	758.7	842.1
CHANGE In 2020 (2006-2035)	Dec-Jan-Feb	-12.8	4.2
	Mar-Apr-May	-33.3	-23.0
	Jun-Jul-Aug	8.5	12.8
	Sep-Oct-Nov	0.0	-2.9
CHANGE in 2050 (2036-2065)	Dec-Jan-Feb	-17.3	-13.2
	Mar-Apr-May	-38.5	-36.4
	Jun-Jul-Aug	21.3	23.6
	Sep-Oct-Nov	3.7	-3.3

Source: PAGASA

Temperature

The average normal annual temperature recorded at the stations in NAIA (MIA) Pasay City, Port Area Manila and Science Garden Quezon City were 27.8°C, 28.4°C and 27.7°C, respectively.

For most parts of the country, the frequency of hot days and warm nights are significantly increasing. Extreme temperature are normally expressed in number of days with maximum temperature greater than 35°C. Based on the climate trends analyzed by PAGASA using the observed data during the period of 1951 – 2010, there has been an increase in annual mean temperature by 0.648 °C or an average of 0.0108 °C per year-increase. The warmest months are observed in April, May and June and the coldest months during December, January and February, with the temperature ranging from of 28-30°C and 25-27°C.

Relative Humidity

The monthly relative humidity (percentage of water vapor in the air) values ranged from 66% to 84%. The average values for relative humidity recorded at NAIA (MIA) Pasay City, Port Area Manila and Science Garden Quezon City were 76%, 74% and 78%, respectively. This shows high humidity in the three stations.

Wind Speed and Direction

PAGASA weather stations in NAIA (MIA) Pasay City, Port Area Manila and Science Garden Quezon City recorded the prevalent wind direction in the respective area for the period of 1981-2010, as shown in Table 2.20. The average annual wind speed for NAIA (MIA), Pasay City and Port Area, Manila is 3.0 meters per second (mps), while Science Garden Quezon City has an average annual wind speed of 1.0 mps.

Table 2.20 Prevalent Wind Direction Recorded from PAGASA Weather Stations

Month	NAIA (MIA,) Pasay City	Port Area, Manila	Science Garden, Quezon City
January-April	E	N, E and SW	N, NE and SE
May-September	W	SW	SW
October-December	E	SW and N	N
Annual	E	SW	N

Source: PAGASA

Table 2.21 shows the prevalent wind direction and average wind velocity at the 4 sampling sites, as measured by CRL Environmental Corporation.

Table 2.21 Speed and Direction During Air Quality Sampling (September 24-26, 2013)

Station	Prevailing Wind Direction	Average Wind Velocity	Weather Condition
Guiguinto	SW-NE	0.10- 1.57 m/s	Cloudy to partly cloudy with isolated rain shower
Valenzuela	SW-NE	0.15- 0.39 m/s	Cloudy to partly cloudy
Caloocan	SW-NE	0.13- 2.05 m/s	Cloudy

Source: PAGASA

3.1.2 Reduction of Greenhouse Gas

In this project, greenhouse gas (GHG) reduction was calculated and the effect was evaluated. However, in this estimate, emission of CO_2 by energy consumption for electricity is not including, because the amount of electricity is not yet estimated at this moment.

(a) Emission Reduction of GHG from Vehicles

Methodology

In order to estimate the emission reduction of GHG from vehicles, the bottom-up approach was applied. The bottom-up approach is a method based on cumulating all the vehicle emission in a target region. The key steps of this approach are summarized below.

(i) The vehicle speed and volume by vehicle type by link: These data were determined from the demand forecast model. The model combined road/ rail assignment model was used. The assignment process used is based on Equilibrium method, where the traffic from each OD pair is assigned interactively to the network until no cheaper/ quicker route could be found. The shortest path was build based on the generalized cost such as operating cost of vehicle, public transport fares and wait& walk times. Therefore the rail passengers will be transfer from private mode, bus and Jeepney and be decided based on the rail network and the road traffic situation. It means the number of rail passengers will be dynamically changed each assignment. The equilibrium method re-calculates the new travel time based on the road capacity and assigned traffic volume after each assignment interaction. The road speed is calculated by using BPR function below depend on the road congestion.

BPR function $\quad t = t_0\left\{1 + \alpha\left(\frac{X}{C}\right)^{\beta}\right\}$

Where,
- t : Travel Time
- t_0 : Free Flow Time
- X : Traffic Volume
- C : Road Capacity
- α, β : Parameters $\alpha = 3.0, \beta = 4.0$

This model was considered four road modes, car, Jeepney, bus and truck. The covered area by this model are Mega Manila, Region III and IV-A.

(ii) The emission factor by vehicle type by vehicle speed class: It was applied the factors which was developed by JICA road map study (Roadmap for Transport Infrastructure Development for Metro Manila and Its Surrounding Area, JICA, 2014). They were shown in Table 2.22.

Table 2.22 Reference Vehicle CO2 Emission Factor

Unit: g/km, Speed Classes / Speed of Representative (km/h)

Vehicle Type	3 to 5 4	5 to 10 7.5	10 to 15 12.5	15 to 25 20	25 to 40 32.5	40 to 60 50	60 to 80 70
Gas car	447.6	363.7	327.5	306.3	292.0	282.5	277.3
Diesel utility vehicle/ jeepney	643.7	544.6	501.8	476.7	459.9	448.7	442.5
Diesel truck/ bus	1182.9	1083.9	1041.1	1016.0	999.1	987.9	981.7

Source: Roadmap for Transport Infrastructure Development for Metro Manila and Its Surrounding Area, JICA (2014)

Note: Dr. Karl N. Vergel of UP-NCTS updated existing Manila emission factors (1992, 1996) upon request of study team as a reference. There emission factors have limitations as they were not based on a reliable chassis dynamometer test.

(iii) Calculation of emissions by vehicle type by link with both outputs of with case and without case. The equation of emission is shown in below.

$$E = \sum_{k} \sum_{i} \left(D_k \times T_{k,i} \times EF_{k,i} \times Days \right)$$

Where: k: Link number, D_k: Link length (km),
$T_{k,i}$: Traffic volume by vehicle type by link (vehicles/day)
$EF_{k,j}$: Emission factor by vehicle type by vehicle speed (g/km), and
Days: the number of days in year (days), 345 day.

(iv) Calculation of emission reduction compared with and without case.

Emission Reduction of GHG

The vehicle emissions are estimated by traffic assignment results of the case with Malolos-Tutuban section and without Malolos-Tutuban section. The results for 2020, 2030 and 2040 are summarized in Table 2.22. The result shows that GHG emission in 2020 will be reduced 97,000 t-CO_2/year by starting the operation of NSCR. In addition the GHG reduction will increase with increased the passengers of NSCR in the future. In 2030 and 2040, GHG emission will be reduced 206,000 and 261,000 t-CO_2/year respectively.

Table 2.23 Emission Reduction of GHG

Unit: 1000t-CO2/year

Year	Mode	Without case	With case	Reduction
2020	Car	5,823	5,774	50
	Jeepney	1,254	1,216	38
	Bus	1,218	1,211	7
	Truck	3,831	3,828	3
	Total	**12,126**	**12,029**	**97**
2030	Car	7,297	7,187	109
	Jeepney	1,565	1,485	80
	Bus	1,561	1,554	7
	Truck	4,966	4,956	10
	Total	**15,388**	**15,182**	**206**
2040	Car	8,818	8,656	162
	Jeepney	1,793	1,717	77
	Bus	1,807	1,793	14

	Truck	6,170	6,161	9
	Total	**18,588**	**18,327**	**261**

Source: JICA Study Team

(b) Loss of Carbon Stock by Land Conversion

Some negative impacts of the project would include reduction of carbon sink area due to clearing of trees and vegetation and GHG emission due to operation of standby generator sets. The impact, however, is minimal.

Loss of Carbon Stock by Land Conversion from Paddy Fields to Depot

The paddy fields of 0.4 ha for proposed depot site in Valenzuela will be disappeared. This conversion of cropland leads loss of carbon stock. The calculation was carried out by the following equation.

$CP_{CONVERSION} = AD_{CONVERSION}$ X CSP

Where, $CP_{CONVERSION}$: Carbon stocks in biomass on paddy fields to other land-use (depot) (tCO2)

$AD_{CONVERSION}$: Area of depot (ha)

CSP: Carbon stocks on paddy fields (tCO_2/ha)

Where, CSP = CSPc X 44/12
CSPc = 4.7 tC/ha (*)

(*: source: for Cropland in Table 8.4 Default biomass carbon sticks removed due to land conversion to settlements, Chapter 8 Settlements, Volume 4: Agriculture, Forestry and Other land Use, 2006 IPCC Guidelines for National Greenhouse Gas Inventories)

The loss of carbon stock by land conversion from paddy fields to depot is estimated 7 tCO_2.

Loss of Carbon Stock by Land Conversion from Wetland to Depot

The soil in wetland (2 ha) for proposed depot site in Valenzuela will be disappeared. This leads loss of carbon stock.

The calculation was carried out by the following equation.

Cwt = Wa X Cwu X (44/12)

Where, Cwt: Carbon stocks in soil in wetland tor removal (viaduct) (tCO2)

Wa: Area of removal of soil in wetland (km2); 0.02 km^2

Cwu: Wa: Carbon contained in soil in wetland (tC/km2); 69 tC/km^{2} (*)

(*Data Source: Chapter 7: Forest Land, Volume 4: Agriculture, Forestry and Other land Use, 2006 IPCC Guidelines for National Greenhouse Gas Inventories)

The loss of carbon stock by removal of soil in wetland is estimated 5 tCO_2.

Emission reduction of GHG from vehicles will be much larger than the losses of carbon stock by land conversion. As mentioned above, reduction of GHG emission will be97,000 t-CO_2/year at

starting the operation of NSCR. Then, the GHG reduction will increase up to about 200,000t-CO_2/year after 2030. However, increase of CO_2 by energy consumption for electricity is not included in these reductions because the amount of electricity is not yet estimated at this moment.

Climate Change Policies in the Philippines

In response to the future projection of climate change, the Government of the Philippines has enacted the Climate Change Act (Republic Act 9729), which provides the policy framework to systematically address the growing threats on community life and its impact on the environment. The Climate Change Commission (CCC) is the lead policy making government body. Recently, the National Framework Strategy on Climate Change (NFSCC) and the Philippine Strategy on Climate Change Adaptation (both in 2010), and the National Climate Change Action Plan (2011-2028) were formulated as the bases of policies on climate change.

Metro Manila is the 20th largest megacity in the world in terms of population but its GHG emission level is limited, at an estimated 5.1 tons of CO_2 equivalent per capita (tCO_2e/capita) total GHG (World Bank, Cities and Climate Change: An Urgent Agenda, 2010). Its GHG emission per person is almost the same level as Tokyo's while those of other large industrial cities are much higher, such as Jakarta (60% more) and Bangkok (5.4 times more). Metro Manila is seen as a minor emitter in terms of GHG emission. The GHG inventory calculated under the Climate Change and Clean Energy Project funded by USAID showed that the Energy sector was the primary source of emissions, representing 89.27% of the overall emissions. The contributions of the industrial, agricultural and land use sectors to Metro Manila GHG emissions are insignificant.

In the National GHG inventory according to NFSCC, the transport sector's contribution to the greenhouse gases (GHG) emission has increased significantly since 1990. The emission contributions from the road transport are projected to increase to 37 and 87 metric tons of CO_2equivalent by 2015 and 2030, respectively. Large amount of GHG emission from transport sector are in Metro Manila and neighboring cities and regions.

The Philippines' commitment to greenhouse gases (GHG) emission reduction under the NFSCC is to prioritize the low carbon emissions in the transport sector. The NFSCC has to address the environmentally sustainable transportation, promotes models to improve the transport sector's efficiency and modal shifts as compressed natural gas and liquefied petroleum gas becomes the primary fuel of the public transport, and supports the expansion to more efficient mass transport systems such as the metro rail transit, light rail transit, and bus rapid transit. Major measures or technologies to potentially reduce pollution and GHG in the transport sector that will be implemented by DOTC and Department of Energy include the following *(DOTC, DOE and JICA Study team)*:

- Mass Rapid Transit System
- Measures on the Traffic Amount/Traffic Flow
- Measures on Freight
- Improve Fuel Efficiency per vehicle
- Fuel switching to bio fuel and low carbon fuel

Impact of the Project to Climate Change

One of the most important and urgent priorities under the NFSCC is the development of railway network such as the NSCR, which will result to potential significant reduction of GHG by shifting passengers from road to a rail-based transportation system. Urban rail systems, such as the LRT and MRT, are high capacity mass transit systems which cater to high passenger demand corridors. Such systems are also types of public transport optimization interventions that promote reduction of both public and private vehicle trips with low passenger occupancy. Being electrically operated, it is also considered environment friendly because of low emission operations. The NSCR will satisfy transport efficiency and contribute to the emission reduction objectives of NFSCC.

For reference, there is an available data on the estimated emission impact of on-going and proposed rail systems of the government. These include the expansion of the Metro Manila LRT System consisting of the on-going LRT Line 1 North Extension (Monumento to North Avenue), proposed LRT Line 1 South Extension to Bacoor, Cavite, and the private sector-led LRT Line 7 (North Avenue to San Jose del Monte City, Bulacan), on-going project preparation study for the west extension of MRT Line 3 (EDSA Line) and a proposed Japanese MITI-funded LRT Line 2 east and west extension. When the on-going and proposed lines are operational, the expected GHG emission reduction can reach 0.2 $MtCO_2$ (*Transport and Traffic Planners, Inc., April 2010*).

Impact of Climate Change to the Project

As presented in the baseline data discussion, extreme weather conditions will be experienced with global warming and climate change. During the operational phase, the NSCR will be directly exposed to oftentimes prolonged and frequent rainfall, strong winds, higher waves (in coastal areas) and temperature variations. This can lead to accelerated structural fatigue and materials failure, and places greater demands on the construction, operation and maintenance of flood control and drainage structures. Severe weather conditions (such as extreme tropical cyclones) and inundation may lead to downtime of operations. Heat waves may result to increased demand of cooling system of passenger cars, building offices and ticket booths. The impacts could be severe in areas where infrastructures are not designed to fully cope with the effects of climate change. Thus, design in making infrastructure robust or resilient to the effects of climate change should be well taken into consideration. These measures, however, could result to higher project cost.

A summary of the potential impacts, assessment of impacts and mitigating measures to address the identified impacts is provided in Table 2.37.

3.2 Air Quality / Noise / Vibration

3.2.1 Ambient Air Quality

Manila, Caloocan, Valenzuela, Malabon, Meycauayan, Marilao, Bocaue, Balagtas, Guiguinto and Malolos are already experiencing a deterioration of air quality. This may be attributed to the congestion of people, high volume of vehicles plying in the cities/municipalities, improperly maintained vehicles servicing them and the significant number of manufacturing companies and industries, with inadequate air pollution control devices, operating within the area.

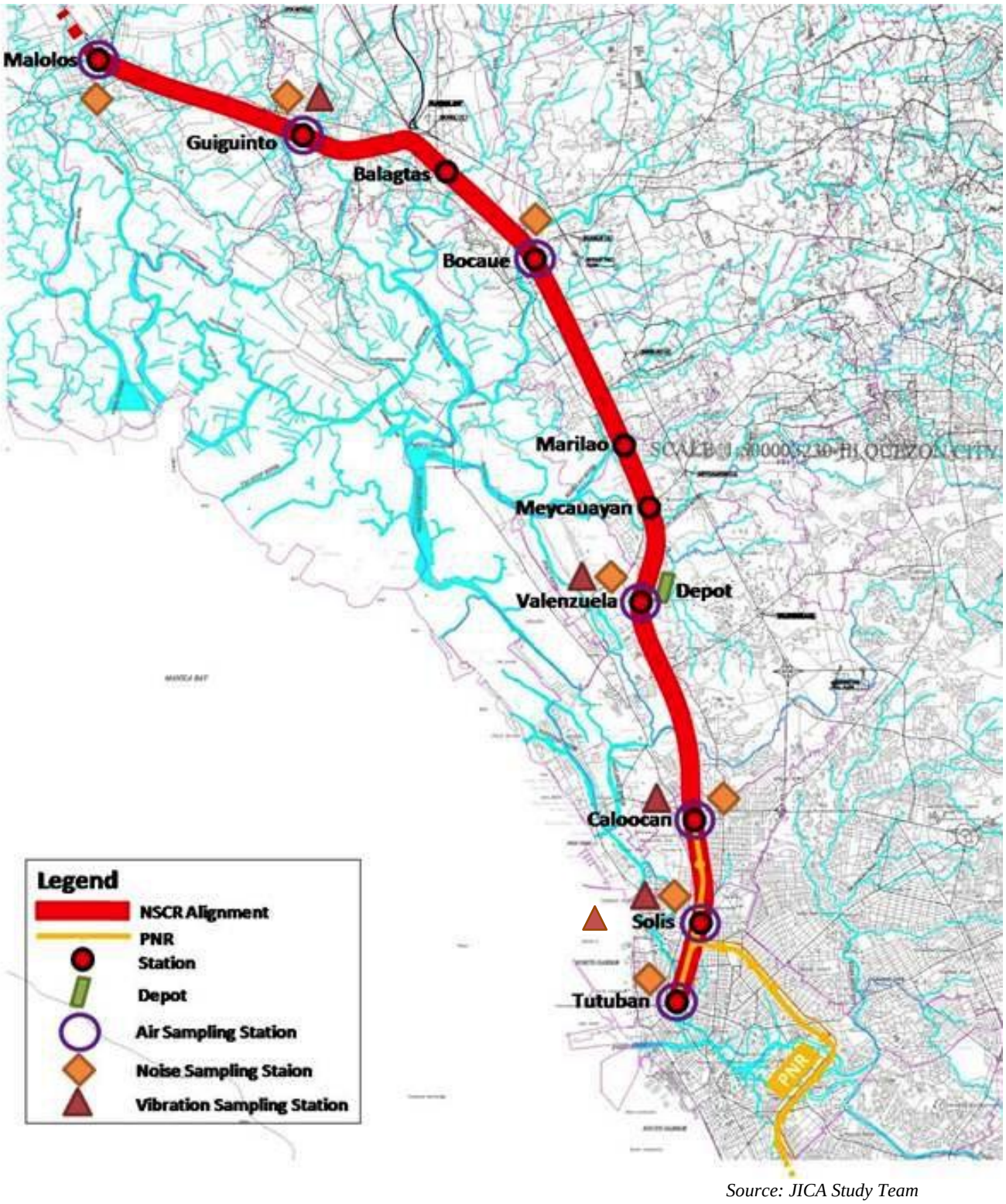
Ambient air quality sampling was conducted at old PNR Malolos and Bocaue stations in October 2012. Sampling was undertaken in the morning and the afternoon. Air quality sampling was also conducted at three Old PNR stations, namely Guiguinto, Valenzuela and Caloocan in September, 2013. In Manila and Caloocan, air quality sampling was conducted at three sites along the proposed NSCR Project alignment in December 2014. Locations of the sampling sites were at Caloocan (near the intersection of Samson Road and existing PNR tracks); Solis (near the existing PNR tracks); and Tutuban (along C.M. Recto Ave. near the old PNR tracks). The sampling sites are shown in Figure 2.25.

The measurement results of the following parameters; TSP, PM_{10}, Pb, CO, NO_2, SO_2 and O_3 are shown in Table 2.24.

TSP level measured at the Malolos station in the afternoon exceeded the DENR standards, although PM_{10} level did not exceed the DENR standards. Particulate Matter, PM_{10}, measured in all sampling points was within the DENR standards. The O_3 level measured in the morning and in the afternoon at Malolos station exceeded the DENR guideline value.

On the other hand, the detected concentration levels of Pb, CO, $NO_2$and SO_2 from all sampling sites were below the DENR standards and guideline values.

The baseline air quality data will be used as reference values in determining the changes of pollutant levels during the monitoring of activities at the pre-construction, construction and operation phases of project.



Source: JICA Study Team

Figure 2.37 Sites for Ambient Air Quality, Noise and Vibration Level Measurement

Table 2.24 Observed Ambient Air Concentrations

Sampling Station	Coordinates	Ambient Air Quality						
		TSP (µg/NCM)	PM_{10} (µg/NCM)	Pb (µg/NCM)	CO (ppm)	NO_2 (µg/NCM)	SO_2 (µg/NCM)	O_3 (µg/NCM)
Malolos[1]	14°51'8.15"N 120°48'56.70"E	95	61.8	<0.003	1.15	3.093	<0.05	659.56
		585	91.3	<0.003	0.92	2.700	<0.05	546.65
Bocaoue[1]	14°48'1.24"N 120°55'53.49"E	133	67.9	0.14	0.31	2.702	<0.05	21.37
		145	104.4	0.10	0.62	2.059	<0.05	37.60
Guiguinto[2]	14^0 50' 07.1" N 120^0 52' 01.2" E	20.20	26.83	ND	ND	8.67	3.68	ND
Valenzuela[2]	14^0 43' 03.0" N 120^0 57' 44.1" E	37.52	49.68	ND	ND	10.43	3.96	ND
Caloocan[3]	14^0 39' 28.3" N 120^0 58' 26.2" E	97.28	97.60	ND	ND	30.81	15.53	ND
Caloocan[3]	14^0 39' 26.75" N 120^0 58' 25.52" E	86.3	30.6	<0.00005	4.0	10.6	0.4	17.27
Solis[3]	14^0 37' 56" N $120^0$58' 34.6" E	84.6	30.5	<0.00005	8.6	10.9	0.9	29.88
Tutuban[3]	14^0 36' 22" N $120^0$58' 17" E	81.3	46.7	0.06159	2.1	12.7	2.3	12.14
DENR Standard (NAAQS/NAAQGV)		230	150	1.5	30*	150	180	140*

Source: JICA Study Team
Note: * Proposed
[1] Conducted Oct 19-20, 2012, upper row: in the morning, lower row in the afternoon
[2] Conducted Sep 17-23, 2013
[3] Conducted Dec 26-28, 2014
ND: Not Detected

Air Quality Impact Identification, Assessment and Mitigation

a) Pre-Construction and Construction Phase

Pre-construction and construction activities, such as clearing of vegetation, earthmoving (excavation, backfilling and reclamation) and movement of various equipment and vehicles will be the major causes of increase in level of air and noise pollution, and vibration measurement around the project site.

Air pollution

Earthmoving activities, such as excavation and backfilling would add to the generation of dusts, which increase level of total suspended particulates (TSP) and particulate matters ($PM_{2.5}$ and PM_{10}). Movements of heavy equipment, dump trucks and service vehicles that will be utilized during these activities would also increase the concentration of TSP and PMs, which would affect the air quality in the surrounding community. Exhaust gas emission coming from these vehicles coming in and out of the project site may increase current level of NO_x, SO_x, carbon monoxide (CO) and hydrocarbons (HC).

The effect of the identified impacts is low and short-term, limited only during the pre-construction and construction phase of the Project. Mitigating measures that is described below will address almost all identified impacts.

To control generation of dusts and exhaust gas emission and prevent drastic effects to workers and the environment, the following measures need to be implemented:

- Regular wetting of ground soil in the construction site will minimize the generation of TSP and dust.
- Regular preventive maintenance of heavy equipment and service vehicle to be used on site must be observed by the contractors/subcontractors. This measure will help minimize emission of noxious gases and particulate matters.
- Construction sites must be fenced for safety and security reasons

In order to minimize the abrupt increase in the levels of pollution, air quality monitoring should be performed regularly.

b) Operation Phase

During the operational phase of the NSCR Project, air pollution is expected to lessen because the railway will be operated using electricity. However, additional noise and vibration will be generated as the train passes through the alignment.

Air Pollution

Sources of air emissions will be limited to service vehicles of the proponent (DOTC) and from the standby generators that will be operated in case of power outage in stations and in the depot. Mitigating measures that need to be implemented to reduce the air emissions impacts are:

- Proper preventive maintenance of service vehicles and equipment
- Use of cleaner fuel for the generator sets

The operation of the railway, as indicated in studies of similar transit system, indicates that the overall impact of a mass railway commuter system is the decline in the concentration of vehicle air emissions as a result of the decline in the number of vehicles plying along the major road near the NSCR alignment. This translates into reduction of pollutants from vehicles, which in turn may have a long-term effect on the improvement of air quality in the area. This is a beneficial impact to the environment, as it will improve air quality.

3.3 Ambient Noise Level

Ambient noise measurement survey was conducted at 7 sites as shown in Figure 2.25. Noise levels were sampled at old PNR stations in Malolos and Bocaue in October 2012, and also in Guiguinto, Valenzuela and Caloocan in September 2013. In Manila, noise sampling was conducted at two sites, Solis and Tutuban, along the proposed NSCR alignment in December 2014, in addition, noise measurement was also taken at Caloocan.

The results compared to the National Pollution Control Commission (NPCC) Memorandum Circular No. 002 Series of 1980, Section 78- Ambient Noise Quality and Emission Standards for Noise. Noise level standard used at the sampling sites also varies depending on the category of each location, as presented in Table 2.25.

The noise measurement was conducted within a 24-hour sampling period in a 10-minute averaging time during the four specified sampling periods (morning, daytime, evening, and night time). A total of 50 noise level readings were carried out within the 10-minute averaging period, and the arithmetic medians of seven readings at the point of maximum noise level were reported. The results are shown in Table 2.25.

Table 2.25 Description of Survey Locations and Noise Level Standards Used

Location	**Malolos**	**Bocaue**	**Guiguinto**	**Valenzuela**	**Caloocan**	**Solis**	**Tutuban**
Description	Near Commercial and residential area	Near Commercial and residential area	Near light heavy industrial area; near Tabang Exit	Near residential and light industrial area	Near Commercial and residential area	Near Commercial and residential area	Near Commercial area
Class/Category[1]	B	B	C	A	AA	B	B
DENR Standard, Maximum Allowable Noise Level (dBA)							
Daytime (9:00 AM to6:00 PM)	65	65	70	55	50	65	65
Morning/Evening (5:00 AM to 9:00 AM/ 6:00 PM to 10:00 PM)	60	60	65	50	45	60	60
Nighttime (10:00 PM to5:00 AM)	55	55	60	45	40	55	55

Source: JICA Study Team

Note: 1) DENR Environmental Quality Standards for Noise: Class AA: Area which requires quietness such as areas within 100m from schools, hospitals and homes for aged, Class A: Residential area B: Commercial area, Class C: Light industry area

In comparison with the maximum allowable noise level set by DENR for Class B, Malolos station slightly exceeded the noise level 65dBA standard during daytime, while Bocaue station exceeded the noise level standard during morning. The rest of the time, noise level was within the DENR standard. The monitored noise levels at Guiguinto station were well below the noise level standard for the fourspecified sampling periods for light industryarea Class C. Valenzuela station exceeded the noise level standard for Class A during the evening and the night. During the morning and the daytime, there were some periods the noise levels exceeded the standard noise levels. The monitored noise levels at Caloocan station went beyond the noise level standard for Class AA and even Class A, both in September 2013 and December 2014. The sampling site at Caloocan faces to the commercial area and the Samson road, where vehicular traffic movement is significant.

The results of the noise levels monitoring at Tutuban showed that all values observed exceeded the DENR standards for the four specified sampling periods for commercial area, Class B. As for the night time noise, the observed noise levels lightly exceeded the DENR standards of 55dBA. Sounds generated by the movements and activities of customers and business operators are the main sources noise at the sampling station. Noise generated by the passing vehicles and construction activities on the adjacent area likewise contributed to the intermittent noise recorded at the time of sampling.

The monitoring results at Solis revealed that the recorded morning noise levels were well below the noise level standard for the four specified sampling periods for commercial area Class B.

Table 2.26 Observed 24 hour Noise Levels (dB)

Malolos[1]		Bocaue[1]		Guiguinto[2]		Valenzuela[3]		Caloocan[4]		Caloocan[5]		Solis[6]		Tutuban[6]		DENR Standard for Noise Level			
Sampling Time	dB(A)	Sampling Time	dB(A)	Sampling Time	dB(A)	Sampling Time	dB(A)	Sampling Time	dB(A)	Sampling Time	dB(A)	Sampling Time	dB(A)	Sampling Time	dB(A)	Class AA	Class A	Class B	Class C
Daytime 0900 – 1800	65.1	Daytime 0900 – 1800	61.9	0900–1100	52.8	0940–1140	51.5	0900–1100	60.7	0930-0940	74	1330-1340	63	1720-1730	74	50	55	65	70
				1100–1300	53.2	1140–1340	52.5	1100–1300	60.8							50	55	65	70
				1300–1500	52.6	1340–1540	68.1	1300–1500	61.1							50	55	65	70
				1500–1700	52.4	1540–1740	51.7	1500–1700	55.3							50	55	65	70
Evening 1800 – 2200	55.9	Evening 1800 – 2200	59.1	1700–1900	52.9	1740–1940	52.2	1700–1900	54.8	2130-2140	73	2130-2140	53	2100-2110	72	45	50	60	65
				1900–2100	53.9	1940–2140	50.9	1900–2100	60.1							45	50	60	65
Nighttime 2200 – 0500	50.8	Nighttime 2200 – 0500	53.2	2100–2300	50.3	2140–2340	52.1	2100–2300	54.8	0100-0010	63	2240-2250	53	0110-0120	57	40	45	55	60
				2300–0100	49.8	2340–0140	50.5	2300–0100	52.8							40	45	55	60
				0100–0300	49.7	0140–0340	48.9	0100–0300	50.8							40	45	55	60
				0300–0500	49.3	0340–0540	48.9	0300–0500	50.8							40	45	55	60
Morning 0500 – 0900	56.3	Morning 0500 – 0900	63.0	0500–0700	51.6	0540–0740	49.2	0500–0700	52.5	0530-0540	73	0700-0710	58	0520-0530	75	45	50	60	65
				0700–0900	52.3	0740–0940	51.1	0700–0900	53.6							45	50	60	65

Source: JICA Study Team

Note: [1] Conducted last October 19-24, 2012,Categorized as Class B; [2] Conducted last October 19-24, Categorized as Class C; [3] Conducted last October 19-24, Categorized as Class A; [4] Conducted Sep 17-23,2013,Categorized as Class AA; [5] Conducted Dec 28,2014,Categorized as Class AA; [6] Conducted Dec26-27,2014, Categorized as Class B.

Noise Level Impact Identification, Assessment and Mitigation

a) Pre-Construction and Construction Phase

Noise pollution

Noise level will definitely increase because of construction activities. Most of the noise will be contributed by operation of heavy equipment and machineries, the generator set, and vehicles coming in and out of the Project site.

Some areas along the NSCR alignment would have institutions that will most definitely be affected by the noise level generated during the pre-construction and construction phase of the Project. It is important to identify these institutions to be able to provide appropriate mitigating measures during the Detailed Design Phase of the Project.

(a) Prediction method

The prediction model developed in the Technical Handbook for Environmental Impact Assessment of Roads (2007)is applied.

i. Prediction model

The noise level at receiving points is calculated by the following formula of sound propagation.

$$L_p = L_w + 10log\left\{\frac{Q}{4\pi r^2}\right\} = L_w - 20logr - 8$$

Where,L_p: Noise level at Receiving Point (dB)

L_w: Power Level of noise source (dB)

r: Distance between noise source and receiving point (m)

Q: Constant on sound radiation (in case of hemisphere radiation: =2)

ii. Power level of construction machinery

The power levels of main construction machinery are shown in Table 2.26.

Table 2.27 Weighted Power Level of Construction Type

Construction Type	A weighted power level (dB)
Pile drivers (hydraulic pile hammer)	135
Rock drilling (soft rock)	119
Slope surface splay	108
Asphalt pavement	108

Source: Technical Handbook for Environmental Impact Assessment of Roads (2007)

iii. Location of noise source and receiving point

Theconstruction machinery, i.e., noise emission sourceis assumed to be set on the center of the track. During the construction temporary wall (3.0m) will be set at the edge of the ROW (construction limit). The height of the receiving point is 1.2m.

(b) Results of the prediction and evaluation

The results of the prediction of the construction noise are shown in Table 2.28. Without the temporary wall, the noise levels of pile driver will exceed the maximum allowable level 90 dB. The predicted noise levels of rock drilling will exceed maximum allowable level 85 dB up to 10 m from the edge of the ROW. In case of the slop surface spray and asphalt pavement, the predicted noise level will exceed just at the edge of the ROW. With the 3 m high temporary wall, the predicted noise levels of all types of construction work will below the maximum allowable noise levels during the construction.

Table 2.28 Results of Prediction of Construction Noise

Construction Work		Distance from the Edge of the ROW to Receiving Point (m)					Maximum Allowable Noise Level[2] (dBA)	
Type[1]	Power Level (dB)	0	5	10	15	20		
Without temporary wall								
Pile drivers	135	112.2	106.6	103.2	100.8	98.9	90	Class 1
Rock drilling (soft rock)	119	96.2	90.6	87.2	84.8	82.9	85	Class 2
Slope surface splay	108	85.2	79.6	76.2	73.8	71.9	75	Class 3
Asphalt pavement	108	85.2	79.6	76.2	73.8	71.9	75	Class 4
With temporary wall (3.0m)								
Pile drivers	135	89.9	88.2	85.4	83.2	81.4	90	Class 1
Rock drilling (soft rock)	119	73.9	72.2	69.4	67.2	65.4	85	Class 2
Slope surface splay	108	62.9	61.2	58.4	56.2	54.4	75	Class 3
Asphalt pavement	108	62.9	61.2	58.4	56.2	54.4	75	Class 4

Source: JICA Study Team

Note 1): Technical Handbook for Environmental Impact Assessment of Roads, 2007

2): NPCC Memorandum Circular No. 002, May 12, 1980

Class 1 Work which requires pile drivers (excluding manual type), file extractors, riveting hammers or combination thereof. This classification does not include work in which pile drivers are used in combination with earth augers.

Class 2 Work which requires rock drills or similar equipment like jack hammers or pavement breakers

Class 3 Work which requires air compressor (limited to those compressors which use power other than electric motors with a rated output of 15 KW or more in excludes air compressors powering rock drills, jack hammers and pavement breakers)

Class 4 Operation involving batching plant (limited to those with a mixer capacity of 0.5 or more cubic meters) and/or asphalt plants (limited to those with mixer capacity of 200 KG or more). Batching plants for the making or mortar are excluded.

The identified impacts will have moderate to high adverse effect, with the effect more pronounced along the alignment where schools, hospitals and residential areas are closely nearby. However, mitigating measures that is described below are anticipated to address almost all identified impacts.

To reduce noise disturbance that will have direct effects to workers and nearby community, the following measures need to be implemented:

- Installation of control devices such as mufflers and noise suppressors to all construction equipment to help minimize noise generated. Regular maintenance of heavy equipment, construction machinery, and other support vehicles is also recommended.
- Provision of temporary noise barriers such as galvanized iron shields, particularly in noise-sensitive areas such as churches, schools, and hospitals in the immediate vicinity of the construction area.

- Construction workers must be provided with personal protective equipment (PPE), e.g. earmuffs.
- Scheduling of high noise generating activities during daytime to reduce disturbances to nearby community
- Construction sites must be fenced for safety and security reasons

b) Operation Phase

Noise Pollution

The noise by train operation was examined with reference to "Proposal of a Prediction Model for Noise of Conventional Railway, Noise Control Engineering 20(3), 1996, Institute of Noise Control Engineering, Japan" and "EIA report for Osaka Outer Ring for East-Osaka Urban Rapid Transit, 1999, Osaka Prefecture".

(c) Prediction method

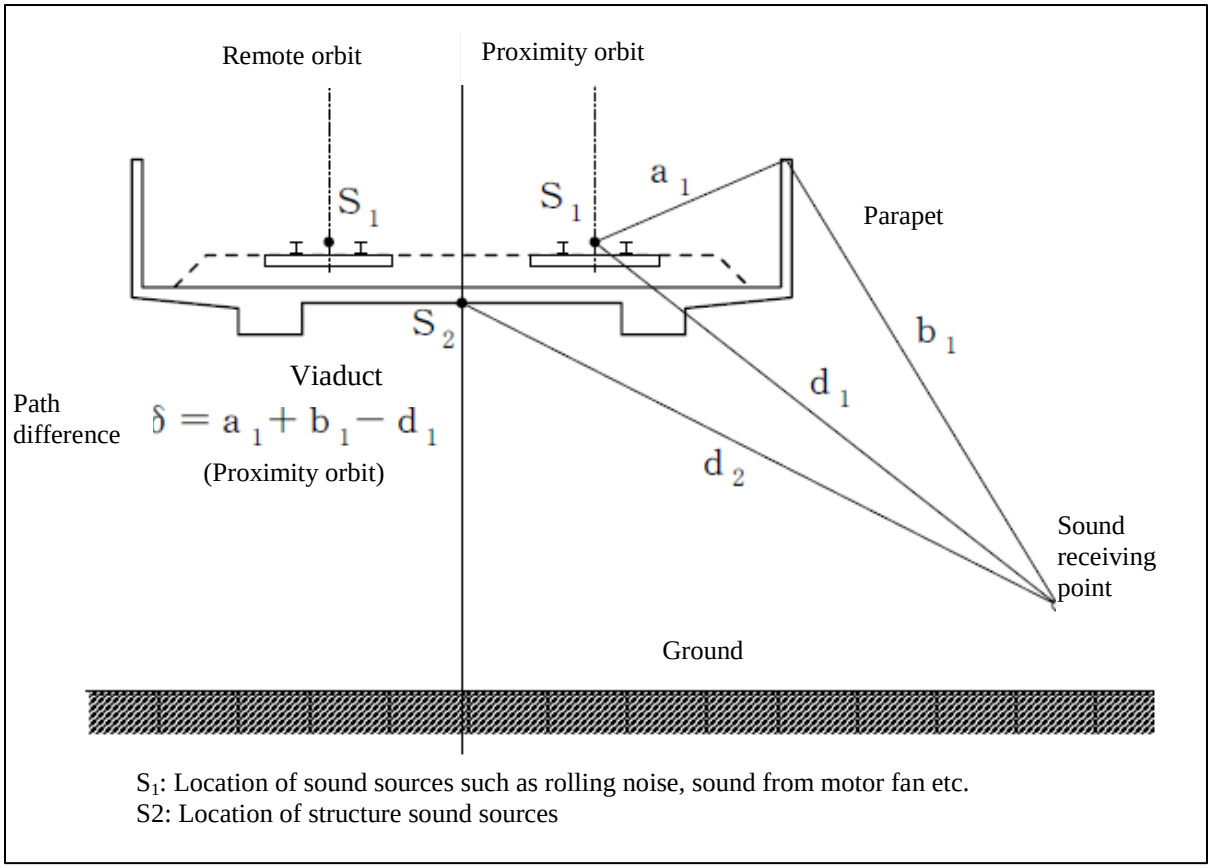
Based on section structure and train velocity, the maximum of the noise level at the time of the run of 1 train (L_{Amax}) is estimated firstly. Moreover single event sound exposure level (L_{AE}) is estimated from train transit time. Finally equivalent continuous sound pressure level (L_{Aeq}) by train number every train type of time zone is calculated.

iv. Prediction model

The prediction model by Japanese formula is applied. The noise by train operation compounds 3 main sound sources such as rolling noise of running train, structure sound from vibration of slab on concrete viaduct, and railway vehicle sound. The formula is calculated by combining these sound sources.

a. Estimation of maximum value of noise level (L_{Amax})

The prediction formula for train length I m and train velocity V km/h indicates Formula 1 - 4 by definition of each variable shown in Figure 2.38.



Source: Proposal of a Prediction Model for Noise of Conventional Railway, Noise Control Engineering 20(3), 1996, Institute of Noise Control Engineering, Japan

Figure 2.38 Arrangement of Sound Source, Sound Receiving Point and Explanation of Path Difference

(a.1) Rolling noise

$$L_{Amax}(R) = PWL_R - 5 - 10log_{10}d_1 + 10log_{10}\left(\frac{\left(\frac{l}{2d_1}\right)}{1+\left(\frac{l}{2d_1}\right)^2} + \tan^{-1}\left(\frac{l}{2d_1}\right)\right) + \alpha_1 \quad --- \text{Fomula 1}$$

Where, $L_{Amax}(R)$: maximum value of noise level (decibel)
PWL_R : Sound source power level (decibel)
$PWL_R = 30.0 \log_{10}(V) + 42.6$
D_1 : Distance between center of run orbit and sound receiving point (m)
L : Train length (m)
V : Train velocity (km/h)
α_1 : damping effect by balustrade (decibel)

(a.2) Structure sound

$$L_{Amax}(C) = PWL_C - 5 - 10log_{10}d_2 + 10log_{10}\left(\frac{\left(\frac{l}{2d_2}\right)}{1+\left(\frac{l}{2d_2}\right)^2} + \tan^{-1}\left(\frac{l}{2d_2}\right)\right) + \Delta L_C \quad --- \text{Formula 2}$$

Where, $L_{Amax}(C)$: Maximum value of noise level (decibel)
PWL_C : Sound power level of structure sound (decibel)

PWL_C = 72

d_2 : Distance between center of structure underside and sound receiving point (m)

ΔL_C : Correction value

$r < 4h$: $\Delta L_C = 0$

$r > 4h$: $\Delta L_C = -10 \log_{10}(r/4h)$

r: Horizontal distance between center of viaduct and sound receiving point (m)

h: Height of viaduct underside from ground (m)

(a.3) Maximum value of noise level (L_{Amax})

The maximum value of noise level for one (1) train formation is calculated by combining noise levels calculated by Formula 1 - 2.

$$L_{Amax} = 10log_{10}\left(10^{\frac{L_{Amax}(R)}{10}} + 10^{\frac{L_{Amax}(C)}{10}}\right) - - - \text{Formula 3}$$

b. Relation between estimation of maximum value of noise level (L_{Amax}) and single event sound exposure level (L_{AE})

The relation between estimation of maximum value of noise level (L_{Amax}) and single event sound exposure level (L_{AE}) is calculated by using Formula 4.

$$L_{AE} = L_{Amax} + 10log_{10}(l/(1000V/3600)) - - - \text{Formula 4}$$

c. Calculation of equivalent continuous sound pressure level (L_{Aeq})

$$L_{Aeq} = 10log_{10}\left(\frac{1}{T}\sum_{i=1}^{n} 10^{L_{AEi}/10}\right) - - - \text{Formula 5}$$

Where, L_{AEi} : Single event sound exposure level by direction and train type (decibel)

N : Number of trains

T : Time for L_{Aeq} (second)

(d) Predictive condition

i. Prediction points

The prediction points are 1.2 m height at 0, 10, 20, 30, 40, 50 m from the edge of railway.

ii. Structural condition

The structural conditions are as follows:

- Railway structure: Viaduct
- Truck structure: Slab track
- Rail type: Long rail
- Train length: 120 m (20 m x 6 cars)from 2020 to 2025, 160 m (20 m x 8 cars)from 2025 to 2040.

iii. Operation condition

The number of operated trains is shown in Table 2.28 based on the train operation condition. The train velocity is maximum 120 km/h.

Table 2.29 Total Number of Operated Trains (one-way)

Day Time (7:00 ~ 22:00)	**Night Time** (22:00 ~ 24:00 & 6:00 ~ 7:00)	**Total**
110	13	123

Source: JICA Study Team

(e) Prediction results

The results of prediction on railway noise of the equivalent continuous sound pressure level (LAeq) (dBA) are shown for year 2020 and 2040in the following tables.

Table 2.29 presents the predicted noise level without noise barrier case. Table 2.30 also shows the noise guideline values for the new project and large-scale modification of the conventional railway in Japan (Environmental Agency, 1995). The guideline values are set at the distance of 12.5 m from the center of the nearest track. That is, in case of NSCR, the noise level at 7m from the edge of ROW should be below guideline values. The predicted noise levels are caused by the train operation and therefore cannot be directly compared to the DENR environmental standards for noise.

Table 2.30 Prediction of Noise Level during Train Operation from 2020 to 2040 (Without noise barrier)

Year	**Day/ Night**	**Distance from ROW**						**Guideline values[1] (LAeq)**
		0 m	**10 m**	**20 m**	**30 m**	**40m**	**50m**	
2020	Day	52.8	52.9	51.7	50.5	49.3	48.2	60
	Night	50.5	50.6	49.5	48.2	47.0	45.9	55
2025	Day	54.0	54.1	53.0	51.7	50.5	49.5	60
	Night	51.7	51.9	50.7	49.4	48.3	47.2	55
2030	Day	54.0	54.1	53.0	51.7	50.5	49.5	60
	Night	51.7	51.9	50.7	49.4	48.3	47.2	55
2040	Day	54.0	54.1	53.0	51.7	50.5	49.5	60
	Night	51.7	51.9	50.7	49.4	48.3	47.2	55

Source: JICA Study Team

Note 1) noise guideline values for the new project and large-scale modification of the conventional railway in Japan (Environmental Agency, 1995)

The outline of results is as follows:

- The predicted noise level will not exceed the guideline values for all day and night even at the edge of the ROW.

(d) Mitigation Measures

The predicted noise levels satisfy the noise guideline values for the areas directly facing the railway. However, according to the guidelines, noise level should be further reduced in the noise sensitive areas. The adequate measurements are recommended for noise sensitive receptors of Class AA within 50 m of the alignment.

The noise barrier is one of the abatement measures to reduce the noise level. Table 2.31 shows the predicted noise level withnoise barrier.

Table 2.31 Prediction of Noise Level during Train Operation from 2020 to 2040 (With noise barrier)

Year	Day/ Night	Distance from ROW						Guideline Values *1 (LAEq)
		0 m	10 m	20 m	30 m	40m	50m	
Case 1: Noise barrier1m								
2020	Day	51.8	51.6	51.0	49.8	48.8	48.0	60
	Night	49.6	49.3	48.7	47.5	46.5	45.7	55
2025	Day	53.1	52.9	52.2	51.0	50.1	49.2	60
	Night	50.8	50.6	50.0	48.7	47.8	46.9	55
2030	Day	53.1	52.9	52.2	51.0	50.1	49.2	60
	Night	50.8	50.6	50.0	48.7	47.8	46.9	55
2040	Day	53.1	52.9	52.2	51.0	50.1	49.2	60
	Night	50.8	50.6	50.0	48.7	47.8	46.9	55
Case 2: Noise barrier 2 m								
2020	Day	49.9	49.4	49.3	48.2	47.2	46.5	60
	Night	47.6	47.1	47.0	45.9	45.0	49.2	55
2025	Day	51.1	50.7	50.6	49.5	48.5	47.7	60
	Night	48.8	48.4	48.3	47.2	46.2	45.5	55
2030	Day	51.1	50.7	50.6	49.5	48.5	47.7	60
	Night	48.8	48.4	48.3	47.2	46.2	45.5	55
2040	Day	51.1	50.7	50.6	49.5	48.5	47.7	60
	Night	48.8	48.4	48.3	47.2	46.2	45.5	55

Source: JICA Study Team
Note 1) noise guideline values for the new project and large-scale modification of the conventional railway in Japan (Environmental Agency, 1995)

The following findings are drawn from the resulting data shown in Table 2.31:

- In order to decrease the noise level below 50 dBA during the night, (5dBA less than the guideline value of 55dBA during the night because the allowable level of noise sensitive area is often set at 5dBA below), the effective height of noise barrier is considered.
- With a 1 m height noise barrier or parapet installed, the noise level during the night is under 50 dBA for the year 2020. Noise level generated by the train operation for years 2025 to 2040 still exceeds 50 dBA during the night operation, at distances from 0m to 30 m, due to the increase of trains.
- With a 2 m height noise barrier installed, the noise level for years 2020 to 2040 is way below 50 dBA.

The impact of the train operations to the generated noise has a moderate adverse effect to the receiving environment, especially in areas where the alignment would be near schools, churches and hospitals.

Table 2.32 lists up the noise sensitive receptors in Class AA within the 50 m distance from the alignment.

Table 2.32 Noise Sensitive Receptors

Institution	Approximate Distance from Alignment (m)	Indicative Location
MALOLOS CITY		
1. AMA Computer College	46	NE
2. Tikay Elementary School	40	NE
MARILAO		
1. Tabing Ilog Elementary School	32	SW
MEYCAUAYAN		
1. Sheperd's College	50	NE
VALENZUELA CITY		
1. Iglesia ni Cristo locale Valenzuela City	50	SW
2. Parish Church of San Isidro Labrador	34	E
3. Malinta Elementary School	32	NE
CALOOCAN CITY		
1. Caloocan Seventh Day Adventist Center Church	50	E
2. Marulas Elem. School	35	E
3. Christ the Good Shepherd Church	50	E
MANILA CITY		
1. Sta. Monica Church	50	W
2. Light of the World Chistian Church	23	W
3. Gregoria De Jesas Elem. School	40	W
4. Iglesia ni Jesukristo Bagong Jerusalem	50	W
5. Antipolo Chapel	20	E

Source: JICA Study Team

There are two sensitive receptors (churches) within 30 m from the alignment in Manila. For these churches, noise barriers or parapet with at least 2 m height should be installed as mitigating measure. The detailed survey in measuring the distance from the guideway to the receptors in the above should be undertaken during the detailed design stage.

3.4 Ground Vibration Level

Ground vibration survey was conducted at 5 sites to monitor ground movement as shown in Figure 2.25. The measurements were conducted at Guiguinto, Valenzuela and Caloocan in September 2013 and at Caloocan and Solis in January 2015. The survey at Caloocan was conducted at the old PNR station in September 2013 and also at the site facing the Samson Road in January 2015. Ground vibration readings were recorded in each site's natural state. Description of the survey sites is presented in Table 2.33. Three records were taken per site using three tri-axial accelerometers positioned at 20 meters distance interval.

Table 2.33 Description of Locations of the Ground Vibration Survey

Location	Description
Guiguinto	Site is a vacant lot near the heavy industrial area, and the major road (NLEX) estimated at 500 meters in distance and near Tabang Exit.
Valenzuela	Site is a vacant lot beside warehouses and light industry with the nearest major road (McArthur Highway) estimated at 300 meters in distance.
Caloocan	Site is a vacant lot and old PNR station with the nearest major road

(Old PNR station)	(Samson Road) estimated at 100 meters in distance.
Caloocan (Samson Road)	Site has a non-operational railway and is located beside a major road (Samson Road).
Solis	Site is a vacant lot between PNR railroad and Dugban Street estimated at 20 meters in distance.

Source: JICA Study Team

Vibration Level (VL) is used for the evaluation index and defined as follows;

$$VL = 20log_{10}\frac{a_w}{a_0}$$

Where,
VL: Vibration level (dB)
a_w: Frequency weighted acceleration reflecting human perception (m/s^2)
a_0: Standard acceleration $=10^{-5}$ (m/s^2)

Although there is no acceptable standard on VL, generally the perceptive threshold of vibration is 55dB for human[1]. When a_w is $0.01m/s^2$, VL is 60 dB, while a_w is $0.005m/s^2$, VL is 54dB. In the Philippines, there is no standard for vibration. According to the above equation, when VL is 55dB, frequency weighted acceleration (a_w) is $0.0056m/s^2$.

The results of ground vibration measurements are shown in Table 2.34. At Guiguinto station, Samson Road and Solis, the registered vibration peak acceleration was 0.2 cm/s^2. The estimated vibration level VL was 46 dB and below the perceptive threshold of vibration for human 55dB. Peak movements recorded in the site were caused by the vehicles passing near the location and influenced by the loose and unpaved roads. The recorded peak accelerations at the old PNR stations at Valenzuela and Caloocan were not detected.

Table 2.34 Observed Vibration Level at Recorded Peak Acceleration

Particulars	**Guiguinto**	**Valenzuela**	**Caloocan** (Old PNR station)	**Caloocan** (Samson Road)	**Solis**	**Perceptive threshold of vibration for human**[*1]
Sampling Date and Time	9/24/2013 10:00 – 11:00	9/24/2013 13:00 – 14:00	9/24/2013 15:00 – 16:00	1/28/2015 14:00 – 15:00	1/28/2015 16:00 – 17:00	-
Recorded Peak Acceleration (m/s^2)	0.002	ND	ND	0.002	0.002	0.0056

Source: JICA Study Team
Note 1) "Technology and Laws Regulation for Pollution Control, 2000"Japan Environmental Management Association for Industry

[1]"Technology and Laws Regulation for Pollution Control, 2000", Japan Environmental Management Association for Industry

Vibration Impact Identification, Assessment and Mitigation

a) Pre-Construction and Construction Phase

Generation of Vibration

Operation of construction machinery, such as pile driver and rock drilling, causes ground vibrations that spread through the ground and diminishes in strength with distance. Ground vibrations from construction activities do not often reach the levels that can damage structures, but can achieve the audible and feelable ranges for human very near the construction site.

(a) Prediction method

i. Prediction model

The prediction model developed in Technical Handbook for Environmental Impact Assessment of Roads (2007) is applied. Vibration transmits from a source to a receiving point according to the following formula.

$$L_{(r)} = L_{r_0} - 15log_{10}\frac{r}{r_0} - 8.68\alpha(r - r_0)$$

Where, $L_{(r)}$: Vibration level (VL) at receiving point (dB)

$L_{(r_0)}$: Vibration level at reference point (dB)

r : Distance from a source (construction machinery) to receiving point (m)

r_0: Distance of reference point (= 5m)

α: Internal damping ratio

ii. Vibration level on reference point

The power levels of main construction machinery are shown in Table 2.35.

Table 2.35 Vibration Level of Construction Machinery and Damping Ratio

Construction machinery	Vibration Level at Reference Point (dB)	Internal Damping Ratio
Pile drivers (hydraulic pile hammer)	81	0.01
Rock drilling (soft rock)	64	0.001
Slope surface splay	48	0.01
Asphalt pavement	59	0.01

Source: Technical Handbook for Environmental Impact Assessment of Roads (2007)

iii. Location of vibration source and receiving point

The construction machinery, i.e., noise emission source is assumed to be set on the center of the track. During the construction temporary wall (3.0m) will be set at the edge of the ROW (construction limit). The height of the receiving point is 1.2m.

(b) Results of the prediction and evaluation

The VL on receiving points was calculated based on the said prediction model. The results of the prediction of the construction noise are shown in Table 2.36.

Table 2.36 Results of Prediction of Construction Vibration

Construction Work		Distance from the Edge of the ROW to Receiving Point (m)					Perceptive threshold of vibration for human (dB)[2]
Type[1]	Vibration Level (dB)	0	5	10	15	20	
Pile drivers	81	77.6	75.0	72.3	70.1	68.3	55
Rock drilling (soft rock)	64	60.9	58.5	56.2	54.4	53.0	
Slope surface splay	48	44.6	42.0	39.3	37.1	35.3	
Asphalt pavement	59	55.6	53.0	50.3	48.1	46.3	

Source: JICA Study Team

Note 1): Technical Handbook for Environmental Impact Assessment of Roads, 2007

2)Technology and Laws Regulation for Pollution Control, 2000"Japan Environmental Management Association for Industry

The operations of pile driver and rock drilling will affect the area around the project site since the vibration is beyond the human perceptive threshold. Asphalt pavement will also affect the area within 10m distance from the edge of the construction limit. Only the vibration of slope surface splay is below the human perceptive threshold.

The identified impacts will have high adverse effect to human, thus, mitigating measures is must still be implemented to alleviate all identified impacts.

To reduce generation of vibration and its impact to direct recipients, such as the workers and nearby residents, and structures along the NSCR alignment, the following measures need to be implemented:

- Use of construction machinery with minimal vibration generation
- Identify nearby sensitive receptors likely to be affected and monitor vibration levels

b) Operation Phase

Vibration

Structural vibration of buildings and houses near the NSCR alignment due to train operation may affect people in many ways, such as deterioration of quality of life or decrease of working efficiency.

There are no established prediction methods for vibration due to train operation sincethe mechanism of occurrence and transmission of train vibration is very complicated. Therefore, the vibration levels are often predicted by using the regression equations based on the actual measurements of the similar cases of train operation and structures for reference. The model below is developed for the East-Osaka Urban Rapid Transit by using the vibration data of the similar type of trains and structures at the existing railways. The NSCR will use the similar type of trains and structures as the existing railways in Japan, therefore, the following model is used for the estimate of vibration level.

(a) Prediction method

The prediction modelis proposed for several types of trains and structuresas shown in Table 2.37.

Table 2.37 Prediction Model of Vibration Levels

Type	Structure	Model Equations
Train	At-grade (Ballast)	VL= 21.3 log_{10}V - 13.9 log_{10}R + 30.9
	Embankment (Ballast)	VL=42.4 log_{10}V -15.4 log_{10}R - 13.0
	Viaduct (Slab)	VL=12.9log_{10}V -13.2log_{10}R+ 39.3
	Viaduct (Ballast)	VL=18.5 log_{10}V -21.0 log_{10}R+ 44.0
Freight	At-grade (Ballast)	VL=15.3 log_{10}V -20.7log_{10}R+ 54.7
	Embankment (Ballast)	VL=18.6 log_{10}V - 8.2log_{10}R+ 31.4
	Viaduct (Ballast)	VL=10.4 log_{10}V -20.8 log_{10}R+ 66.7

Source: EIA report for Osaka Outer Ring for East-Osaka Urban Rapid Transit, 2006, Osaka Prefecture
Note. VL: Vibration Level (dB), V: Velocity (km/h), R: Distance from the center of railway track (m)

(b) Structures

Thetypes of structure of the NSCR are viaduct (slab) and embankment (ballast).

(i) Parameter
According to the operation plan, the train velocity is 120km/h.

(ii) Prediction
The vibration level VL is estimated in Table 2.38. In the case of the viaduct (slab), VL at the edge of the ROW is estimated 54.6 dB and below the perceptible threshold of human (55dB). However, in the case of embankment (ballast), the estimated VL at distance from 0 m to 10 m will be over the perceptible threshold of human (55dB).

Table 2.38 Estimated Vibration Level VL (dB)

Type of Structure	Distance from ROW					Threshold VL (dB)
	0	5	10	15	20	
Viaduct (slab)	54.6	51.6	49.7	48.3	47.1	55
Embankment (ballast)	61.7	58.3	56.0	54.3	53.0	

Source: JICA Study Team

(c) Mitigation Measures

In the case of the viaduct (slab), mitigation measures will not be neededto be implemented.On the other hand, the embankment will be used for the section where the alignment goes through the rural areas and no flood-prone area. However, the following measures should be taken to abate the vibration level where the residences are located within 15m distance from the ROW.

- Design of rail tracks must incorporate measures to reduce level of vibration generated by the railway during train operations, such as use of long rail, sleeper with the anti-vibration mat.
- Proper maintenance of trains, structures and tracks, such as regular rail grinding, must be conducted.
- Regular reconditioning of train and its components, such as, suspension system, brakes, wheels and slip-slide detectors

Table 2.39 Impact Identification, Assessment and Mitigating Measure for Air

Environmental Aspect	Environmental Component Likely to be Affected	Potential Impacts	Assessment of Impacts	Mitigating/Enhancement Measures
PRE-CONSTRUCTION AND CONSTRUCTION PHASE				
• Earthmoving, demolition and earth-balling • Operation of equipment, machineries and service vehicles	Air Quality	Generation of dusts and particulate matter, and gas emissions	Low adverse impact	• Regular wetting of ground soil in the construction site • Regular preventive maintenance of heavy equipment and service vehicle • Construction sites must be fenced for safety and security reasons
	Acoustic environment	Noise Pollution	Moderate to high adverse impact	• Installation of control devices such as mufflers and noise suppressors to all construction equipment • Regular maintenance of heavy equipment, construction machinery • Provision of temporary noise barriers such as galvanized iron shields, particularly in noise-sensitive areas such as churches, schools, and hospitals in the immediate vicinity of the construction area. • Construction workers must be provided with personal protective equipment (PPE) • Scheduling of high noise generating activities during daytime • Construction sites must be fenced for safety and security reasons
	Ground vibration	Increase in ground vibration level due to operation of heavy equipment and machineries	High adverse impact	• Use of construction machinery with minimal vibration generation • Identify nearby sensitive receptors likely to be affected and monitor vibration levels
OPERATION PHASE				
• Operation of service vehicles • Operation of standby generator set	Air Quality	Air Pollution	Low adverse impact	• Proper preventive maintenance of service vehicles and equipment • Use of cleaner fuel for the generator sets
Operation of Trains	Air Quality	Reduction of Air Pollution	Beneficial	• Reduction of pollutants from vehicles
	Acoustic environment	Occurrence of higher	High adverse impact	• 2 m noise barrier will be considered for the class AA area,

		noise level		especially sensitive facilities such as school, hospital, etc. are located within 30 meter distance • Detailed survey in measuring the distance from sensitive area should be carried out at detail design stage. • Proper maintenance of structures and tracks, such as regular rail grinding, must be conducted
	Ground Vibration	Generation of Vibration	Low adverse impact	• Design of rail tracks must incorporate measures to reduce level of vibration generated by the railway during train operations, such as use of long rail, sleeper with the anti-vibration mat • Proper maintenance of trains structures and tracks, such as regular rail grinding, must be conducted • Regular reconditioning of train and its components, such as suspension system, brakes, wheels and slip-slide detectors
Climate Change	Climate	• Accelerated structural fatigue and materials failure • Greater demands on the construction, operation and maintenance of flood control and drainage structures.	Moderate adverse	• Design in making infrastructure robust or resilient to the effects of climate change should be taken into consideration • Improvement of current drainages along the alignment to be resilient to climate change
	Climate	• Reduction of Greenhouse Gases	Positive	• GHG emission in 2020 will be reduced by 97,000 t-CO2 / year by starting the operation of NSCR

Source: JICA Study Team

4. THE PEOPLE

Baseline data are presented at city and municipality level where such data are available. Where data is not available, provincial data is used. The data also sometimes differ in reference years, and this is always reflected in the text and tables so as to enable the reader to distinguish the timelines of the data. All information are secondary data, except for the data on PAPs which were derived from the primary socio-economic surveys conducted during the data gathering phase.

4.1 Displacement of Affected People

a) Demography of Impact Areas

The EIA study for the NSCR Project will cover 10 cities and municipalities traversed by the project. Currently, the available demographic data for the affected areas are on a city/municipality level.

Table 2.40 summarizes the latest population of the cities and municipalities covered by proposed alignment.

Table 2.40 Table of Population (2010)

City/Municipality	Population	Population Density (persons per hectare)	Land Area (hectares)
Malolos	234,945	35	6,725
Guiguinto	90,507	33	2,750
Balagtas	65,440	32	2,866
Bocaue	106,407	33	3,187
Marilao	185,624	55	3,374
Meycauayan	199,154	90	2,210
Malabon	353,337	179	1,971
Valenzuela	582,088	130	4,459
Caloocan	1,489,040	270	5,580
Manila	1,652,171	429	3855

Source: NSO

Brief discussion of demographic profiles of affected areas is presented in the following paragraphs.

Bulacan

Bulacan is the fastest growing in terms of population among the provinces in Region 3. Based on the National Statistics Office (NSO) Census of Population and Housing as of May 1, 2010, Bulacan's total population is about 2,924,433. This is around 30.5% of the region's total population of 9,590,223. The increasing pressure of development on the province may be attributed to two factors, namely its proximity to Metro Manila and secondly, its being a major urban center.

There is a larger urban population in Bulacan which comprises 78% of the total population or 1,738,056. In contrast, the rural population is 496,032 (22%).

Number of households is 659,158 having an average of 4.43 persons per household. The population density of Bulacan is 1,046 persons per square kilometer.

Valenzuela

Valenzuela City, on the other hand, had a projected population of 582,088 in 2011 (Valenzuela Socio-economic Profile 2011). Valenzuela accounted for 4.92 percent of the NCR's population. It ranked sixth out of the cities/municipalities of the National Capital Region.Valenzuela has a total land area of 4,459.4 hectares and a population density of 109 persons per hectare.

Malabon

Malabon City ranked 13th in terms of population in Metro Manila, based on the 2000 census of Population and Housing. It has an annual growth rate of 0.98%.

Over the 10-year period (1990-2000), the population of the city of Malabon grew at an annual rate of 1.98% a decrease from 1990-1995's annual growth rate of 4.12%. Malabon City posted a negative annual growth rate of 0.54% for the year 1995 to 2000, far below the annual growth rate of Metro Manila at 1.08% for the same reference period.

Among the cities and municipalities in the National Capital Region, Malabon City ranked 7th in terms of population density, having 14,481 persons per square kilometre. The larger portion of the household population of Malabon of about 63.36% belongs to those classified as productive population of working age group. About 34% or 118,222 belong to the segment of child and youth group while the older population or those belonging to the 65 years and over, accounts for only 2.61% of the household population of 9,069.

Caloocan

The population of Caloocan City, a highly urbanized city in the National Capital Region, was 1,489,040 persons as of May 1, 2010. It has an average annual population growth rate of 2.37 percent from year 2000. The average household size was 4.3 persons per household. It is important to note that more than half (53.5%) of the households in the city lived in lots that they owned or amortized.

Manila

The City of Manila registered a population of 1,652,171 persons as of May 1, 2010. This figure is based on the 2010 Census of Population and Housing (CPH). The numbered showed an increased rate of 0.44 percent annually and is larger by 71,089 persons compared from the last count in year 2000. The total number of households recorded in 2010 was 386,835. The average household size was 4.2 persons per household.

b) Gender and Age Profile

Bulacan

The male and female population of Bulacan (2010) is at par at 50% male and 50% female. Total population of both sexes is 2,919,370, while male population is 1,461,977 and female population is 1,457,393.

In terms of age, those belonging to 14 years and below totals 918,218 which is 31% of total popultation. Those belonging to the 15 – 64 age totals 1,883,661 which is 65%. This means

that there is a large working age population. The over 65 age group comprises only 4% of the total population , or 117,491.

Manila
In terms of age profile, SEP data showed that 485,453 constituents that belong to the 14 years old and below group, 1,106,951 belonging to the 15 to 64 years old group of which consist most of the city's working group, and about 58,308 belong to the 65 years old and above group.

In 2007 the household population of the City of Manila was young with 20-29 years old representing 21.4% followed by the 10-19 age group at 19.5% and the 30-39 age group coming in third at 14.9%. The dependency ratio shows that there are two independent persons (those aged 15-64) for every dependent person (those aged below 15 and above 64).

c) Literacy Rate, Profile of Educational Attainment

Bulacan

Bulacan has a high literacy rate of 98.57%. In terms of educational attainment, Bulacan's populace consists largely of high school educated population at 957,177 (37%), followed by elementary educated population at 857,901 (33%). College undergraduate educated population consists of 256,244 (10%) while those with college academic degrees total 291,991 (11%).

Manila
In terms of educational attainment, majority or about 43% finished high school. Of these, 263,855 or 48.4% are male, and 281,066 or 51.6% are female. This is followed by 25.3% who finished elementary education, and a high 18.4% who are academic degree holders.

Valenzuela
About 28% of the household population five years old and above had completed elementary education, 15% attended elementary education, 37.35%, high school, and 19.64% were either college undergraduates, academic degree holders or had post baccalaureate courses.

By gender, females dominated household population who were college undergraduates (50.04%) academic degree holders (42.3%) and with post baccalaureate course (6.27%).

Per records obtained from the division of city schools, the average number of students per classroom is one teacher for every 41 pupils. Enrolees in public schools are greater than 36% as compared to private schools.

There is also a high number of out-of-school children and youth. Population on the age bracket of 4 years old to 16 years old is at least 110,000. Enrolees are just about 60,000.

Malabon
The elementary level has a total 53,871 student enrolled as of August 2007. There are 46, 998 students who are enrolled in public elementary schools while 6,873 students are in private elementary schools.

There are 24, 636 enrolees in secondary levels with 18,937 enrolled in public secondary schools and 5,698 students in private schools.

Non-formal education is provided by the city of Malabon Polytechnic Institute (CMPI) which has already benefited out of school youths and the women sector through its various training programs.

Caloocan

Of the household population five years and over, 24.7% had attended or finished elementary education. 40.2% had reached or completed high school, 12.1% were college undergraduates and 10.6% were academic degree holders.

There were more females than males, among those who had attained higher levels of education. Females comprised 54% of those with academic degrees and 56.8% of those with post baccalaureate course.

Among household population 5 to 24 years old, 64.5% had attended school at anytime during school year 2007 to 2008. Of the total males aged 5 to 24 years, 65.2% had attended school at anytime during the said school year. School attendance for females was 63.8% of the total females aged 5 to 24 years.

d) Involuntary Resettlement of Project Affected Persons

Table 2.41 shows the affected cities and municipalities and corresponding barangays that will be traversed by the NSCR Alignment.

Given that the project will pass through congested areas like Valenzuela, Malabon and Caloocan, and Manila, residential communities and some commercial and business establishment along the proposed alignment will be displaced. However, based on the census and tagging conducted, there will be no affected people, lots and communities in Malabon and Bocaue, since the PNR and Northrail ROW were already cleared in these areas.

Table 2.41 Affected Cities and Municipalities and Corresponding Barangays

	Cities and Municipalities									
	Manila	**Caloocan**	**Malabon**	**Valenzuela**	**Meycauayan**	**Marilao**	**Bocaue**	**Balagtas**	**Guiguinto**	**Malolos**
Barangays	Zone2 (Br.48,49, 50, 51,54)	D1, Zone 1 (Br.1,2,9)	Potrero	Karuhatan	Bancal	Ibayo	Lolomboy	Longos	Tuktukan	Tikay
		D2, Zone 1 (Br.5)	Tinajeros	Malinta	Banga	Saog	Bundukan	Burol First	Sta. Cruz	San Pablo
	Zone14 (Br. 152,155, 156, 159, 160, 161, 162, 163, 164, 165)	D2, Zone2a (Br.15,17)		Dalandanan	Tugatog	Tabing Ilog	Bunlo	San Juan	Tabe	Bagong Bayan
		D2, Zone3 (Br.21)		Malanday	Malhacan	Abangan Sur	Binang First		Poblacion	Mabolo
		D2, Zone3 (Br.25, 29, 32, 33)		Veinte Reales		Abangan Norte	Binang Second		Ilang-Ilang	Cofradia
	Zone16 (Br. 184, 185, 186)						Taal		Malis	Caniogan
		D2, Zone4 (Br.36, 37, 38, 43, 46)					Longos		Tabang	Catmon
	Zone18 (Br.198, 200, 203,204)	D2, Zone5 (Br. 49, 52)								Bulihan
	Zone20 (Br. 213, 214, 217)	D2, Zone6 (Br. 59, 63, 64)								
	Zone21 (Br. 221, 228, 232)	D2, Zone7 (Br. 73)								
	Zone22 (Br. 241)									

Source: JICA Study Team

Note: Gray areas represent unaffected Cities and Barangays by the NSCR Project.

Based on the conducted survey, the total household to be displaced by the proposed NSCR project is 321. Valenzuela has the most number of affected households at 194, followed by Marilao with 44.

Since the alignment of NSCR can use preferentially the existing PNR ROW between Caloocan to Tutuban (refer to Case 2 in Figure 1.3 Relationship between NSCR and Highway in terms of the Use of PNR ROW), the affected households in this section are reduced to 40.

Of the 321 total displaced households there are 179 affected households living in the informal settlements. By city/municipality, the biggest number of affected informal settlers families (ISFs) is still in Valenzuela, numbering 116. Following is Marilao and Manila, with total affected households is 26 each.

On the other hand, a total of 54 households will be displaced under the Commercial, Industrial/Institutional, Business Enterprises (CIBE) and Residential categories.

In terms of lots, About 16 hectares will be affected along the track in 10 cities/ municipalities. By city/municipality, Valenzuela City has the largest affected area of about 146,320 m^2, followed by Marilao with about 4,380 m^2, and third is Guiguinto with 3,600 m^2.

4.2 In-Migration

Manila

Housing Ownership Profile

Tondo has the most number of informal settlers reported in Manila's 2007 SEP, with 13,327 compared to less than 2,000 in San Nicolas and Sta. Cruz, and even less than 200 in Binondo.

Informal Settlements/Availability of Housing

Based on the 2005 SEP the housing need of the City of Manila centered on the provision of housing units for relocated informal settlers and the upgrading of housing units on site. The total housing need included housing for city employees, policemen, teachers, and other public employees without their own homes.

The Urban Development and Housing Act states that settlers on danger areas need to be relocated. Danger areas refer to places, which when occupied for residential purposes; pose a danger to the life and safety of either the concerned residents or of the general community. Danger zones include riverbanks, earthquake faults, creeks, and coastal areas.

As of 2005 there was already a need for some 49,000 units for families to be relocated from danger zones (river banks, earthquake faults, creeks, and coastal areas) and 21,500 units to be upgraded on site. Some 16,800 new housing units were needed for city employees, policemen, and teachers

Housing Programs

Based on the recorded number of upgraded and constructed housing units as of 2000, there was a serious housingbacklog for the City of Manila. The housing program for informal settlers was only 5 percent accomplished, while the accomplishment for the housing program for government employees did not even reached 1 percent.

Valenzuela

Housing

Housing and building structures along the main thoroughfare (McArthur Highway) are built with permanent materials. However, settlements at the back streets and around warehouses

and factories are built with semi-permanent to temporary materials. These settlements are rented by lower income earners to middle income earners working and vending in the barangays and nearby barangays. Shanties are found within the fenced up compound of vacated lands in the depressed areas of San Jeremias, Saint Brigida and Pagasa.

Caloocan

Housing

From a total of 235,469 occupied housing units in 2000, the number of occupied housing units reached 297,199 in 2007, showing an increase of 26.2%. In 2007, a ratio of 104 households for every 100 occupied housing units was recorded while in 2000 the ratio was 106 households per 100 occupied housing units. The ratio of persons per occupied housing was 4.6 in 2007 lower than the ratio of 5.0 in 2000.

Nearly 6 in every 10 (58.9%) of the 297,199 occupied housing units had outer walls made of concrete/brick/stone, while more than one in four (27.6%) had outer walls made of half concrete/brick/stone and half wood. As to construction materials of the roofs, majority (86.6%) of the occupied housing units have roofs made of galvanized iron. Occupied housing units with roofs made of half galvanized iron and half concrete comprise 8.8%.

Malabon

Housing

Malabon's land area is primarily devoted to residential use. The 2000 census of informal settlers conducted by the Community and Urban Poor Affairs Office (CUPAO), revealed that Malabon registered an estimated 18,090 families residing in government and privately owned lands. Population study of the city revealed that its population density is more than Metro Manila's density of 158 persons per hectare.

There are different completed and on-going housing project of the national government, coordinated through the LGU such as the Community Mortgage Program (CMP) and Group Land Acquisition Development Project (GLAD-PAGIBIG).

Bulacan

For Bulacan areas, the following is the housing / resettlement profile (Table 2.42)

Table 2.42 Profile of housing / resettlement in cities and municipalities within NSCR

	Malolos	Guiguinto	Balagtas	Bocaue	Marilao	Meycauayan
Government Housing Projects						
# Housing Projects	4		1	3	5	3
# Housing Units	3692		1	7795	5653	3327
# Families	2924		1		5649	2689
Informal Settlements						
# Barangays	6 locations 6 barangays	47locs 12bgys		35locs 16bgys	16 locs 14 bgys	17 locs 16 bgys
# Families	550	1120		1831	3261	1269
# Dwelling Units	550	1120		5812	1183	1219
Subdivisions						
# Subdivisions	75	30	13	27	92	66
# Lots/Units	33056	4231	1279		89771	12755

Source: Bulacan Socio Economic Profile

Displacement and In-Migration Impact Identification, Assessment and Mitigation

Pre-Construction and Construction Phase

A Resettlement Action Plan (RAP) is being prepared to ensure that affected households and establishments are provided an acceptable relocation area and/or just compensation. The measures of compensation and assistance to all PAPs in the RAP are based on the JICA Guidelines for Environmental and Social Considerations (2010) and World Bank OP4.12 and other established and applicable Philippine Laws and similar policies and guidelines. These include the Republic Act No. 8974, otherwise known as An Act to Facilitate the Acquisition of Right-of-Way (2000) and Republic Act No. 7279, also known as the Urban Development and Housing Act (UDHA) of 1992. Also adopted for compensation and assistance is the Land Acquisition, Resettlement, Rehabilitation and Indigenous Peoples' Policy (LARRIP) (3rd edition, 2007) of the Department of Public Works and Highways.

Section 5 of the EPRMP is the Social Development Plan Frameworkthat will address, among others, the displacements involving resettlement of the Project Affected Persons (PAPs). It is further elaborated in the Resettlement Action Plan for the NSCR, which is separate document. The RAP also includes the livelihood/income restoration program as contained in this SDP. The Social Development Framework is shown in Table 5.1.

A noted positive impact of the project is that the affected families may eventually be provided houses and amenities. The project will also lead to improvement of living condition because the relocation areas are provided for with basic utilities such as power and water and health and educational facilities.Vulnerable Persons such as women-headed households, elderly, persons with disabilities, the poor will benefit the Livelihood and Income Restoration Program. The project will also lead to improvement of living condition because the relocation areas are provided for with basic utilities such as power and water and health and educational facilities.

4.3 Historical Cultural/Heritage

There are no Indigenous Cultural Communities and Indigenous Peoples in the cities and municipalities covered by NSCR Project.

4.4 Physical Cultural Resources

Historical structures found along the NSCR alignment include old PNR stations in Malolos, Valenzuela, Balagtas and Meycauayan. There are also minor dilapidated PNR stations in Bocaue, Guiguinto and Balagtas These structures may be affected with the construction of the new railway. There are no UNESCO cultural heritage sites in the project sites.

Physical Cultural Resources Impact Identification, Assessment and Mitigation

Pre-Construction and Construction Phase

During the stakeholders meetings conducted, residents of Malolos and Meycauayan have expressed interest to preserve the old PNR structures for historical and educational purposes. The Old Malolos Station may be retained and built as new proposed site. On the other hand, since the old Meycauayan, Valenzuela and Balagtas stations are located right at the middle of

the alignment, it may not be possible to retain the old structure. Preservation of the structure may be limited to the replication of the design of the old into the new station.

The National Historical Commission of the Philippines (NHCP)has recommended the restoration/preservation of the Malolos Station, Meycauayan Station and Polo/Valenzuela Station. The other stations (Bocaue, Guiguinto and Balagtas) may be demolished, if design requires it to be removed. This was expressed in the letter of the NHI to NORTHRAIL dated January 25, 2010.

At the Tutuban Station, there is a current study being done (Transit Oriented Development [TOD]for Urban Railway) for the concept design of the Tutuban PNR Property which includes the Tutuban Center Mall (TCM). The TCM has a historic marker from NHCP because it is the old central terminal for the PNR Railway, and it has preserved its original façade as well as columns, beams and roof trusses. The preservation of these structures is included in the Concept Design. The Concept Design will preserve the historic structures and integrate it into the development design called "Old and New Heart of Manila."

4.5 Basic Services (water, power, communications, transportation, peace and order/crime, educational facilities, etc)

Bulacan

The basic services in Bulacan's 6 cities and municipalities covered by the NSCR are summarized in Table 2.43.

Table 2.43 Basic Services in Cities & Municipalities where NSCR Alignment Pass Through

	Malolos	Guiguinto	Balagtas	Bocaue	Marilao	Meycaua-yan
Education						
Private Elem Schools	47	14	13	16	43	41
Public Elementary Schools (# schools/#classrooms)	43/616	14/254	11	14/313	18/393	24/515
Public High Schools	14	3	1	4	2	2
Private High Schools	23	9	7	11	16	17
Tertiary Schools	6		2	5	1	4
Technical And Vocational Schools	7		5	1	2	
Training Centers	1	1			2	
Transportation and communications						
Transportation systems	3			1	38	14
Communications Towers / Cell Sites	28				13	9
Water						
Access To Safe Water (HH)	1631	19680	13376	Nd	41146	42720
Solid Waste Management						

Waste Mgt Facilities / MRF	1	4			1	1
Garbage Trucks	6				14	8
Ave Daily Volume Solid Waste(Cu. M.)	64				80	50
Protective Services						
Monthly Crime Rate / 100,000 Pop.	66.02	37.42	57.27	22.33	31.65	22.09
Police Force	80	35	24	48	53	90
Police vehicles	2	5	5	2	9	5
Fire Protection Force	17	14	7	8	20	9
Fire Patrol Vehicles	9	1	2	1	5	4

Source: Bulacan Socio Economic Profile

Manila

Water and Power Supply

Manila is being served by two concessionaires in the distribution of its water supply namely: Maynilad Water Services Inc. (MWSI) and Manila Water Company (MWC). The coverage service area of MWSI include Tondo, Sta. Cruz, Quiapo, Sampaloc, Sta. Mesa, Pandacan, Binondo, San Miguel, Ermita, Malate, Intramuros, and part of Singalong. MWC on the other hand covers Sat. Ana, and part of Singalong. As of 2002 the average monthly consumption in million cubic meters in Manila was about 3.12 for residential areas, 0.26 for residential households with business, about 1.7 for commercial areas and about 0.29 for industrial areas. The service provider in terms of the City's power requirement is the Manila Electric Company (MERALCO).

Communication

The Philippine Long Distance and Telephone Company (PLDT) monopolize the telephone system in the City of Manila. PLDT's microwave network linked its various exchanges with those owned by other telecommunications network. Other telecommunication systems available in the city consist of mobile phones. Major service providers include Globe Telecom & Smart Communications. As reported in its 2005 SEP the negative impact of this trend was that it made cellular phones hot items for pick- pockets, snatchers, and hold- uppers, especially in Manila where most universities and colleges are located, and students are considered easy prey.

Peace and Order

In 2005 the City had eleven (11) Police Stations and 40 Police Substations with 2,984 uniformed personnel of which 441 accounts for the traffic police of the 170 outposts. These stations are all strategically located in different areas to facilitate immediate enforcement of the law.

At that time, there was one policeman per 622 populations (this was short of 619 policemen that are needed to meet the PNP manning level standard of 1 policeman per 500 populations). In addition there was one traffic police per 3,585 (this was also short of 86 traffic police personnel needed to meet the standard of 1 traffic police per 3000 population). To date it cannot be determined yet whether these were met until the City completes its latest SEP.

Transportation

Major modes of land public transport in Manila are bus, taxi, FX, jeepney, and tricycle while informal land transport systems are kalesa, pedicab and kuliglig. The Philippine National Railways (PNR) and the Light Rail Transit Authority (LRTA) operate the railway systems in

Manila. The PNR has 6 terminals or stations within Manila, which includes Blumentritt, España, Laong Laan, Pandacan, Pedro Gil, and Tutuban. The LRT-1 (Yellow Line) that runs along the length of Taft Avenue (R-2) and Rizal Avenue (R-9), and the LRT-2 (Purple Line) that runs along Ramon Magsaysay Blvd (R-6) are the only mass rail rapid transit lines traversing Manila. As the chief seaport of the Philippines, the Port of Manila along Manila Bay served as the City's main entry/exit point accessible via passenger/ cruise ships, while the Pasig River can be traversed via ferry service.

Manila is the premier international port in the country and one of the major domestic ports for inter-island shipping. As a major center of water transport and storage, it has experienced a steady increase in shipping, cargo and container traffic from 1994 to 1997. The shipping cargo and container traffic generate substantial revenues to the City, reaching PHP2.227 billion in 1997. The port will remain the major international and domestic port for the country in the future. It will continue as one the main entry points for passengers, immigrants from the island provinces, imported goods and products from various parts of the country. It will also remain as a major exit point for the country's exports.

Sewerage

The Manila Sewerage System was constructed in 1909 with the original overload capacity to serve 450,000 people. The system covers 1,850 hectares, serving 530,000 people with the total length of 240 km.

Sewage is collected by lateral interceptor pipes of 15 cm. to 150 cm. in diameter from the various districts of the City. It is the conveyed to the Tondo main sewage pumping station through seven pumping stations. Sta. Ana, a sub-district of Manila, has a separate system and has its wastes discharging directly to the Pasig River. However, the construction of a sewer main line is presently ongoing to interconnect the system in Sta Ana to the Paco Sewage Station.

Not all of the City of Manila are connected to the system of the sewers and lift stations. In these areas, the sewerage is combined in one. In residential areas and in light commercial districts, the septic vault is used to pre-treat wastewater. In newer building constructions housing bigger populations, the use of package-type wastewater treatment plants being pursued.

Among the problems in sanitation and sewage in Manila is the heavy pollution from the effluent of domestic septic tanks. According to the Manila Second Sewerage Project (World bank-JGA TF 2252-3PH), the estimated number of septic tanks in the year 2000 is about 125, 279 with a population septic tanks in the year 2000 is about 125,279 with a population septic tank ratio of 13:6. The number of septic tanks is expected to increase slightly with new constructions and rehabilitation. There are no records of desludging of tank nor of the in use of packaged type waste water treatment plants but their use may be seen in high-rise commercial-residential buildings in Central Manila.

With the Manila Sewerage System serving roughly 30% of the City, other households discharge wastewater either into storm drain, septic tank or directly into esteros. The untreated water in this case carries with it fecal matter and other debris which finds its way in catch basins or ultimately to nearby bodies of water. Records of desludging are unavailable, but adequately sized septic tanks normally are desludged once in two or three years.
The Metropolitan Waterworks and Sewerage System (MWSS) is a public corporation mandated to handle, supervise and control waterworks and sewerage systems in Metropolitan Manila that includes Caloocan City. The sewerage system, in this case, refers to the network of manmade channels and facilities installed for the collection, transmission, treatment and disposal of sewage or domestic wastewater. Nevertheless, in most instances, drainage and sewerage systems in Metro Manila share a single network system of pipes or canals, except in

City of Manila and some parts of Makati. Sewerage system has treatment facilities purifying wastewater that will conform to acceptable standards, prescribed by authority.

The MWSS operates sewerage systems for more than 50 years now and most of this system is already aged and in defective operating condition 36. Among the sewerage systems, the Dagat-Dagatan Sewer System and Wastewater Treatment Pond, is the sole facility that serves portion of Caloocan City, particularly Kaunlaran Village (DagatDagatan Development Project). Dagat-Dagatan Treatment Pond along with the sewer system was built in the late 1970's at the Tondo Foreshore Reclamation and Housing Development Project, of which a large portion lies within Caloocan City. The oldest treatment facilities being operated by MWSS are Manila Central Sewerage System, that is formerly built during 1900's with last major expansion and rehabilitation made in 1985; the Ayala Sewerage System and Treatment Plant follows the construction in the 1960s, and then, various communal sewer systems of government housing projects completed during the 1960s and 1970s. The Manila Central and Ayala sewerage systems serve the largest population and have been recommended for major rehabilitation and upgrading in past studies.

Caloocan

One of the major problems in the sanitation and sewage condition of Caloocan City is the heavy pollution from the effluent of domestic septic tanks. In year 2000, there are about 149,985 septic tanks built in Caloocan City and expected to increase up to 179,398 units in 10 years. In as much as the design and utility of septic tanks is concerned, these tanks need to be desludged once every 5 to 10 years for them to maintain effective treatment of sewage. Settling sludge in tanks is accumulated from long period of use, which eventually fills the tank. The wastewater or fecal matter discharged from an under sludge tank, in time, releases through and not restrained as expected. Inevitably, the effluent becomes an untreated sewage that flows into storm drains and finally discharges to nearby bodies of water. At the time rainy season come, creeks or esteros' overflow from clogged drainage and cause floods, exposing people to hazards of polluted floodwater. During dry periods, the problem gets worse when discharges from septic tanks fill the street drains, since concentration of pollution on storm water increases accordingly when no rain is available to flush the sewage.

Population of Caloocan City in year 2000, should be about 1.35 million, and is estimated to increase to 2.35 million in 2010. At a BOD 38 generation rate of 35 gms/capita/day, the population of Caloocan City shall generate about 47.25 tons/day (t/d) of BOD in year 2000. According to past studies, septic tank serves 60% of Metro Manila's population. Correspondingly, in Caloocan City, septic tank serves about 0.81 million persons, that generates 28.35 t/d of BOD in their sewage. Concerning BOD removal rate of desludged tanks, that is 28-65% BOD load reduction, BOD load in sewage water will reduce about 13-31 t/d, if all tanks will be desludged. These results are equivalent to 27-65% of total BOD generation in Caloocan City. Treated accordingly, desludging also removes suspended solids, significantly improves the sanitary condition of the community and reduces pollution level on waterways.

Based on estimates, septic tanks in Caloocan shall increase by about 20% for the next 10 years or an average of 2,941 septic tanks per year. However, the ratio of population to number of septic tanks also increases proportionately. In year 2000, the ratio of household per one septic vault shall be at 1.9, and expected to increase after ten years at about a ratio of 2.7.

Valenzuela City **(Source: Socio-Economic Profile 2009-2018)**

The topographic characteristic of the city is one of the factors that make it susceptible to flooding. Barangays which normally experience flooding are on the western portion of the city where the Polo River and Coloong River traverses.

To address flooding, several flood control structures have already been constructed throughout the city, particularly in the flood prone areas. The city's drainage facilities include concrete-lined canals, open ditches, sidewalk gutters and river dikes. The existing drainage structures, however, are unable to cope with the increasing water discharges and surface run-off. Some of these structures are already clogged while some were built with deficient outfalls..

Solid Waste Management

Manila

Generation

Garbage generated in Manila is includes wet and dry household waste, industrial waste commercial waste, and some hospital waste. In 1997, solid waste collection became the responsibility of the local governments and only one percent (1%) was handled by the MMDA.

Collection

Manila has 100% coverage of solid waste collection through a private contractor which uses 250 compactors and heavy equipment are used for collection on a daily basis.

Disposal

Since the city has no final disposal facility, waste collected is brought to a transfer station situated at Pier 18, NHA Compound, Tondo. Waste is brought to either the Tanza Facility or the Rodriguez Facility. This 10-hectare Pier 18 facility (Vitas Transfer Station) is located on an area of reclaimed land within the Manila North Harbor Center, adjacent to the Smokey Mountain dumpsite. Low-income housing, informal settlements and industrial developments bound it on the landward side, while Manila Bay is immediately adjacent to the north and west. The facility currently includes a site office and two 500-ton capacity barges each docked at the end of 2 separate ramps. Operations started in October 2002 under the management of its builder, Phil. Ecology Systems Corporation.

Caloocan City

Generation

Based on its CLUP, the average waste-generation-rate per day in the City is 0.60 kilograms per person and the average municipal waste generation rate varies from 212 to 316 tons per day.

Collection

Solid Waste Management in Caloocan City is presently under the supervision of the Environmental Sanitation Services (ESS) with two sections namely, the: (1) Garbage Collection and Disposal Services, and (2) Street Cleaning Services. The refuse collection operation at present is being managed by a Public Services Officer who serves as the assistant of the City General Services Officer in the delivery of the said basic service.

Disposal

Hauling is primarily used in solid waste collection. As of 1995, solid waste collected daily within the City by private contractors are transported to Payatas dumpsite (open dumpsite), San Mateo Landfill, or dumped to an open area in Bagumbong, North Caloocan.

Valenzuela City

Collection and Disposal

Like most LGUs, the city is not yet fully compliant with the provisions of R.A. 9003 or the Solid Waste Management Act of 2000. It is, however, in the process of closing the existing dumpsite in Barangay Lingunan. At present, the city is utilizing the five-hectare controlled dumpsite in Barangay Lingunan. Unsegregated garbage is collected from households twice a week for every route while daily collection is done in markets and along the major thoroughfares of the city. Parts of the garbage collected in the 32 barangays are diverted for recovery and recycling at the Valenzuela EcoCenter and MRF in Barangay Marulas before these are finally disposed into the controlled dumpsite.

In order to achieve efficient and ecological means of managing solid waste, the city government institutes the support of barangays for waste minimization, segregation and recycling. It is also studying the possibility of acquiring land for a Materials Recovery Facility. Even though garbage collection is available to all households in the city, there are still about 493 households (0.68%) from the total households surveyed which do not have proper garbage storage and disposal facilities.

At present, the city is utilizing the five-hectare controlled dumpsite in **Barangay Lingunan**. Unsegregated garbage is collected from households twice a week for every route while daily collection is done in markets and along the major thoroughfares of the city. Parts of the garbage collected in the 32 barangays are diverted for recovery and recycling at the Valenzuela EcoCenter and MRF in Barangay Marulas before these are finally disposed into the controlled dumpsite.

Bulacan

Majority of the municipalities in Bulacan are still using traditional way of disposing their solid wastes, which is through open dumping. Of the 24 municipalities, 21 towns practice open dumping, while remaining three municipalities have simplified landfilling.

Disposal of solid waste represents a major challenge to residents of Bulacan. In a series of consultations conducted by the provincial government, it has been found that majority of the municipalities of the province has difficulties dealing with the management of their own solid wastes. One reason cited is the absence of proper disposal sites particularly in highly urbanized areas where most of the vacant lands have been built-upon by subdivisions and industries. Neighboring municipalities with enough space for disposal sites, on the other hand, reject any prelude from municipalities with disposal problem, as this would tarnish the image of the municipalities.

Basic Services Impact Identification, Assessment and Mitigation

Pre-Construction and Construction Phase

The project is not expected to have impact on the basic services of the municipalities and cities where it will pass through.

4.6 Public Health & Safety

Bulacan

Table 2.44 shows the list of both government and private hospitals operating in Bulacan, and the other health and sanitation profile of the province. As can be gleaned from the information contained in the said table, the province is well served with a network of hospitals. According to the Provincial Health Office (PHO), there are 150 government and private hospitals and clinics in the province but the biggest in terms of number of beds available is the Provincial Hospital with a total capacity of 300 beds. The provincial hospital serves as the main health facility for the entire province of Bulacan.

Table 2.44 Health and Sanitation Profile of Bulacan

	Malolos	Guiguinto	Balagtas	Bocaue	Marilao	Meycauayan
Crude Birth Rate	18.05	9.40	18.75	13.33	16.66	25.17
Crude Death Rate	6.67	4.59	4.03	3.92	2.30	3.48
Infant Mortality	1	0.15	0.03	0.13	0.18	0.44

Rate						
Access To Safe Water (HH)	1631	19680	13376	Nd	41146	42720
Access To Sanitary Toilets (HH)	1880	19073	13164	2766	41733	39462
Gov't Hospitals	1					
Bed Capacity	300					
Rural Health Unit/ Community Hospital	6	2	2	2	2	7
Private Hospitals /Clinics	149	11	9	30	43	67

Source: Bulacan Socio-Economic Profile

Manila

The city of Manila has 23 private hospitals, six (6) national government hospitals, and four (4) city government hospitals. The hospitals operated by the City of Manila are the Ospital ng Maynila, Ospital ng Tondo II, Ospital ng Sampaloc and Gat Andres Bonifacio Hospital. The distribution of health facilities shows that District IV has eight of the 23 private hospitals in Manila, while District II has one private hospital. District III has three national hospitals. The health center-population ratio is 1:32,267. The Department of Health (DOH) minimum standard is 1:20,000, which may means that 30 additional health centers are needed in the city. The Manila Health Department reported that 22 new health centers will be constructed under the World Bank-funded Urban Health and Nutrition Project of the Department of Health. While the detailed architectural and engineering plans have been prepared and approved, sites in Manila have yet to be identified for such new health centers. A major criterion in the site identification is the accessibility of the health centers to their urban poor clients.

While there are more private hospitals than public hospitals, the total bed capacity of public hospitals is greater (3,769 beds compared to 3,438). Thus, the hospitals bed population ratio is more favorable in the public sector (one bed per 419 population) than in the private sector (one bed per 460 population).

All hospitals, whether secondary or tertiary, fulfill the requirement on the number of beds according to their service category.

Caloocan

Caloocan has twelve (12) private hospitals, a birthing home and three (3) government-owned hospitals in the entire city. One of the government hospitals is the Jose N. Rodriguez Memorial Hospital, a special hospital. The total bed capacity of the private hospitals is 529. The newly constructed Diosdado Macapagal Memorial Medical Center, a tertiary hospital, has a total bed capacity of 82 and is equipped with facilities such as Intensive Care Unit, X-ray, Laboratory, Operating Room, Physical Therapy, Dental Clinic and Ambulance. Health services include OPD, emergency room, specialty clinic, laboratory, X-ray, pharmacy, physical therapy, dental, surgery, Animal Bite Center, social service, dietary, newborn screening, family medicine, ICU and DOTS. Another effort of the city government for the health benefit of the city residents is the free laboratory procedures and seminars on fasting blood sugar determination, cholesterol determination, triglycerides, electrocardiogram (ECG), fat screening, bone screening and diabetes education. In partnership with non-government organizations, free surgical procedures were given to 77 harelip cases under the "Operation Smile", 48 were cataract patients and 200 persons benefitted under the operation tule. As of

2006, the DMMC responded to 64,557 treatments comprising of: 41,504 emergency room consultation, 12,109 out-patient, 2,887 admission of patients (ward), 1,045 dental consultation and 7,217 availed the Specialty Clinic consultation.

Health manpower is provided by 8 regular doctors and 38 consultants, 17 regular nurses and 35 consultants and 11 regular midwives while the government health centers has 36 physicians, 41 nurses, 66 midwives and 28 dentists.

Aside from hospitals, Caloocan maintains forty (40) health centers located in different barangays of the City. Nine (9) of these heath centers are certified by the Department of Health (DOH) as "Sentrong Sigla" centers (Level 1) which means that they passed strict evaluation criteria on quality health servicing. These centers provide local health services to maintain and improve the health of the populace. Services include vaccination, medical and dental services, nutrition supplements, immunization programs and family planning services. These health centers are under the administrative and technical supervision of the City Health Department whose tasks extend to continuous monitoring of water supply and ensuring public access to safe water and promoting the use of sanitary toilet facilities particularly in depressed barangays.

Valenzuela City

Valenzuela City has 51 public health facilities, which include two hospitals, two lying-in clinics, two physical therapy clinics and 41 health centers in 29 barangays. There are also private hospitals (7), medical clinics (38), rehabilitation clinics (2) and laboratory/ diagnostic/ drug testing centers (21) which are supplementing the city's public health services.

Access to Sanitary Toilet

Most (98.96%) of the households surveyed in Valenzuela City have access to toilet facilities. Only about 1.04 percent of the 73,037 households surveyed by the Sanitation Division do not have access to sanitary toilets. All surveyed households in Barangays Bagbaguin, Lawang Bato, Pariancillo Villa and Poblacion have access to sanitary toilet facilities.

Public Health and Safety Impact Identification, Assessment and Mitigation

Pre-Construction and Construction Phase

There may be increased risk of construction-related accidents due to improper work ethics, which may threat health and safety of workers and local residents. Appropriate personal protective equipment (PPE) must be provided to all construction workers, especially those who are working on heights, heavy and electrical equipment. The contractor shall submit an Occupational Health and Safety Management Plan prior to commencement of work. A medical station within the complex will be provided to safeguard the health of the workers. The project site will also be fully fenced and access points will be available for residents in selected areas only.

The Workers and the local community also run the risk of exposure and spread of contagious/ infectious diseases due to unsanitary condition at the project site. Stringent observance of high standards of cleanliness and sanitation will minimize the risk of disease transmission. Medical certificates will also be requested to ensure workers are fit to work. Appropriate sanitary facilities shall be provided at all construction sites. A health education campaign and training should be conducted for the construction workers in safety and health protection measures as part of their Occupational Health and Safety Management Plan.

Operation Phase

There may be risk of accidents due to improper work ethics, which may be a threat health and safety of workers and passengers at the stations and depot. An Occupational Health and SafetyManagement Plan will also be implemented by the proponent during the operations stage. This will be aligned with the policy of the DOTC mandating the strict implementation of precautionary, safety and security measures to ensure safe, fast, efficient and reliable transportation services. Appropriate personal protective equipment (PPE) must be provided to all personnel undertaking maintenance work. Security guards will be deployed in all stations to direct passengers on the safe zone. An Emergency Response Plan shall also be established by the proponent in order to define actions in preventing the occurrence of accidents and response procedure in case of accidents, fire and natural hazards.

The health of employees working at the stations and depot may be affected from exposure to unsanitary conditions. Sanitary facilities or utilities to maintain sanitary and healthy conditions will be made available in all stations and depot.

4.7 Local Benefits / Employment and Livelihood

a) Local Economy of Cities and Municipalities in NSCR

Province of Bulacan

Bulacan's proximity to Metro Manila has contributed to its industrialization. Various companies have put up manufacturing and industrial plants in Bulacan. The manufacturing sector has since played a significant role in the over-all economy of the province (Table 2.43). Based on initial results of the 1995 NSO census, the manufacturing sector is the second leading economic activity because it offers some 113,051 individuals employment opportunities in the various sub-sectors of this particular activity. This number represents at least 15 percent of the total employment in Bulacan (for 1995) making it the second leading sector in terms of providing employment opportunities to Bulakenos.

However despite the highly urbanized nature of the province, agriculture remains to be the major economic activity in the area. Aside from the services and manufacturing sectors, agriculture is the third leading sector in terms of total number of employed individuals. The rural areas still mostly depend on agriculture and fisheries as a source of income. Some of the major crops are rice, corn, vegetables, and fruits such as mangoes and various kinds of fishes and seafood.

Based on trend analysis, the sector's contribution in the overall economy of the province will diminish in view of the massive rush of urban development. During the period 1990 to 1995, the agricultural sector decreased by 1.35 percent or -0.27 percent per year and of the seven major sectors, only the agricultural sector experienced a decline in the employment pattern.

Table 2.45 List of Industrial Sites in Bulacan

Industry	Location
First Bulacan Industrial City	Malolos City
Intercity Industrial Estate	Wakas, Bocaue
Bulacan Agro-Industrial Subdivision	Calumpit
Bulacan Metro Warehouse (BMW) Center	Guiguinto
Meycauayan Industrial Subd. I, II, III & IV	Meycauayan

Industry	Location
Meridian Industria l Compound	Meycauayan
Muralla Industrial Project	Meycauayan
First Valenzuela Industrial Compound	Meycauayan
Sterling Industrial Park Phase I, II, III & IV	Meycauayan
Grand Industrial Estate	Plaridel
SapangPalay Industrial Estates	San Jose del Monte
Agus Development Corporation	Sta. Maria
Bulacan ICT Park	Marilao
Golden City Business Park	Wakas, Bocaue
Sterling Industrial Park	Marilao

Source: JICA Study Team

Table 2.46 List of Industry Sectors in Bulacan

	Malolos	Guiguin-to	Balagtas	Bocaue	Marilao	Meycaua-yan
Banking Institutions	32	7	12	6	7	30
Financial Institutions	18					1
Cooperatives	51	18	5	16	26	26
Hotels / Lodging Houses	12	3	4	2	10	5
# of Rms	376	59	26		269	102
Resorts/ Recreation Centers	14	7	7	7	14	8
Markets/Supermarkets	13	5	4	9	8	19
Industrial Estates	1	4		3	9	13
Manufacturing Industry – Food Processing	6	7		8	82	9

Source: Bulacan Socio Economic Profile

Malabon

Malabon industries, on the other hand, include sugar refinery, patis making, cigar making, fishing and export of distilled perfume produced from flower extract.

Valenzuela City

According to the 2007 Sectoral Studies, Valenzuela City had a total of 7,695 commercial establishments. The most dominant is the wholesale and retail sector, which particularly pertains to trade and repair of motor vehicles, motorcycles and personal and household goods. This comprises 41.99 percent of the total number of establishments. Real estate rentals and business activities followed and accounts for about 21.73 percent. Large commercial centers are also located in the city including SM Supercenter Valenzuela located in Karuhatan, Puregold Supermarket in Dalandanan, Royal Family Mall and CVC Supermarket in Paso de Blas and South Supermarket in Karuhatan.

About 62.02% of the total number of manufacturing industries in Metro Manila is located in Valenzuela City. Metal works, machine shops, fabricators had the biggest share in terms of the number of followed by manufacturers of plastic and rubber products, food products and beverages, garments and wearing apparels and manufacturers with machinery. Some of the

manufacturing industries which arose include those engaged in machinery, and packaging and repacking. About 22% of the manufacturing establishments were concentrated in Marulas and Canumay. Karuhatan, Ugong, Maysan, Malinta and Lawang Bato each have more than a hundred manufacturing establishments. All other barangays have at least one industry operating in their area except for Wawang Pulo.

There are two public markets in Marulas and Pulo this is being managed by the city government. There are also privately-managed wet and dry markets located in six barangays operating in the city. In terms of agricultural crop production, about two percent of the city's total land area is devoted to it. Majority of the agricultural area are cultivated with rice while the rest were planted with corn and vegetables.

About two percent (2%) or 89.70 hectares of the city's total land area is devoted to agricultural crop production. These are located in Barangays Bignay, Canumay, Lawang Bato, Malinta, parade and Punturin. The crops produced, rice, corn and vegetables, are either for household consumption or sold to the markets for family's subsistence. There are also six commercial and two semi-commercial livestock, poultry farms are operating in the city located in Barangays Canumay, Parada, Veinte Reales, Lawang Bato, Maysan and Bignay. Fishpond areas, on the other hand, are located in Barangays Balangkas, Bisig, Coloong, Isla, Malanday, Tagalag and Wawang Pulo.

Caloocan City

The City of Caloocan, being strategically positioned in the northern portion of Metropolitan Manila, is considered as the gateway of the metropolis towards North Luzon. Being as such, the City continues to be the premier center for trade and industry in CAMANAVA (Caloocan-Malabon-Valenzuela-Navotas) area. Within the last seven years (2000 – 2006), the City has registered its highest number of business establishments in 2006 at 15,199 establishments. However, from 2000 to 2006, number of business establishments showed an unstable rate of change having its lowest figures at 10,287 establishments in 2002. About 65.28% of these economic activities in 2006 were engaged in trading, 27.70% in services and the remaining 7.02% were in manufacturing, mostly located in South Caloocan.

A. Bonifacio Monument area serves as the Central Business District (CBD) of Caloocan City. This area covers approximately 102 hectares of land, with various business establishments like variety stores, specialty shops, banks, business and professional offices, restaurants, malls, department stores, theaters and other entertainment facilities. Considered as the CBD's advantage points are the presence of a 90-meter wide Circumferential Road (EDSA), the Rizal Ave. Extension, Light Rail Transit (LRT), major modes of transportation such as buses and jeepneys, different communication facilities and other public utilities. As a result, the area extends its services to its neighboring cities and municipalities like Malabon, Navotas and Valenzuela, and areas as far as Marilao and Meycauayan, Bulacan. With a developed trading, banking and other complimentary industrial activities, it now serves as an alternative financial and transaction center, to Manila, Makati and Quezon City.

Growth of commercial strips with chain of eateries like Jollibee, Max's Restaurant, Barrio Fiesta, Hap Tian, Kentucky Fried Chicken and other restaurants and food chains now extends up to Rizal Avenue Extension and 10th Avenue. At present, there are also 40 commercial and savings banks situated along these major roads.

The Caloocan City Commercial Complex, formerly Plaza Rizal Park, which is located in front of the Caloocan City Hall, also housed the various business establishments, like food chains, salons, computer shops, convenience store, coffee shops and others. Sangandaan area on the other hand, having minor concentric development is slowly growing into a medium-intensity

commercial site. Once the long overdue expansion of Samson Road is realized, it is expected that this area will become another Central Business District (CBD).

Intersections of C-3 Road and A. Mabini Street, and C-3 Road and Rizal Avenue Extension (RAE) are both business potential sites capable of accommodating High- Intensity Commercial Development. Said areas have ideal road pattern, capacity, and location, modes of transportation, communication facilities and distribution of goods to other areas.
Due to the existence of small parcel of lands along these major arteries, land consolidation is imperative to adapt high intensity commercial activities. Likewise, underdeveloped spaces for foot traffic along these areas needs to be addressed.

Areas in North Caloocan which shows potentials for commercial growth are the following: (i) Camarin Zabarte Roads intersection, (ii) junction of Susano, Camarin and Congressional Roads, (iii) Block Phase 1 Bagong Silang, Sta. Quiteria Road, Tala Road and (iv) Quirino Hi-way (Caloocan side). Despite being potential sites, economic progress along these areas are limited due to its existing narrow roads, insufficient transportation facilities and support facility services like communication, water supply and other public utilities.

Manila
Manila's economy is diverse and multifaceted. With its fully protected harbor, Manila serves as the Chief Seaport of the Country, one of the busiest in the world.

Diverse manufacturers produce industrial-related products such as chemicals, textiles, clothing, and electronic goods. Local entrepreneurs process primary commodities for export, including rope, plywood, refined sugar, copra, and coconut oil. Food, beverages and tobacco products are also locally produced. The food-processing industry is one of the most stable major manufacturing sectors in the City.

Manila has 27 public markets and talipapa that are strategically located in its 6 legislative districts. These markets are classified according to average monthly income during the preceding three months: Class A (Php 60,000 or more); Class B (Php 30,000 – 59,000); Class C (less than Php 30,000) (SEPP 2005).

b) Labor Force and Employment

Manila
Manila is predominantly a service-oriented city. It is one of the most densely populated cities in the country, next to Navotas, and it is fully built-up. Thus very little agriculture, forestry, mining and quarrying are undertaken. The leading industries, namely textile/garments, food, personal products, chemical/pharmaceutical, and rubber/plastic products, are generally light, labor-intensive activities. They take advantage of the city's substantial labor and the labor supply from the rest of the metropolis. Service sector employment has steadily dominated the share in total employment, to average about 80% from 1994-1999. The rest are employed in industry sector with a minuscule number in agriculture, possibly backyard vegetable growing and small-scale fishing.

Like major global cities, Manila has become less of a center of manufacturing but more of a center for services, amenities and leisure. Given the centrality of the city in the National Capital Region, it provides employment, services, amenities and facilities for a large floating population that does not reside in the city. Unfortunately there is no data on labor force status.

Caloocan

As of April, 2003, Caloocan City's potential labor force was estimated at 882,000 or 3.39% over the record of year 2000 labor force. Economically active force was posted at 535,000 (60.66%) of which 426,000 or 79.63% were employed and 109,000 or 20.37% are unemployed. On the other hand, labor force, which is economically inactive, was posted at 347,000.

In 2003, the City has an unemployment rate of 20.37%. The City ranked 4th in NCR cities and municipalities with highest unemployment rate in 2003. Based on 2000-2003 report, the City's projected labor force was estimated to reach 1,126 (in thousands) by 2010.
Province of Bulacan
In Bulacan, the province's total working population was estimated at 1,116,000. With a labor force participation rate of 62.6 percent, the total labor force was pegged at 699,000. Records from the Provincial NSO showed that the province normally have an employment rate of 94.6 percent. Ten years hence, with a total population of 2,683,000 and a labor force of 970,000, projected employed labor force will reach close to the one million marks.

Bulacan Province

Bulacan has a high employment rate of 89.7% as shown by 2007 provincial records. The total working population in Bulacan is estimated at 1,413,000 who were engaged in various income-generating activities. The increase in the labor force is attributed mostly to the service sector, which accounts for almost 60 percent. This includes wholesale and retail trade, transportation, storage and communication, community, social and personal services. The industry sector consisting of manufacturing, construction, electricity, gas and water and mining constitutes 30% of the province's labor force. On the other hand, agriculture comprises the rest of the total employment in Bulacan.

Malabon

For Malabon, about 400,390 or 66.4% of the total number of families derive their income in the form of salaries either sourced out from agricultural-type or non-agricultural-type of industry. About 19% source their income from non-agricultural type of industry such as wholesaling and retailing, manufacturing, community, social, recreational and personal services, transportation, storage and communication services and construction.

Local Benefits / Employment and Livelihood Impact Identification, Assessment and Mitigation

Pre-Construction and Construction Phase

The construction of the NSCR Project will require both skilled and unskilled laborers, thus, will provide temporary employment opportunities. To boost economic activity of the local community and affected LGUs, the project proponent will mandate contractor to give priority to the local residents.

Livelihood of the local community, such as that from commercial establishments, small vendors and farmers, may experience temporary disturbance during construction. The project may also lead to a decline or eventual loss of business in affected areas. In consideration of affected groups, construction activities shall be undertaken at the shortest possible time to restore normal business operations immediately. Alternative livelihood programs in coordination with the LGUs and other government agencies will also be taken in to consideration. For business establishments that will be permanently removed, the RAP details a replacement cost for the loss.

Operations Phase

The NSCR Project will also boost regional economic activities along the route through provision of an efficient mass transit system that enhances workforce mobility between the industrial zones in Bulacan and the CAMANAVA area. This fast and continuous means of transportation gives the labor force in NCR and parts of Region 3 more chances of getting available jobs without having to consider the distance between their home and their place of work. Shorter and more comfortable travel time will also bring workers better physical and psychological state resulting to work productivity.

Employment for skilled personnel to operate and maintain the railway system will also be available. The presence of the stations will also attract future commercial development around the area.

4.8 Traffic Condition

The traffic condition in the cities and municipalities along the NSCR alignment will be discussed in the Traffic Management Plan that will be submitted to DPWH and MMDA for approval**.**

Pre-construction and Construction Phase

Because of the mobilization of heavy vehicles, construction activities and staging of works, it will be unavoidable to restrict some roadway. This will lead to increased traffic congestion and changes in traffic patterns. A Traffic Impact Assessment (TIA) is currently being conducted, and based on the findings of the TIA,a Traffic Management Plan (TMP) that details the activities to adequately manage traffic flow will be prepared for strict implementation. Some measures that may be included in the plan are rerouting of traffic and proper scheduling of transport of heavy structures (i.e. guideway beams) during periods when there are less vehicles on the road. The TMP will be properly coordinated and approved by the MMDA and/or LGUs concerned.

Operations Phase

The introduction of the project will generally improve the traffic situation within the project area due to expected shift of commuters from road-based to rail-based transport system. The project will also result to a shorter travel time and convenience for commuters who reside inthe provinces but go to work in the NCR. This will relieve traffic congestion since people will not need to find residence in the metropolis where employment is mostly available.

The project benefit will be enhanced by expanding ridership between various parts of Metro Manila and Bulacan. Thus, the operator should ensure the efficient, reliable and safe operation of the system with zero down time through regular maintenance. Linkages with LRT, MRT lines, bus and jeepney stations will also be considered for efficient passenger flow transferring to other modes of transportation. Fares must be affordable to the riding public. Discounts should be extended to students, person with disabilities and senior citizens.

On the contrary, there may also be increased vehicular flow in areas adjacent to stations that may cause traffic congestion. This could be addressed by providing loading and unloading and or park and ride areas per station. Likewise, jeepney /bus terminals could be provided, if possible. Coordination with MMDA and the LGUs could also be done to assign traffic enforcers in critical areas.

A summary of the potential impacts, assessment of impacts and mitigating measures to address the identified impacts is provided in Table 2.45Table .

Table 2.47 Impact Identification, Assessment and Mitigating Measures for People

Environmental Aspect	Environmental Component Likely to be affected	Potential Impacts	Assessment of Impacts	Mitigating/Enhancement Measures
PRE-CONSTRUCTION AND CONSTRUCTION				
Land acquisition for ROW and involuntary Resettlement for PAPs	PEOPLE (Project Affected Persons or PAPs)	Displacement of residents and few commercial establishments along the proposed alignment	Moderate adverse impact	• Implementation of Resettlement Action Plan (RAP) to ensure that affected households and establishments are provided a proper relocation area and/or justly compensated.
		Improvement of living conditions	Beneficial	• Provision of housing and amenities for PAPs of ISF • Livelihood and Income Restoration for PAPs of ISF and Vulnerable Persons (Women-headed households, Elderly, Persons with disabilities, Poor)
Land acquisition for ROW	Historical/cultural heritage	Loss of old PNR stations	Low adverse impact	• Implement recommendations of NHCP in the detailed design to preserve and integrate the old PNR stations • Implement the concept design of Tutuban Station to preserve the historical structures and integrate it into the development design
	Local economy (Employment and Livelihood)	• Commercial establishments and small vendors may experience temporary disturbance during construction. • Decline or eventual loss of business in affected areas.	Moderate adverse impact	• Implementation of RAP including temporary relocation of ambulant vendors, replacement cost for the losses of affected business establishments and alternative livelihood programs in coordination with the LGUs and other government agencies
Civil Works		Generation of temporary employment	Beneficial	• The project proponent will mandate contractor to give priority to the local residents.
• Mobilization of workers, equipment and construction materials, • Transport of demolition debris and construction materials to and from the construction site.	Traffic Management	Increase in traffic	Moderate adverse impact	• Strict implementation of Traffic Management Plan (TMP) that details the activities to adequately manage traffic flow • The TMP will be properly coordinated and approved by the MMDA and/or LGUs concerned prior to implementation of activities in the areas concerned

Environmental Aspect	Environmental Component Likely to be affected	Potential Impacts	Assessment of Impacts	Mitigating/Enhancement Measures
Civil Works	Occupational Health and Safety	Increased risk of accidents due to improper work ethics, which may threat health and safety of workers and local residents.	Low adverse impact	• Provide appropriate personal protective equipment (PPE) to all construction workers • Strict use of PPE by construction workers • Implement Occupational Health and Safety Management Plan • Put up fences / enclosures around the project site to keep away unauthorized persons • Provide access points for residents in selected areas only. • Provide First Aid Stations at construction sites with resident doctors and nurses
		Increased risk to communicable and infectious diseases	Low adverse impact	• Construction workers submit Medical certificates for fitness to work. • Construct sanitary facilities (toilets, bathrooms, kitchens) at all construction sites. • Implement Occupational Health and Safety Management Plan prior to commencement of work.
OPERATIONS				
Railway Operation	Traffic Management	Traffic congestion near railway stations	Low adverse impact	• Designate / Provide for loading and unloading areas • Fielding of traffic enforcers near the stations • Provision for tricycle / jeepney/bus terminals
	Local economy (Employment and Livelihood)	Increased economy along NSCR route	Beneficial	• Ensure efficiency of NSCR system in order to attract passengers and increase ridership • Encourage commercial development at Stations
• Passengers, NSCR Employees at Stations • Maintenance work at Depot	Occupational Health and Safety	Risk of accidents at the stations and depot	Low adverse impact	• Strict implementation of precautionary, safety and security measures
		Risk of communicable and infectious diseases	Low adverse impact	• Sanitary facilities or utilities to maintain sanitary and healthy conditions at all stations and depot.

Source: JICA Study Team

4. ENVIRONMENTAL RISK ASSESSMENT

4.1 Objectives

The primary objective of the ERA is to identify the risks to the environment associated with NSCR Project activities with focus on the air quality, water quality, and the structures to be built. These risks occur from a variety of conditions which may ultimately result in a release of substances harmful to the environment.

Once risks were identified, a hazard characterization was performed to evaluate adverse impacts, estimate the levels of risk andprepare methods to minimize those risks. Analyses completed to satisfy this program consisted of the following:

- Identification of materials to be stored and used within the site
- Identification of methods of materials release
- Identification of pathways that allow the introduction of materials to the environment
- Identification and evaluation of risk management tools and methods to reduce risks and control impacts.

Risk characterization and assessments can be done using either a qualitative or quantitative approach. Descriptive assessments and systematic characterization form the basis of the qualitative assessment. This is best applied to accidents or events with little or no data pertaining to frequencies of occurrence or ecosystem and health impacts. The quantitative method uses a probability approach and attempts to quantify the risk using frequency and probabilistic models. This is sometimes difficult to complete in a manner that provides reasonable and accurate results. There were limited data available for the Philippines that can be used for statistical analysis.

3.2 Method of assessment

The assessment method can generally be defined as an engineering reliability method known as Failure Modes and Effects Analysis (FMEA). This approach is a systematic characterization and evaluation of sources of risks to the environment. It can be considered as a qualitative approach based on expert opinions. The primary objective of this approach is to identify the risks, prioritize those risks, identify risk tradeoffs, and identify means and methods to reduce the risks. Four questions must generally be answered to fully satisfy the process:

- What can go wrong?
- What is the range of severity of the adverse consequences?
- How likely are those adverse consequences to occur?
- What can be done to reduce risks that are unacceptable?

3.3 Hazard Identification

Hazards associated with this project can be grouped into 7 categories:

i. Rail system failure
ii. Structural failure
iii. A breach or release of harmful chemicals at maintenance depot
iv. A breach or release of toxic substances during transport
v. Fire
vi. Terrorism attacks
vii. Construction related accidents

Additional information relative to the specific hazards and risks associated with those hazards is presented below:

3.3.1 Rail system failure

This includes failure of rail equipment particularly rail track, signaling/ communication systems and rolling stock. Failure of these devices due to natural hazards (flood, earthquake, volcanic eruption and the like), natural wear and tear of rail parts, terrorist attacks or other forms of accidents may result to derailment.

3.3.2 Structural failure

Structural failure as a hazard is related to buildings at the Depot and stations as well as all infrastructures where the rail tracks are laid. Failure of these structures due to natural or man-made hazards may result to damage of property and/or loss of human life.

3.3.3 Harmful chemicals

The chemicals used for maintenance activities at depot are not harmful when handled properly. However, if accidental spills during their usage or a breach in containment unit occur, these chemicals may cause hazard to air and surface water.

3.3.4 Transport of toxic substance

Freight service will be introduced into the rail system or when the system has been developed to warrant the introduction of this service. However, since this Project is a transportation facility, some passengers may opt to carry with them "dangerous" goods that they need to transport. These goods may be accidentally spilled or released from its containers during transport and may cause fire, damage to property and / or loss of human life.

3.3.5 Fire

Fire normally occurs during summer season due to excessive heat. It can also occur due to accidents and equipment failure. Fire may result to damage of property and/or loss of human life.

3.3.6 Terrorism attacks

The Rizal Day bombing of LRT Line 1 followed by the September 11 terrorist attacks claimed lives and destroyed properties and thus became a valid concern to all types of public transport facilities especially mass transport systems like this rail project.

3.3.7 Construction related accidents

During construction, all personnel assigned at the project site may be subject to accidents if health and safety management plans are not properly carried out.

3.4 Environmental Pathways

3.4.1 Air

Air can only become an environmental pathway when substances are in gaseous state. Vapors from hazardous chemicals and other substances are volatile. If these substances are released, they may diffuse into the air.

3.4.2 Ground

Ground can be considered as an environmental pathway when liquid substances travel through it by seepage or surface runoff.

3.4.3 Water

Water is one of the fastest and the most short-term pathway for potential pollutant impact. In many cases, this pathway is also a combination of surface water runoff and groundwater. The physical and chemical processes that affect migration of contaminants with both surface water and groundwater pathways are similar. Additionally, topographic and geomorphologic conditions also influence this pathway.

3.5 Accident Scenarios

A "what if" type of procedure was used to construct the different accident scenarios using an Event Tree type of procedure. This approach begins with consideration of a component failure and follows a "forward" analysis to identify how these failures can lead to major accidents. Variations in these scenarios can result in a large number of accident scenarios and risk characterization analysis. These accidents can rank from minor to severe. Some have a much higher probability of occurrence while others are significantly less probable. This study focuses on the scenarios of "what can go wrong" that have the potential to adversely affect the environment and human health. Seven (7) accident scenarios were prepared and are described below.

i. Scenario 1 – Failure of rail component may result to derailment
ii. Scenario 2 – Failure of structures
iii. Scenario 3 – Release of liquid and vapors from harmful chemicals may contaminate air and surface / groundwater
iv. Scenario 4 – Release of liquid and vapors from toxic substances during transport may contaminate air and surface/ groundwater
v. Scenario 5 – Fire may occur due to extreme hot temperature, equipment failure and other accidents
vi. Scenario 6 – Construction-related accidents
vii. Scenario 7 – Terrorist attacks may damage properties and affect human health and life

3.5.2 Failure of rail component

Failure of any components of the rail system can occur due to natural or man-made hazards, normal wear and tear of rail system parts or other forms of accidents. Natural or man-made hazards may come in the form of fire, seismic events, terrorism attacks, etc. Other forms of accidents include failure due to materials defects or lack of proper maintenance of the system equipment.

DOTC will comply and incorporate in its performance specifications a number of design standards and codes (both local and international) in order to secure the necessary permit

requirements. Once the rail system is built, the Prime Contractor together with DOTC will conduct testing and commissioning prior to acceptance of the DOTC for the works. For the maintenance of its rail equipment during operations, DOTC will utilize a third party contractor to operate and maintain the rail system.

The above activities will ensure that the operation of the rail system will be safe. Moreover, the Rail Operator will have to set up safety measures and emergency procedural plans to ensure timely and proper response to emergency situations cause by rail system failure.

3.5.3 Failure of building and other structures

Failure of the buildings and other structures may only occur as a result of natural hazards. It usually takes a catastrophic event for this failure to be considered as a risk that may lead to damage of buildings or structures as well as injury or death of human beings.

DOTC will have to comply with the necessary codes and standards (i.e. the Philippine National Structural Code and National Building Code) in order to obtain the required permits. This will serve as an assurance that the facilities are structurally sound.

3.5.4 Release of liquid and vapors from harmful chemicals

This is in relation to accidental spills of chemicals (especially diesel fuel) used during operations and maintenance activities. Even on storage, breach in containment unit may accidentally happen allowing the chemicals to diffuse into the air or be spilled on soil and surface/groundwater.

The fuel containers will be properly designed to ensure its safety and durability. Personnel who will be assigned at the depot will be trained to ensure safety of handling chemicals for maintenance activities.

3.5.5 Release of liquid and vapors from toxic substances

This can be due to accidental spills or breach in containment unit of toxic substances while in transport.

The design of rail facilities to handle storage of toxic substances during freight service should be in accordance with applicable local and international codes and standards. Inspection of containment units of toxic substances for transport will be handled by qualified DOTC personnel.

3.5.6 Fire

Fire may occur due to excessive heat, failure of equipment and other accidents. DOTC will comply with the Bureau of Fire Protection requirements as part of its application for building permits. Firefighting (fire hydrants, fire extinguishers) will be placed at strategic locations within the project site. The emergency response plans will ensure timely and proper response to emergency situations caused by fire.

3.6 Construction-related accidents

Similar to other construction activities, risk may occur due to construction related accidents.

Examples of these accidents include:

- Collapse of scaffolding
- Falling of construction materials while being lifted by a crane boom

- Fire or electrocution from welding and use of other electrical equipment
- Personnel being run over by heavy equipment
- Accidental fall of workers while in elevated location
- Injury from construction debris and materials

Health and safety management plans required for the Works will be set up by the Prime Contractor. Safety regulations should be followed by all personnel.

3.7 Terrorism attacks

Terrorism attacks are prevalent in mass transport systems these days.

Tight security measures will be implemented during construction and operation stages to avoid occurrence of this risk.

Failure Mode and Effects Analysis

Based on the previous discussions of hazard identification, environmental pathways and accident scenarios, a Failure Mode and Effects Analysis (FMEA) was performed. This is primarily a qualitative assessment approach but does provide a systematic characterization and evaluation of the risks. The analyses combine subjective ratings or categories of livelihoodand consequences of various events, which are identified in the following tables.

Table 3.1 Likelihood categories for risk assessment

Subjective category	Likelihood occurrence	Likelihood occurrence
Negligible	$<10^{-6}$	Less than 1:1,000,000
Very low	10^{-6} to 10^{-4}	1:1,000,000 to 1:10,000
Low	10^{-4} to 10^{-2}	1:10,000 to 1:100
Moderate	10^{-2} to 10^{-1}	1:100 to 1:10
Significant	$>10^{-1}$	Greater than 1:10

Source: JICA Study Team

Table 3.2 Environmental and health consequence categories for risk assessment

Subjective category	Environmental and health consequences
Safe	Negligible effect on environment and human health
Marginal	Failure will cause some environmental degradation but no major or long term damage. Minor injury or illness.
Moderate	Failure will cause significant environmental degradation but no long term damage. Major injury or illness.
Critical	Failure will degrade environment, and if not mitigated will cause significant and permanent damage. Permanent disability.
Severe	Failure will cause major and irrevocable environmental damage. Fatalities

Source: JICA Study Team

A summary of these analyses using these categories as applied to the seven (7) accident scenarios is presented in Table 3.3.

Table 3.3 Summary of Failure Modes and Effects Analysis

Accident scenario	Description of failure mode	Project phase	Effects	Consequences		Likelihood		Compensa-ting factors
				Category	Confi-dence	Category	Confi-dence	
1	Failure of rail component may result to derailment	Operational phase	Possible damage to property and injury/loss of human life	Minimal to moderate (environmental degradation)	High	Very low	High	Design of rail system should conform with known standards
2	Structural failure of encapsulation facility by seismic events	Construction and operational phase	Possible damage to property and injury/loss of human life	Minimal to marginal (environmental degradation)	High	Very low	High	Structural design follows or exceeds Code require-ments
3	Release of harmful chemicals during maintenance activities	Operational phase	Possible damage to property and injury/loss of human life	Minimal to moderate (environmental degradation)	High	Very low	High	Safety training for depot personnel and proper design of depot facilities
4	Release of toxic substances during transport of dangerous goods	Operational phase	Possible damage to property and injury/loss of human life	Minimal to moderate (environmental degradation)	High	Very low	High	Inspection of goods for transport by qualified personnel and design of rail facility to handle transport of dangerous goods
5	Fire	Construction and operational phase	Possible damage to property and injury/loss of human life	Minimal to moderate (environmental degradation)	High	Very low	High	Installation of firefighting facilities
6	Terrorist attacks	Construction and operational phase	Possible damage to property and injury/loss of human life	Minimal to moderate (environmental degradation)	High	Very low	High	Tight security measures within the project site
7	Construction related accidents	Construction phase	Possible damage to property and injury/loss of human life	Minimal to moderate (environmental degradation)	High	Very low	High	Follow health and safety regulations

Source: JICA Study Team

Risk Assessment Conclusions

As indicated in the FMEA analysis, a number of individual events would need to occur in near simultaneous fashion to result in potential occurrence of these risks. Individually, each event has a low probability of occurrence. When taken as a joint occurrence the probabilities are even lower. As such, only a catastrophic event would present a potential environmental hazard.

4 IMPACTS MANAGEMENT PLAN (IMP)

The Impact Mitigation Plan (IMP) presented in Table 4.1 in this chapter presents the significant impacts that may arise during the Pre-Construction, Construction, and Operational Phases of the proposed North South Commuter Rail Project.Also discussed in the matrices are the responsible entities who will manage the identified impacts.

Table 4.1 Impact Management Plan

Project Phase / Environmental Aspect (Project Activity Which Will Likely Impact the Environmental Component)	**Environmental Component Likely to be Affected**	**Potential Impact**	**Options for Prevention or Mitigation or Enhancement**	**Responsible Entity**	**Cost**	**Guarantee/ Financial Arrangements**
I. PRECONSTRUCTION AND CONSTRUCTION PHASE						
THE LAND						
Earthworks (excavations for foundations; cut and fill; land grading, etc.)	**Topography**	Alteration of topography	• Depot area must be re-graded to match the original topography	DOTC PMO Contractor	To be included in the project cost to be finalized during the Detailed Engineering Design (DED)	EGF/Contractor's budget will be tapped for compensation of damages resulting from accidents/ untoward incidents
	Soil	Soil erosion	• Use of silt fences and sediment traps, cover exposed earth especially before heavy rains are expected, benching of cuts, use of sediment basins • Provision of surface water runoff drainage systems • Limit stockpile height up to 2 m high only • Minimize removal of vegetation cover as much as possible • Plan earthwork activities (e.g. excavation, cutting and filling) while considering weather conditions (rainy season)	DOTC PMO Contractor	Included in the contractor's service fee	EGF/Contractor's budget will be tapped for compensation of damages resulting from accidents/ untoward incidents
	Soil	Soil contamination due to oil or lubricant spills	• Provide proper construction machines and heavy vehicles and maintain them properly	DOTC PMO Contractor	To be included in the contractor's service fee on	EGF/Contractor's budget will be tapped for

Table 4.1 Impact Management Plan						
Project Phase / Environmental Aspect (Project Activity Which Will Likely Impact the Environmental Component)	**Environmental Component Likely to be Affected**	**Potential Impact**	**Options for Prevention or Mitigation or Enhancement**	**Responsible Entity**	**Cost**	**Guarantee/ Financial Arrangements**
			• Oil and grease traps in the drainage system • Establish and implement health and safety management plan and emergency and contingency plan in case of spills		health, safety and environmental management	compensation of damages resulting from accidents/ untoward incidents
	People (Health and Safety of Workers and nearby communities)	Worker and community exposure to health and safety hazards due to working in areas with contaminated soils and/or excavation of such soils (Meycauayan dumpsite and RAMCAR battery site)	• Establish and implement specifications for worker safety, and proper disposal of excavated materials • Further study of soil to verify extent of contamination based on evaluation by DENR EMB (RAMCAR battery site) • Disposal of excavated soil (from Meycauayan dumpsite and RAMCAR battery site) in a registered landfill operator	DOTC PMO Contractor	To be included in the project cost to be finalized during the DED	EGF/Contractor's budget will be tapped for compensation of damages resulting from accidents/ untoward incidents
Excess soil for disposal from earthwork activities Demolition of existing railway structures	Solid Waste	Generation of solid waste	• Submission and implementation of Solid Waste Management Plan as part of contractors' engagement • Recycling of wastes including soil, as much as possible • Use of leftover concrete and metals for suitable alternative projects	DOTC PMO Contractor	To be included in the project cost to be finalized during the DED	EGF/Contractor's budget will be tapped for compensation of damages resulting from accidents/ untoward incidents

Table 4.1 Impact Management Plan

Project Phase / Environmental Aspect (Project Activity Which Will Likely Impact the Environmental Component)	**Environmental Component Likely to be Affected**	**Potential Impact**	**Options for Prevention or Mitigation or Enhancement**	**Responsible Entity**	**Cost**	**Guarantee/ Financial Arrangements**
			• Proper sorting of waste for disposal and designation of appropriate temporary storage area • Disposal of non-recyclable wastes by a licensed contractor			
Construction / Civil Works Liquefaction Ground subsidence Ground shaking/ground rupture	• Solid Waste • People (Health and Safety)	• Generation of solid waste; Land and water contamination; aesthetic impacts; spread of diseases	• Submission and implementation of Solid Waste Management Plan as part of contractors' engagement • Provision of waste bins to avoid dispersal of litter and regular site maintenance duties • Regular collection, transportation and disposal of wastes to minimize the attraction of vermin, insects and pests	DOTC PMO Contractor	To be included in the contractor's service fee on health, safety and environmental management	EGF/Contractor's budget will be tapped for compensation of damages resulting from accidents/ untoward incidents
	Liquefaction	• Loss of soil strength, settlement of soil, lateral spreading, bearing failures, floatation of embedded structures, damage to overlying structures, in the event of an earthquake	• Consider liquefaction hazards in the final design of the structures	DOTC PMO Contractor	To be included in the project cost to be finalized during the DED	EGF/Contractor's budget will be tapped for compensation of damages resulting from accidents/ untoward incidents
	Ground	• Subsidence due to soft	• Design of structures and facilities	DOTC PMO	To be included in the project cost to	EGF/Contractor's budget will be

Table 4.1 Impact Management Plan

Project Phase / Environmental Aspect (Project Activity Which Will Likely Impact the Environmental Component)	**Environmental Component Likely to be Affected**	**Potential Impact**	**Options for Prevention or Mitigation or Enhancement**	**Responsible Entity**	**Cost**	**Guarantee/ Financial Arrangements**
	subsidence	soil at depot area	to withstand ground subsidence	Contractor	be finalized during the DED	tapped for compensation of damages resulting from accidents/ untoward incidents
	Ground shaking/ground rupture	• Damage to components of the construction work	• Undertake site-specific seismic risk characterization and estimates of how the ground beneath the structure will move • Design and construct structures that will address seismic hazards (adopt 0.4 g value of acceleration speed of peak value for seismic force)	DOTC PMO Contractor	To be included in the project cost to be finalized during the DED	EGF/Contractor's budget will be tapped for compensation of damages resulting from accidents/ untoward incidents
Removal of trees and other vegetation	Flora	• Narra trees along the alignment form Caloocan to Tutuban and at the Valenzuela depot site may be affected and removed during the clearing operation • Other trees, such as fruit bearing trees, along the alignment will be removed	• Coordination with concerned agencies or groups for relocation sites of earth-balled trees. • Provision of corresponding number of tree seedlings will be provided by the proponent in replacement of trees to be cut. • Monitoring of survival of trees planted • Provision of compensation to owners of non-timber species such as fruit trees that are	DOTC PMO Contractor	To be included in the project cost to be finalized during the DED Tree seedlingand monitoring cost Php 20,000/ha	EGF/Contractor's budget will be tapped for compensation of damages resulting from accidents/ untoward incidents

Table 4.1 Impact Management Plan

Project Phase / Environmental Aspect (Project Activity Which Will Likely Impact the Environmental Component)	**Environmental Component Likely to be Affected**	**Potential Impact**	**Options for Prevention or Mitigation or Enhancement**	**Responsible Entity**	**Cost**	**Guarantee/ Financial Arrangements**
			removed (to be included in the RAP)			
Development of Depot site	Wetland Habitat	• Loss of small swampy area used for a few migratory and resident birds	• To offset the lost wetland, the proponent will seek assistance from the Society for the Conservation of Philippine Wetlands (SCPW) to identify an adjacent wetland area that the proponent will conserve and enhance so that this area will attract the birds and stay here instead. • Conduct seasonal bird count to monitor the bird population in the surrogate wetland area established.	DOTC PMO Contractor	To be included in the project cost to be finalized during the DED	EGF/Contractor's budget will be tapped for compensation of damages resulting from accidents/ untoward incidents
THE WATER						
Land development, earthworks and civil works	Flooding	• Aggravation of existing flooding problems	• Sufficient and effective drainage systems shall be incorporated in the designs. The proponent shall coordinate with DPWH and LGUs how to integrate the drainage systems into the existing canals/culverts. • NSCR structures will be designed to have a clearance of	DOTC PMO Contractor	Php 30 M (cost sharing with LGU)	EGF/Contractor's budget will be tapped for compensation of damages resulting from accidents/ untoward incidents

Table 4.1 Impact Management Plan

Project Phase / Environmental Aspect (Project Activity Which Will Likely Impact the Environmental Component)	**Environmental Component Likely to be Affected**	**Potential Impact**	**Options for Prevention or Mitigation or Enhancement**	**Responsible Entity**	**Cost**	**Guarantee/ Financial Arrangements**
			above established flood level and discharges which will be established and included in the detailed design.			
Demolition, excavation and bore piling activities	Water Quality	• Increase in suspended sediments in the receiving water	• Implementation of appropriate erosion control measures particularly during high precipitation periods. • Soil/sediments/debris and other excavated materials shall be hauled out from the site immediately and disposed by accredited waste handlers	DOTC PMO Contractor	To be included in the project cost to be finalized during the DED	EGF/Contractor's budget will be tapped for compensation of damages resulting from accidents/ untoward incidents
Domestic wastewater generation	Water Quality	• Pollution of receiving water bodies	• Portable sanitary facilities (portalets) will be installed to collect wastewater, which will be collected and disposed by accredited waste handles	DOTC PMO Contractor	To be included in the project cost to be finalized during the DED	EGF/Contractor's budget will be tapped for compensation of damages resulting from accidents/ untoward incidents
Fuel and oil leaks from vehicles and other equipment	Water Quality	• Pollution of receiving water bodies	• Equipment and machinery shall be regularly checked for fuel and oil leaks. • During repair of equipment and machinery, containers/drip trays shall be used to collect leakage. • Any spilled or spent oil will be	DOTC PMO Contractor	To be included in the project cost to be finalized during the DED	EGF/Contractor's budget will be tapped for compensation of damages resulting from accidents/ untoward incidents

Table 4.1 Impact Management Plan						
Project Phase / Environmental Aspect (Project Activity Which Will Likely Impact the Environmental Component)	**Environmental Component Likely to be Affected**	**Potential Impact**	**Options for Prevention or Mitigation or Enhancement**	**Responsible Entity**	**Cost**	**Guarantee/ Financial Arrangements**
			collected, stored properly and disposed by accredited waste haulers.			
THE AIR						
• Earthmoving, demolition and earth-balling • Operation of equipment, machineries and service vehicles	Air Quality	• Generation of dusts and particulate matter, and gas emissions	• Regular wetting of ground soil in the construction site • Regular preventive maintenance of heavy equipment and service vehicle • Construction sites must be fenced for safety and security reasons	DOTC PMO Contractor	To be included in the project cost to be finalized during the DED	EGF/Contractor's budget will be tapped for compensation of damages resulting from accidents/ untoward incidents
		• Noise Pollution	• Installation of control devices such as mufflers and noise suppressors to all construction equipment • Regular maintenance of heavy equipment, construction machinery • Provision of temporary noise barriers such as galvanized iron shields, particularly in noise-sensitive areas such as churches, schools, and hospitals in the immediate vicinity of the construction area.	DOTC PMO Contractor	To be included in the project cost to be finalized during the DED	EGF/Contractor's budget will be tapped for compensation of damages resulting from accidents/ untoward incidents

Table 4.1 Impact Management Plan

Project Phase / Environmental Aspect (Project Activity Which Will Likely Impact the Environmental Component)	**Environmental Component Likely to be Affected**	**Potential Impact**	**Options for Prevention or Mitigation or Enhancement**	**Responsible Entity**	**Cost**	**Guarantee/ Financial Arrangements**
			• Construction workers must be provided with (PPE • Scheduling of high noise generating activities during daytime • Construction sites must be fenced for safety and security reasons			
		• Increase in ground vibration level due to operation of heavy equipment and machineries	• Use of construction machinery with minimal vibration generation • Identify nearby sensitive receptors likely to be affected and monitor vibration levels	DOTC PMO Contractor	To be included in the project cost to be finalized during the DED	EGF/Contractor's budget will be tapped for compensation of damages resulting from accidents/ untoward incidents
THE PEOPLE						
Land acquisition for ROW and involuntary Resettlement for PAPs	PEOPLE (Project Affected Persons or PAPs)	• Displacement of residents and few commercial establishments along the proposed alignment	• Implementation of Resettlement Action Plan (RAP) to ensure that affected households and establishments are provided a proper relocation area and/or justly compensated.	DOTC PMO Contractor	To be included in the Final RAP Budget	RAP Budget can be adjusted to accommodate changes after DED
		• Improvement of living conditions	• Provision of housing and amenities for PAPs of ISF • Livelihood and Income Restoration for PAPs of ISF and Vulnerable Persons (Women-	DOTC PMO Contractor	To be included in the Final RAP Budget	RAP Budget can be adjusted to accommodate changes after DED

Table 4.1 Impact Management Plan

Project Phase / Environmental Aspect (Project Activity Which Will Likely Impact the Environmental Component)	**Environmental Component Likely to be Affected**	**Potential Impact**	**Options for Prevention or Mitigation or Enhancement**	**Responsible Entity**	**Cost**	**Guarantee/ Financial Arrangements**
			headed households, Elderly, Persons with disabilities, Poor)			
Land acquisition for ROW	Historical/cultural heritage	• Loss of old PNR stations	• Implement recommendations of NHCP in the detailed design to preserve and integrate the old PNR stations • Implement the concept design of Tutuban Station to preserve the historical structures and integrate it into the development design	DOTC PMO Contractor	To be included in the project cost to be finalized during the DED	EGF/Contractor's budget will be tapped for compensation of damages resulting from accidents/ untoward incidents
	Local economy (Employment and Livelihood)	• Commercial establishments and small vendors may experience temporary disturbance during construction. • Decline or eventual loss of business in affected areas.	• Implementation of RAP including temporary relocation of ambulant vendors, replacement cost for the losses of affected business establishments and alternative livelihood programs in coordination with the LGUs and other government agencies	DOTC PMO Contractor	To be included in the project cost to be finalized during the DED	EGF/Contractor's budget will be tapped for compensation of damages resulting from accidents/ untoward incidents
		• Generation of temporary employment	• The project proponent will mandate contractor to give priority to the local residents.	DOTC PMO Contractor	To be included in the project cost to be finalized during the DED	EGF/Contractor's budget will be tapped for compensation of damages resulting from accidents/ untoward incidents
• Mobilization of workers, equipment	Traffic Management	• Traffic Condition	• Strict implementation of Traffic Management Plan (TMP) that	DOTC PMO	Php 300, 000.00	EGF/Contractor's budget will be

Table 4.1 Impact Management Plan

Project Phase / Environmental Aspect (Project Activity Which Will Likely Impact the Environmental Component)	**Environmental Component Likely to be Affected**	**Potential Impact**	**Options for Prevention or Mitigation or Enhancement**	**Responsible Entity**	**Cost**	**Guarantee/ Financial Arrangements**
and construction materials, • Transport of demolition debris and construction materials to and from the construction site.			details the activities to adequately manage traffic flow • The TMP will be properly coordinated and approved by the MMDA and/or LGUs concerned prior to implementation of activities in the areas concerned	Contractor		tapped for compensation of damages resulting from accidents/ untoward incidents
Civil Works	Occupational Health and Safety	• Increased risk of accidents due to improper work ethics, which may threat health and safety of workers and local residents.	• Provide appropriate personal protective equipment (PPE) to all construction workers • Strict use of PPE by construction workers • Implement Occupational Health and Safety Management Plan • Put up fences / enclosures around the project site to keep away unauthorized persons • Provide access points for residents in selected areas only • Provide First Aid Stations at construction sites with resident doctors and nurses	DOTC PMO Contractor	Php 7, 000.00 per person (for PPE) Included in the contractor's service fee	EGF/Contractor's budget will be tapped for compensation of damages resulting from accidents/ untoward incidents
		• Increased risk to communicable and infectious diseases	• Construction workers submit Medical certificates for fitness to work. • Construct sanitary facilities	DOTC PMO Contractor	Included in the contractor's service fee on health, safety and environmental	EGF/Contractor's budget will be tapped for compensation of damages resulting

Table 4.1 Impact Management Plan

Project Phase / Environmental Aspect (Project Activity Which Will Likely Impact the Environmental Component)	**Environmental Component Likely to be Affected**	**Potential Impact**	**Options for Prevention or Mitigation or Enhancement**	**Responsible Entity**	**Cost**	**Guarantee/ Financial Arrangements**
			(toilets, bathrooms, kitchens) at all construction sites. • Implement Occupational Health and Safety Management Plan prior to commencement of work.		management	from accidents/ untoward incidents
II. OPERATION PHASE						
THE LAND						
Use of railway transportation	Land use	• More efficient and safer transportation facility due to reduced travel time, reduced traffic congestion, improved traveler safety and reduced energy consumption. • Increase in land development along or near the corridor	• Identification of future land use of surrounding areas that will result to a significant increase in commercial activities especially near train stations, to guide urban planners of the LGUs to adapt future development plans accordingly.	LGUs	N/A	N/A
Maintenance Works at the Depot site	Soil	• Soil contamination resulting from leaks of lubricants agents and used oil.	• Provide proper machines and equipment and maintain them properly. • Store bulk waste oils and lubricants in impermeable area and with appropriate secondary containment. • Prepare a procedure manual for	DOTC PMO	Php 50,000.00 / year. Part of the health, safety and environmental management plan and budget of the proponent	EGF will be tapped for compensation of damages resulting from accidents/ untoward incidents

Table 4.1 Impact Management Plan						
Project Phase / Environmental Aspect (Project Activity Which Will Likely Impact the Environmental Component)	**Environmental Component Likely to be Affected**	**Potential Impact**	**Options for Prevention or Mitigation or Enhancement**	**Responsible Entity**	**Cost**	**Guarantee/ Financial Arrangements**
			workers at the depot to prevent oil and chemical spills and also provide regular training to workers to keep working and surrounding environment in good condition. • Emergency and contingency plan in case of spills and health and safety management plan must be in place.			
Passengers Movement	Solid wastes from staff and patrons	• Land and water contamination; aesthetic impacts; spread of diseases	• Proper segregation of wastes • Provision of waste bins that will allow proper waste segregation • Use of sealable waste bins to avoid attraction of vermin, insects and pests, • Regular collection and transportation of wastes for recycling or disposal at licensed facilities • Formulation and implementation of policies on solid waste minimization and solid waste management for patrons and staff	DOTC PMO	Php100,000.00/ year. Part of Maintenance Cost of the Facilities	EGF will be tapped for compensation of damages resulting from accidents/ untoward incidents
Movement of trains	Ground subsidence	• Subsidence due to soft soil at depot area	• Regular monitoring and measurement of level of ground subsidence	DOTC PMO	Part of the regular operation and maintenance and	N/A

Table 4.1 Impact Management Plan

Project Phase / Environmental Aspect (Project Activity Which Will Likely Impact the Environmental Component)	**Environmental Component Likely to be Affected**	**Potential Impact**	**Options for Prevention or Mitigation or Enhancement**	**Responsible Entity**	**Cost**	**Guarantee/ Financial Arrangements**
					budget of the proponent	
	Liquefaction	• Loss of soil strength, settlement of soil, lateral spreading, bearing failures, floatation of embedded structures, damage to overlying structures, in the event of an earthquake	• Consider liquefaction hazards in the final design of the structures	DOTC PMO	Part of the regular operation and maintenance and budget of the proponent	N/A
	Ground shaking/ground rupture	• Damage to infrastructure in the event of an earthquake	• Conduct regular check on integrityof structures; reinforce, if necessary	DOTC PMO	Part of the regular operation and maintenance and budget of the proponent	N/A
THE WATER						
Maintenance activities in the railway stations and depot	Water Quality	• Pollution of receiving waters bodies	• Wastewater with oil shall be separately collected and disposed for treatment. • A wastewater treatment facility (WTF) with oil removal will be constructed at the Depot. • Draw up a Procedure Manual for Workers at the Depot to prevent oil spills in EMP	DOTC PMO	• Construction Cost of WFT will be included in the Project Cost to be finalized during the DED. • Php 30, 000 .00/ quarter (overhead cost	EGF will be tapped for compensation of damages resulting from accidents/ untoward incidents
Domestic wastewater generation	Water Quality	• Pollution of receiving water bodies	• Sanitary facilities at the stations will be installed to collect	DOTC PMO	• Php 20, 000 / quarter	EGF will be tapped for compensation of

Table 4.1 Impact Management Plan						
Project Phase / Environmental Aspect (Project Activity Which Will Likely Impact the Environmental Component)	**Environmental Component Likely to be Affected**	**Potential Impact**	**Options for Prevention or Mitigation or Enhancement**	**Responsible Entity**	**Cost**	**Guarantee/ Financial Arrangements**
			wastewater, which will be collected and disposed by accredited waste handles			damages resulting from accidents/ untoward incidents
THE AIR						
• Operation of service vehicles Operation of standby generator set	Air quality	• Air Pollution	• Proper preventive maintenance of service vehicles and equipment • Use of cleaner fuel for the generator sets	DOTC PMO	N/A	N/A
Operation of Trains	Air quality	• Air Pollution	• Reduction of pollutants from vehicles	DOTC PMO	N/A	N/A
	Acoustic environment	• Occurrence of higher noise level	• 2 m noise barrier will be considered for the class AA area, especially sensitive facilities such as school, hospital, etc. are located within 30 meter distance • Detailed survey in measuring the distance from sensitive area should be carried out at detail design stage. • Proper maintenance of structures and tracks, such as regular rail grinding, must be conducted	DOTC PMO	To be included in the project cost to be finalized during the DED	EGF will be tapped for compensation of damages resulting from accidents/ untoward incidents
	Ground vibration	• Generation of Vibration	• Design of rail tracks must	DOTC PMO	To be included in	EGF will be tapped

Table 4.1 Impact Management Plan						
Project Phase / Environmental Aspect (Project Activity Which Will Likely Impact the Environmental Component)	**Environmental Component Likely to be Affected**	**Potential Impact**	**Options for Prevention or Mitigation or Enhancement**	**Responsible Entity**	**Cost**	**Guarantee/ Financial Arrangements**
			incorporate measures to reduce level of vibration generated by the railway during train operations, such as use of long rail, sleeper with the anti-vibration mat • Proper maintenance of trains structures and tracks, such as regular rail grinding, must be conducted • Regular reconditioning of train and its components, such as suspension system, brakes, wheels and slip-slide detectors		the project cost to be finalized during the DED Part of the regular operation and maintenance and budget of the proponent	for compensation of damages resulting from accidents/ untoward incidents
Climate Change	Climate	• Accelerated structural fatigue and materials failure • Greater demands on the construction, operation and maintenance of flood control and drainage structures.	• Design in making infrastructure robust or resilient to the effects of climate change should be taken into consideration • Improvement of current drainages along the alignment to be resilient to climate change	DOTC PMO	To be included in the project cost to be finalized during the DED	EGF will be tapped for compensation of damages resulting from accidents/ untoward incidents
	Climate	• Reduction of Greenhouse Gases	• GHG emission in 2020 will be reduced by 97,000 t-CO2 / year by starting the operation of NSCR	DOTC PMO	N/A	N/A
THE PEOPLE						

Table 4.1 Impact Management Plan

Project Phase / Environmental Aspect (Project Activity Which Will Likely Impact the Environmental Component)	**Environmental Component Likely to be Affected**	**Potential Impact**	**Options for Prevention or Mitigation or Enhancement**	**Responsible Entity**	**Cost**	**Guarantee/ Financial Arrangements**
Railway Operation	Traffic Management	• Traffic congestion near railway stations	• Designate / Provide for loading and unloading areas • Fielding of traffic enforcers near the stations • Provision for tricycle / jeepney/bus terminals	DOTC PMO LGUs	N/A	N/A
	Local economy (Employment and Livelihood)	• Increased economy along NSCR route	• Ensure efficiency of NSCR system in order to attract passengers and increase ridership • Encourage commercial development at Stations	DOTC PMO	N/A	N/A
• Passengers, NSCR Employees at Stations • Maintenance work at Depot	Occupational Health and Safety	• Risk of accidents at the stations and depot	• Strict implementation of precautionary, safety and security measures	DOTC PMO	Included in the health, safety and environmental management plan and budget of the proponent	EGF will be tapped for compensation of damages resulting from accidents/ untoward incidents
		• Risk of communicable and infectious diseases	• Sanitary facilities or utilities to maintain sanitary and healthy conditions at all stations and depot.	DOTC PMO	Included in the health, safety and environmental management plan and budget of the proponent	EGF will be tapped for compensation of damages resulting from accidents/ untoward incidents

Source: JICA Study Team

5 SOCIAL DEVELOPMENT PLAN AND IEC IMPLEMENTATION

The Social Development Plan (SDP) Framework is intended for formulation in coordination with the City and Municipal Planning and Development Officers of the cities and municipalities where NSCR will pass through, in order to derive from the respective local SDPs of the LGUs, their programs and projects for people's livelihood, health and environment. The NSCR SDP should be aligned with the local SDP, incorporate those programs and projects that prevent, mitigate or enhance the project's negative and positive impacts, especially those relating to the livelihoods, health and environment of the communities affected by the project. The formulation of the SDP will involve also those government agencies with mandates to deliver services in social development such as Department of Health (DOH), DENR, Department of Education (DepEd), Department of Trade and Industry (DTI), Philippine National Police, etc. It should also include civil society such as NGOs and People Organizations. The cost estimates shall be prepared once the specific projects have been identified and processed in consultation with the LGUs and sectors concerned. DOTC shall share in the cost of the selected projects. The Social Development Framework is shown in Table 5.1.

The Information, Education and Communication (IEC)Plan Framework will be undertaken to encourage the participation and cooperation not only of the affected households but a broader sector of stakeholders and facilitate the establishment of support linkages in the implementation of the NSCR project, from the Pre-Construction Stage through the Completion Stage. The IEC will also inform the stakeholders about the progress of the project and provide feedback to the proponent regarding the concerns raised issues and by the stakeholders during the project progress. The IEC methods shall include individual methods (key informant interviews), group methods (focus group discussions), and multi-media (printand social media). The IEC should also inculcate value formation by making members of the community aware of their responsibilities as stakeholders. The DOTC shall also engage the services of local teachers and community organizers in planning, implementing and conducting the IEC. The IEC Framework is shown in Table 5.2.

Table 5.1 Social Development Framework for the North South Commuter Rail Project

	Concern	Responsible Community Member/ Beneficiary	Government Agency/ Non-Government Agency and Services	Proponent	Indicative Timeline	Source of Fund
1	Preparation of Resettlement Action Plan (RAP)	• Barangay Chairman; and • Presidents of Homeowners Association	• DOTC • NHA • LGU	• DOTC – PMO	• Detailed Engineering Design (DED) i.e., After conduct of Parcellary Survey	• Part of DED Consultancy budget
2	Relocation of informal settlers	• Barangay Chairman; and • Presidents of Homeowners Association	• DOTC • NHA • LGUHousing Office • DSWD • DPWH	• DOTC – PMO	• Pre-Construction Stage	• DOTC • NHA • Site development cost and other basic facilities can be included in DED budget
3	Gender Responsive Livelihood Training Program • Skills training for construction work • Skills training for handicraft making • Skills training for food preparation, etc.	• Barangay Chairman; • Barangay Kagawad for Livelihood; • Presidents of Homeowners Association; and • Officers of Women's organizations	• LGU Livelihood Office • DSWD • TESDA	• DOTC PMO	• After ECC Issuance	• LGU Livelihood Office • TESDA
4	Formation of/Support toVendors Organizations	• Barangay Chairman; and • Leaders of Vendors Organizations	• DOTC • DTI • LGU	• DOTC PMO	• Prior to RAP Implementation	• LGU Livelihood Office
5	Health and Safety	• Barangay Chairman; and • Barangay Kagawad for Health and Safety	• City Health Office; • DSWD; and • Barangay Health Centers	• DOTC PMO	• Pre-Construction, Construction, Operation Stage	• LGU Health Office

Table 5.1 Social Development Framework for the North South Commuter Rail Project

Concern		Responsible Community Member/Beneficiary	Government Agency/ Non-Government Agency and Services	Proponent	Indicative Timeline	Source of Fund
6	Environment and Sanitation	• Barangay Chairman; and • Barangay Kagawad for Environment and Sanitation	• LGU and CENRO; and • DENR RegionIII and NCR	• DOTC PMO	• Pre-Construction, Construction, Operation Stage	• LGU CENRO
7	Peace and Order	• Barangay Chairman; • Barangay Kagawad for Peace and Order; and • Homeowners Association Sergeant-at-Arms	• LGU • PNP	• DOTC PMO	• Pre-Construction, Construction, Operation Stage	• LGU&PNP
8	Spiritual	• Barangay Chairman; • Parish Pastoral Council; • President Homeowners Association; • Leaders of other religious groups	• Parish Priests • LGU	• DOTC PMO	• Pre-Construction, Construction, Operation Stage	• LGU

Source: JICA Study Team

Table 5.2 Information, Education and Communication Framework for the North South Commuter Rail Project

Target Sector	Major Topics	IEC Scheme/Strategy Methods	Information Medium	Indicative Timelines and Frequency	Indicative Cost
LGUs along railway alignment	• Presentation of Project StatusComposition: SC	• Group Meeting	• Slide Presentation • Minutes of meetings	• Quarterly during Detailed Engineering Design (DED) or as needed	• P60,000/yr
	• Presentation of Work ProgressComposition	• Group Meeting	• Slide Presentation • Minutes of meetings	• Monthly during DED	• P40,000.00
Affected Sectors: 1. Barangay Chairman of Project-affected barangays	• Presentation of Project Status – DED Consultant	• Group Meeting	• Audio-Visual Presentation • Slide Presentation	• At the onset of the updating of Resettlement Action Plan, at least six (6) months prior to R-O-W Acquisition	• P50,000.00
2. LIACs	• Presentation of Project Status; and • Presentation of valuation methodology and next steps for R-O-W Acquisition	• Group Meeting	• Slide Presentation • Multi-sectoral Cluster meetings	• During updating of RAP and every month thereafter until completion of R-O-W Acquisition	• P120,000.00
3. Land and Structure owners	• Presentation of Project Status; and • Presentation of valuation methodology and next steps for R-O-W Acquisition	• Group Meeting	• Slide Presentation • Multi-sectoral Cluster meetings	• During updating of RAP and every month thereafter until completion of R-O-W Acquisition	• P120,000.00
4. Vendors	• Presentation of Project Status	• Group Meeting	• Slide Presentation • Multi-sectoral Cluster meetings	• During updating of RAPand every month thereafter until RAP is implemented	• P100,000.00
5. Informal Settlers	• Presentation of Project Status	• Group Meeting	• Slide Presentation • Multi-sectoral Cluster meetings	• During updating of RAPand every month thereafter until RAP is implemented	• P100,000.00

Source: JICA Study Team

6 ENVIRONMENTAL COMPLIANCE MONITORING

6.1 Self-Monitoring Plan

The Self-Monitoring Plan shows the monitoring that needs to be accomplished with regard to NSCR compliance to the environmental laws (PEISS, Air Quality, Water Quality and Solid Waste Management). The Self-Monitoring Report shall be submitted to EMB as in accordance with DAO No. 2003-27, on a quarterly basis.

Table 6.1 Table 6.1shows the Self-Monitoring Plan for the North South Commuter Rail Project during the Pre-Construction, Construction, and Operational Phases of the project.

Table 6.1 Environmental Monitoring Plan (EMoP) for the North South Commuter Rail Project

Key Environmental Aspects per Project Phase	Potential Impacts per Environmental Sector	Parameter to be Monitored	Sampling Methodology and Measurement Plan			Lead Person	Annual Estimated Cost	Environmental Quality Performance Levels (EQPL) Management Scheme					
								EQPL Range			Management Measures		
			Method	Frequency	Location			Alert	Action	Limit	Alert	Action	Limit
I. PRE-CONSTRUCTION PHASE													
THE PEOPLE													
Land acquisition for ROW and involuntary Resettlement forPAPs	Displacement of residents and few commercial establishments along the proposed alignment	Compensation for affected land, structures and improvements	Consultation Meeting and Survey with PAPs	Monthly until ROW is fully acquired	Affected barangays	DOTC PMO	To be determined and finalized during the RAP updating in the Detailed Engineering Design Phase	N.A.			N.A.		
	Improvement of living conditions	Resettlement of Informal Settlers Families (ISFs) to the relocation sites	Consultation Meeting and/or Survey with the PAPs	Semi-annually until the end of livelihood restoration program	Affected barangays	DOTC PMO,NHA	To be determined and finalized during the RAP updating in the Detailed Engineering Design Phase	N.A.			N.A.		
II. CONSTRUCTION PHASE													
THE LAND													
Earthworks (excavations for foundations; cut and fill; land grading, etc.)	Soil contamination due to oil on lubricant spill	Oil spill	Ocular inspection	Weekly Immediately after the spills	All construction sites	PCO of the Contractor and DOTC PMO	To be included in engineering cost	N.A.	N.A.		N.A.		
	Worker and community exposure to health and safety hazards due to working in areas with excavation of such soils (Meycauayan dumpsite and RAMCAR battery site)	Proper removal and disposal of excavated soil (from Meycaucyan dump site and RAMCAR battery site	Checking compliance to RA 9003 – Ecological Solid Waste Management Act and RA 6969 – Toxic and Hazardous Substances	N.A.	Meycauayan dumpsite and RAMCAR battery site	PCO of the Contractor and DOTC PMO	PhP 200,000	POST-ECC Agreement between DOTC, Contractor and EMB, as indicated in Annex 2-20 of the RPM for DAO 2003-30	N.A.		POST-ECC Agreement between DOTC, Contractor and EMBas indicated in Annex 2-20 of the RPM for DAO 2003-30		
Construction/ Civil Works/ Liquefaction / Ground Subsidence/ Ground shaking/ Ground rupture	Generation of solid waste; Land and water contamination; aesthetic impacts; spread of diseases	Proper waste management and disposal	Checking compliance to RA 9003 – Ecological Solid Waste Management Act and RA 6969 – Toxic and Hazardous Substances	Weekly	All construction sites	PCO of the Contractor and DOTC PMO	To be included in engineering cost	POST-ECC Agreement between DOTC, Contractor and EMB, as indicated in Annex 2-20 of the RPM for DAO 2003-30	N.A.		POST-ECC Agreement between DOTC, Contractor and EMBas indicated in Annex 2-20 of the RPM for DAO 2003-30		
	Ground Subsidence	Level of ground subsidence	Measurement of level	Monthly	Valenzuela Depot	PCO of the Contractor and DOTC PMO	To be included in engineering cost	N.A.	N.A.		N.A.		
Removal of trees and other vegetation during the clearing operation	Narra trees along the alignment form Caloocan to Tutuban and at the Valenzuela depot site may be affected and removed during the clearing operation Other trees such as fruit bearing trees along the	• Number of trees cut • Number of trees replaced • Survival rate of the species (e.g., Nara) introduced. • Provision of corresponding number of tree	Ocular inspection	Number of trees cut and replaced, Survival rate of the species introduced: Monthly. Provision of number of tree	Designated tree planting site and/or reforestation area designated by the DENR-EMB Region III and NCR	PCO of the Contractor and DOTC PMO	To be determined and finalized implementation of the project based on current prices of seedlings	POST-ECC Agreement between DOTC, Contractor and EMB, as indicated in Annex 2-20 of the RPM for DAO 2003-30	85-90% survival rate of the trees planted as prescribed by the DENR-EMBRegion III and NCR		POST-ECC Agreement between DOTC, Contractor, DENR-EMB Region III and NCR		

Table 6.1 Environmental Monitoring Plan (EMoP) for the North South Commuter Rail Project

Key Environmental Aspects per Project Phase	Potential Impacts per Environmental Sector	Parameter to be Monitored	Sampling Methodology and Measurement Plan			Lead Person	Annual Estimated Cost	Environmental Quality Performance Levels (EQPL) Management Scheme					
								EQPL Range			Management Measures		
			Method	Frequency	Location			Alert	Action	Limit	Alert	Action	Limit
	alignment will be removed.	seedlings.		seedlings: Monthly									
Development of Depot site	Loss of small swampy area used for a few migratory and resident birds	Seasonal bird count	Ocular Survey	Quarterly	Adjacent offset wetland of the Valenzuela depot	DOTC PMO, The Society for the Conservation of Philippine Wetlands (SCPW)	To be detained in preparation of Restoration Plan. (Note: monitoring cost is P20,000.00)	POST-ECC Agreement between DOTC, Contractor and EMB, as indicated in Annex 2-20 of the RPM for DAO 2003-30		N.A.	POST-ECC Agreement between DOTC and EMB as indicated in Annex 2-20 of the RPM for DAO 2003-30		
THE WATER													
Demolition, excavation and bore piling activities	Increase in suspended solid of receiving water	pH, DO, Oil & Grease, BOD, Fecal Coliform/ Total Coliform, and TSS	Water Sampling in accordance with the prescribed procedures described in DAO 34-1990 and EMB-DENR Manual for Ambient Water Quality Monitoring Volume I	Quarterly	At sampling locations in Guiguinto River, Santol (Balagtas) River, Bocaue River, Marilao River, Meycauayan River, Valenzuela Depot, Tullahan River, and Estero de Maypajo.(8 points)	PCO of the Contractor and DOTC PMO	Total sampling cost shall be determined during implementation of the project (Note: sampling cost per monitoring station P50,000.00)	POST-ECC Agreement between DOTC, Contractor and EMB, as indicated in Annex 2-20 of the RPM for DAO 2003-30		For Class "C" freshwater pH – 6.5 to 8.5 DO – 5.0 mg/L Oil & Grease – 2.0 mg/L BOD – 7.0 mg/L TSS – not more than 30g/L increase	POST-ECC Agreement between DOTC, Contractor, EMB, and PMO as indicated in Annex 2-20 of the RPM for DAO 2003-30		
Domestic wastewater generation.	Pollution of receiving water bodies												
Fuel and oil leaks from vehicles and other equipment	Pollution of receiving water bodies.												
THE AIR													
•Earthmoving, demolition and earth-balling •Operation of equipment, machineries and service vehicles	Generation of dusts and particulate matter, and gas emissions.	TSP, $PM_{2.5}$, PM_{10}, NO_2, SO_2,	Air Quality sampling using the following: 1. TSP – High Volume Gravimetric Method; 2. $PM_{2.5}$ – High Volume w/2.5 micron particle size iblet, Gravimetric 3. PM_{10} – High Volume w/ 10 micron particle-size inlet, Gravimetric 4. SO_2 – Pararosaniline Method; 5. NO_2 – Griess Saltzman Reaction	Quarterly. Immediately based on complaints	At sampling locations at Malolos, Bocaue, Guiguinto, Valenzuela, Caloocan and Manila, Solis and Tutuban using the same sampling stations of the baseline air quality surveys.	PCO of the Contractor and DOTC PMO	Total sampling cost shall be determined during implementation of the project (Note: Cost P5,000.00 per monitoring station)	POST-ECC Agreement between DOTC, Contractor and EMB, as indicated in Annex 2-20 of the RPM for DAO 2003-30		TSP 24 hr – 230 μ/Ncm $PM_{2.5}$ 24hr – 75 μ/Ncm PM_{10} 24 hr – 150 μ/Ncm SO_2 24hr – 180 μ/Ncm NO_2 24 hr – 150 μ/Ncm	POST-ECC Agreement between DOTC, Contractor, and EMB, as indicated in Annex 2-20 of the RPM for DAO 2003-30		
•Earthmoving, demolition and earth-balling •Operation of equipment, machineries and	Noise pollution	Noise level	Noise Level monitoring using a noise level meter	Monthly Immediately based on complaints	Residential area including noise sensitive receptors in the vicinity of the construction site	PCO of the Contractor and DOTC PMO	Total sampling cost shall be determined during implementation of the project (Note: sampling cost	POST-ECC Agreement between DOTC, Contractor and EMB, as indicated in Annex 2-20 of the RPM for		For **"AA"** categorized areas (general areas) Morning (0500-0900H) – 45 dB Daytime (0800-1800H) – 50 dB	POST-ECC Agreement between DOTC, Contractor and EMBas indicated in Annex 2-20 of the RPM for DAO 2003-30		

Table 6.1 Environmental Monitoring Plan (EMoP) for the North South Commuter Rail Project

Key Environmental Aspects per Project Phase	Potential Impacts per Environmental Sector	Parameter to be Monitored	Sampling Methodology and Measurement Plan			Lead Person	Annual Estimated Cost	Environmental Quality Performance Levels (EQPL) Management Scheme					
								EQPL Range			Management Measures		
			Method	Frequency	Location			Alert	Action	Limit	Alert	Action	Limit
service vehicles							P10,000.00 per monitoring station)	DAO 2003-30		Evening (1800-2200H) – 45 dB Night Time (2200-0500H) – 40 dB For **"A"** categorized areas (general areas) Morning (0500-0900H) – 50 dB Daytime (0800-1800H) – 55 dB Evening (1800-2200H) – 50 dB Night Time (2200-0500H) – 45 dB For **"B"** categorized areas (general commercial areas) Morning (0500-0900H) – 60 dB Daytime (0800-1800H) – 65 dB Evening (1800-2200H) – 60 dB Night Time (2200-0500H) – 55 Db For **"C"** categorized areas (lightindustrial areas) Morning (0500-0900H) – 65 dB Daytime (0800-1800H) – 70 dB Evening (1800-2200H) – 65 dB Night Time (2200-0500H) – 65 Db			
•Earthmoving, demolition and earth-balling •Operation of equipment, machineries and service vehicles	Increase in ground vibration level due to operation of heavy equipment and machineries	Vibration level	Vibrationlevel monitoring using a vibration level meter	Quarterly Immediately based on complaints	Residential area including sensitive receptors in the vicinity the construction site	PCO of the Contractor and DOTC PMO	Total sampling cost shall be determined during implementation of the project (Note: Monitoring cost P10,000.00 per sampling station)	POST-ECC Agreement between DOTC, Contractor and EMB, as indicated in Annex 2-20 of the RPM for DAO 2003-30		Vibration level VL-55dB	POST-ECC Agreement between DOTC, Contractor and EMBas indicated in Annex 2-20 of the RPM for DAO 2003-30		

Table 6.1 Environmental Monitoring Plan (EMoP) for the North South Commuter Rail Project

Key Environmental Aspects per Project Phase	Potential Impacts Per Environmental Sector	Parameter to be Monitored	Sampling Methodology and Measurement Plan			Lead Person	Annual Estimated Cost	Environmental Quality Performance Levels (EQPL) Management Scheme					
								EQPL Range			Management Measures		
			Method	Frequency	Location			Alert	Action	Limit	Alert	Action	Limit
III. OPERATIONAL PHASE													
THE LAND													
Passengers Movement (Solid/domestic wastes)	Land and water contamination; aesthetic impacts; spread of diseases	Proper waste management and disposal	Checking compliance to RA 9003 – Ecological Solid Waste Management Act and RA 6969 – Toxic and Hazardous Substances	Weekly	All 10 Stations	DOTC PMO	N.A	N.A		N.A	N.A		
Maintenance Works at the Depot site	Soil contamination resulting from leaks of lubricants agents and used oil.	Proper waste management and disposal	Compliance to RA 9003 – Ecological Solid Waste Management Act and RA 6969 – Toxic and Hazardous Substances	Weekly	Depot	DOTC PMO	N.A	N.A		N.A	N.A		
Movement of trains	Ground Subsidence	Level of ground subsidence	Measurement of level	Quarterly	Depot	DOTC PMO	N.A	N.A		N.A	N.A		
Development of Depot Site	Loss of habitat for migratory and resident birds	Restoration status of replacement site, seasonal bird count	Ocular Survey	Quarterly	Adjacent offset site of the Valenzuela depot	DOTC PMO, The Society for the Conservation of Philippine Wetlands (SCPW)	To be detained in preparation of Restoration Plan. P20,000.00	POST-ECC Agreement between DOTC, Contractor and EMBas indicated in Annex 2-20 of the RPM for DAO 2003-30		N.A	POST-ECC Agreement between DOTC and EMB as indicated in Annex 2-20 of the RPM for DAO 2003-30		
Removal of trees and other vegetation	Nara trees along the alignment from Caloocan to Tutuban and at the Valenzuela depot site might be affected and removed during the clearing operation. Other trees such as fruit bearing trees along the alignment will be removed.	Number of trees surviving	Tree count	Biannual	Tree planting site designated by DENR Region III and NCR	DOTC PMO	P20,000.00	POST-ECC Agreement between DOTC, Contractor and EMBas indicated in Annex 2-20 of the RPM for DAO 2003-30		85-90% survival rate of the trees planted as prescribed by the DENR-EMBRegion III and NCR	POST-ECC Agreement between DOTC, Contractor, DENR-EMB Region III and NCR		
THE WATER													
Maintenance activities in the railway stations and depot Domestic wastewater sensation	Pollution of receiving water bodies	pH, Oil & Grease, BOD, Total Coliform, and TSS	DAO35 S.90 Revised Effluent Regulations of 1990	Monthly	Effluent of wastewater treatment plant in Valenzuela Depot	DOTC PMO	Total sampling cost shall be determined during implementation of the project (Note: **P20,000.00** sampling cost per sampling site)	N.A		Effluent standards of inland waters. For Class "C" freshwater pH – 6.5 to 9.0 Oil & Grease – 5.0 mg/L BOD – 50 mg/L TSS –70mg/L Total Coliform – 10,000 MPN/100ml	N.A		

Table 6.1 Environmental Monitoring Plan (EMoP) for the North South Commuter Rail Project

Key Environmental Aspects per Project Phase	Potential Impacts Per Environmental Sector	Parameter to be Monitored	Sampling Methodology and Measurement Plan			Lead Person	Annual Estimated Cost	Environmental Quality Performance Levels (EQPL) Management Scheme					
								EQPL Range			Management Measures		
			Method	Frequency	Location			Alert	Action	Limit	Alert	Action	Limit
THE AIR													
Operation of Trains	Occurrence of higher noise level	Noise level	Noise Level monitoring using a noise level meter	Quarterly Immediately based on complaints	Noise sensitive receptors within 50 m distance from the alignment	DOTC PMO	Total sampling cost shall be determined during implementation of the project (Note: P200,000.00 sampling cost for the seven sampling sites)	N.A		Daytime: 60 LAeq. Night: 55LAeq. For sensitive receptors night: 50 LAeq.	N.A		
Operation of Trains	Generation of vibration	Vibration level	Vibration level monitoring using a vibration level meter	Quarterly Immediately based on complaints	Sensitive receptors (schools, hospitals) within 50 m distance from the alignment	DOTC PMO	Total sampling cost shall be determined during implementation of the project (Note: P200,000.00 sampling cost per sampling site)	-		Vibration level VL-55dB	-		

Note:
PMO – Project Management Officer

Presented in Table 6.2 are the maximum noise for construction activities and allowable working hours per area in accordance with the National Pollution Control Commission (NPCC) Circular No. 002 (May 12, 1980). The values indicated in the Table shall serve as the basis of monitoring during implementation of the project.

Table 6.2 Maximum Noise Standards for Construction Activities & Allowable Working Hours per Area

Class of Activity	Maximum Noise Level	Allowable Working Hours	Areas
Class 1	90 dBA	7:00 am – 7:00 pm	AA, A, B
Class 2	85 dBA	7:00 am – 7:00 pm	AA, A, B
Class 3-4	75 dBA	7:00 am – 9:00 pm	AA, A, B
Source: NPCC Memorandum Circular No. 002, May 12, 1980			

Note:

AA – Area which requires quietness such as areas within 100 m. from schools, hospitals and homes for the aged

A – Residential area

B – Commercial area

Class 1 Work which requires pile drivers (excluding manual type), file extractors, riveting hammers or combination thereof. This classification does not include work in which pile drivers are used in combination with earth augers.

Class 2 Work which requires rock drills or similar equipment like jack hammers or pavement breakers

Class 3 Work which requires air compressor (limited to those compressors which use power other than electric motors with a rated output of 15 KW or more in excludes air compressors powering rock drills, jack hammers and pavement breakers)

Class 4 Operation involving batching plant (limited to those with a mixer capacity of 0.5 or more cubic meters) and/or asphalt plants (limited to those with mixer capacity of 200 KG or more). Batching plants for the making or mortar are excluded.

6.2 Third Party Monitoring

As agreed in the Technical Scoping for the NSCR Project, instead of creating the MMT, the proponent may hire a Third Party Monitoring entity to undertake the validation monitoring in accordance with DAO 03-30 Section 2.3 (Monitoring, Validation & Evaluation/Audit Procedures).

In line with this, the specific roles and responsibilities of the Third Party Monitoring entity will be:

- Validate project compliance with the conditions of ECC and the EMP
- Validate the proponent's conduct of self-monitoring
- Prepare validation reports for submission to proponent, EMB and for documentation to stakeholders

6.3 Environmental Monitoring Fund (EMF)

The EMF is supposed to be established to support the MMT but since the proponent will utilize the services of a Third Party Monitoring entity, the proponent (DOTC) will allocate a specific annual budget (EMF) for the monitoring expenses and services of the Third Party Monitoring entity.

6.4 Environmental Guarantee Fund (EGF)

The EGF shall be established for NSCR for the following purposes:

a. Rehabilitation of areas affected by damages to the environment and the resulting deterioration of environmental quality as a direct consequence of project construction and operation.
b. Just compensation of parties an communities affected by the negative impacts of the project
c. Conduct of research studies related to the project that will aid in the prevention or rehabilitation of accident and/or environmental damages.
d. Contingency clean-up activities, environmental enhancement measures, damage prevention programs and social equity measures including IEC and capability-building activities related to the project.

The draft MOA between DOC and EMB for the establishment of the EGF is in Annex I.

7 EMERGENCY RESPONSE POLICY AND GENERIC GUIDELINES

7.1 Objective

During the Detailed Engineering Design Stage, the Department of Transportation and Communications, through the PMO, will establish an Emergency Response Plan (ERP) in order to define actions in preventing the occurrence of accidents and response procedure in case of accidents, fire and natural hazards. For the construction phase, the contractor is required to prepare the ERP.

During the operational phase, the DOTC and PMO operator of NSCR should also prepare a specific ERP for its operations.

This will be aligned with the policy of the Department of Transportation and Communications mandating the strict implementation of precautionary, safety and security measures to ensure safe, fast, efficient and reliable transportation services.

Emergency Risk Management and Emergency Response Program

Possible causes of emergency situations due to man-made and natural hazards should be considered in the Detailed Design to reduce the chance of their occurrence. There are a number of design standards and codes that DOTC PMO will have to comply with and incorporate in its performance specifications. These standards are part of the requirements of the local agencies concerned in order to grant permits and licenses to DOTC.

7.2 Concept

Procedures for each of several emergency categories shall be established. The procedures shall specify necessary actions to be performed by appropriate personnel within a time or event sequence. The emergency response plan shall as a minimum address, but not limited to the following categories:

- Construction-related accidents
- Fire
- Bomb Threat
- Total Power Failure
- Structure Failure
- Train Derailment or Collision
- Transport of Dangerous Goods
- Suicide/Railway Injuries or Fatalities
- Criminal Acts
- Natural disasters (High Winds, Flood, Earthquake, etc.)

The plan shall establish what constitutes an emergency and procedure should be developed for:

- Emergency Reporting
- Notification of Emergency Response Personnel
- Dispatching of Emergency Response Personnel and Equipment to the Site

- Coordination of all Emergency Response activities
- Protection of passengers/personnel, and equipment at the emergency site
- Evacuation of passengers/personnel
- Communication to all passengers, employees, emergency response personnel,
- Restoration of normal operations

Training of contractors, employees and emergency response team shall also be undertaken. Education of the riding public with regard to emergency procedures and equipment as well as required passenger emergency response will also be included. Facilities and equipment, vehicles needed to cope effectively with emergency situations shall also be required.

7.3 Organization

The proponent through its vision shall adopt an active program of pursuing a healthy, safe and environment-friendly operation. Company guidelines on health and safety will be made clear to contractors and all employees during construction and operations. An orientation briefing for contractors and training for employees shall be implemented.

Safety considerations during construction and operation

Construction Stage

Emergency situations that could occur during construction are construction-related accidents and fire. The Prime Contractor will set up safety measures required for the Works. This could include the following:

- The Prime Contractor shall provide and enforce wearing of efficient helmets, and where necessary, eye goggles, ear protection, safety harnesses, and other personal protection equipment for all the personnel.
- The Prime Contractor shall submit for the approval of DOTC detailed proposals for safety regulations and emergency procedures.
- Approved copies of such safety regulations and emergency procedures shall be produced by the Prime Contractor and distributed and displayed at each place of work, together with any other documents, posters, notices boards, or the like which are required by law. The Prime Contractor shall revise, replace, maintain, or remove the notices, regulations and the like as required by legislation.
- The Prime Contractor shall provide at designated stations within the site emergency telephones, suitable accommodation, and transport and first aid equipment including stretchers.
- The Prime Contractor will provide adequate service for the protection against fire at the site in accordance with the local fire regulations.

Operation Stage

For the operation stage, emergency situations that could occur are as follows:

Table 7.1 Preventive Maintenance During Emergency Situations

Emergency Situation	Preventive Measures
Derailment	DOTC PMO will procure emergency re-railing and rescue equipment. These are part of the depot equipment.
Fire	The Fire Safety Enforcement Manual of the Bureau of Fire Protection Philippine Standards will be principally used as the design criteria of this project as imposed by the laws of the Philippines to be complied with.
Typhoon	Regulations to follow for each typhoon signal no.: 1 – speed restriction for trains (60 kph max) 2 – speed restriction for trains (30 kph max) 3 – speed restriction for trains (30 kph max) 4 – suspend operation
Flood	The bridge design will be carried out for a 50 and/or 100 yr return period high water level with a minimum safety margin clearance of 1 m and/or 0.5 m, respectively whichever is the greater. In addition, all drainage will be replaced, and in most cases by a better system. DOTC PMO will conduct periodic maintenance or when necessary for its drainage and water systems.
Failure of Structure	DOTC PMO will comply with international and national standards to ensure that the structures are designed and built in accordance with these safety standards.
Transport of Dangerous Goods	DOTC PMO has no immediate plans for the transport of dangerous goods. However, DOTC PMO train crew and emergency re-rail and rescue crews would receive specific training on emergency procedures associated with the specific types of goods carried.
Medical attention required by passengers	For every station, security guards will be equipped with first aid kits. During extreme emergency cases, medical services including ambulance would be summoned to the nearest station by the central supervising station.
Criminal Acts	DOTC PMO will provide security services to ensure the safety of passengers, crew and office workers.

DOTC PMO will produce an emergency procedural plan, which shall include, but not limited to, the following:

- Policy, purpose, scope and definitions
- List of participating agencies and signatures of executives signing for each agency
- Safety procedures during emergency situations
- Purpose and operation of Centralized Train Control (CTC) System and alternate CTC
- Purpose and operation of command post and auxiliary command post
- Communication facilities available for use during emergency cases
- Operating manuals of all specialized rescue equipment
- Maps and plans of complex areas of the system
- Any additional information and data that the particular agencies require to have in the plan.

LGUs and other participating agencies within the locality shall be coordinated with by DOTC PMO to cooperate and assist depending on the nature of an emergency which would include:

- Medical services
- Building department
- Fire department
- Police department
- Utility companies
- Other transportation agencies

Training for emergency response crew for the operation stage will be programmed. This would include training programs:

- Sponsored by equipment suppliers for the rescue equipment, firefighting equipment and the like
- Courses being offered by some government agencies such as DSWD, Bureau of Fire Protection, etc.
- Evacuation of passengers from train, to a point of safety along the guideway
- Evacuation of passengers from stations (surface and underground)
- Emergency procedures to be controlled from the CTC within the Depot control center, including co-ordination of participating agencies such as fire service, police, ambulance, public works and utility companies, etc.

Earthquake, Ground Setting and Liquefaction Risks

Guideway Structures

NLRC shall perform regular inspections by routine patrol of all guideway structures and perform maintenance and repairs. A detailed structure inspection shall be performed at least once per year.

The general condition of the structure as viewed from the track shall be included in the item list of all route patrols, which are carried out on a regular basis.

All structures will be catalogued and numbered in a register of structures that records the conditions, inspection requirements, results and any corrective actions.
Main structures such as the elevated sections of the route and other special features such as bridge sections shall be the subject to periodic structural inspections. These inspections will be designed and performed according to general practice according to the structure types, materials (steel or concrete), foundations and any specific examination of components such as bearing and expansion joints.

Stations and Depot buildings will also be inspected using route patrolling and general route inspections. The inspections will be supplemented with fault reports made by the operational staff and the NorthRail Project users.

Tracks

DOTC PMO shall inspect, maintain adjust and replace defective, excessively worn or broken running rails, cross ties, special trackwork components, ballast, direct fixation fasteners, and other track materials, related hardware and support equipment.

DOTC PMO shall also inspect and adjust the smoothness of the alignment and levels of the track geometry.

In addition to the patrols described above, there will be inspections for:

- Track geometry and ride quality
- Turnouts (which may be combined with regular lubrication and cleaning)
- Ultra-sonic testing of rail joints and turnout components. These tests will be based on an annual test in each of the first two years and then scheduled as necessary according to the initial results.

Should periodic inspection detect signs of ground movement, services shall be suspended or be run at reduced speed. If services are allowed to continue, detailed monitoring of the site would be instigated. If services shall be suspended, passengers would be de-trained at the next available station stop. Detailed investigation into the improvements required would be undertaken before services are recommenced or speed restrictions be lifted and such works would be put in hand as soon as reasonably.

8 DEMOBILIZATION / DECOMMISSIONING / REHABILITATION POLICY

The demobilization/decommissioning/rehabilitation policy referred to here is the restoration plan of the areas directly affected by the construction of the proposed North South Commuter Rail Project.It should be noted that a more detailed rehabilitation policy will be prepared and submitted, once the DED is completed.

Prior to abandonment of the construction areas, the Contractors must undertake and comply the following decommissioning/demobilization activities:

- Complete restoration of affected social service utilities (i.e. power and water supply, and telecommunication lines) to their normal functions;
- Complete closure and dismantling of the workers' camps, field offices, and temporary construction facilities;
- Complete dismantling of the temporary sanitation facilities, particularly the portable toilets;
- Clean-up and sterilization of the worker's camps and field offices to ensure that no wastes are abandoned in the sites;
- Remaining muck soils, construction spoils and debris are hauled and disposed to sites duly-approved by the Cities of Manila, Caloocan, Valenzuela, Meycauayan, Marilao, Bocaue, Balagtas, Guiguinto and Malolos.
- Complete restoration/reconstruction of affected public and cultural and historicalstructures.

9 INSTITUTIONAL PLAN FOR IMP IMPLEMENTATION

9.1 Department of Transportation and Communications (DOTC)

The Department of Transportation and Communications (DOTC) as the proponent for the North South Commuter Rail Project, is the primary policy, planning, programming, coordinating, implementing and administrative entity of the executive branch of the government on the promotion, development and regulation of a dependable and coordinated network of transportation and communications systems, as well as in the fast, safe, efficient and reliable transportation and communications services.

The DOTC plays a crucial role in accelerating the country's economic development. It provides the backbone for growth and enhances the country's competitive edge by providing effective and efficient transportation and communications infrastructure systems that narrow the geographical and physical divide, connecting the country, its islands, and its people to the rest of the world.

Vision

The DOTC is a world class organization, providing integrated transport, connecting people, islands, families, communities and the nation with the rest of the world, and constantly responding for environmentally sustainable and globally competitive transport and communications system.

Mission

To provide the country with efficient, effective and secure transportation systems those are globally competitive, compliant with international standards and responsive to the changing times.

Sectorial and Attached Agencies

The DOTC has three (3) Sectoral Offices and fifteen Attached Agencies. The sectorial offices include the Maritime, Road and Rail Transport Offices. The latter includes the Metro Rail Transit (MRT) Line 3 which is a Project Management Office (PMO) of the Department.

Among the attached agencies are three Railway agencies namely: Philippine National Railways (PNR), Light Rail Transit Authority (LRTA), and North Luzon Railways Corporation (NLRC or Northrail).

For the NSCR Project, the DOTC will create a new office or designate one of the railway attached agencies to serve as Project Management Office.

DOTC Roles of the IMP

TheDOTC as the Implementing Agency shall be responsible for providing overall policy and guidance with regards to implementation of the Project under the Project Planning Division-Planning Service (PPD-PS). It shall ensure that all the necessary provisions for implementing the Impact Management Plan (IMP) and the Environmental Monitoring Plan (EMoP), including budgets and agreements with other concerned national and local government agencies are included in all contracts. In accordance with D.O. 245 Series of 2003 and the Social and Environmental Management System (SEMS) Operations Manual, DPWH is not authorized to set aside an Environmental Monitoring Fund (EMF) from which honoraria for

MMT Members may be drawn from, but the Department will shoulder the costs of travel, food, and other monitoring expenses.

9.2 Implementation of the IMP

9.2.1 PMO

The PMO designated by the Department of Transportation and Communications shall be responsible for complying with the conditions stipulated in the Environmental Compliance Certificate (ECC), including the Impact Management Plan (IMP), which is an integral part of this EPRMP.

The PMO will be responsible for the implementation, coordination, supervision, and monitoring activities that will be undertaken by the Contractor as part of the agreement. The specific responsibilities of the PMO shall include:

i. Prior to bidding process, prepare the "DOTC Environmental Protection Clauses" of the Bid Documents to apply to the project based on the EMP and the ECC for the project;

ii. Discuss contract environmental clauses with bidders to allow the latter to include realistic costs of complying with contract provisions in their bids;

iii. Ensure that compliance to all conditions stipulated in the ECC are included as provisions in the Bid Documents to be issued to prospective Contractors;

iv. Ensure that all engineering interventions in the approved EMP, RAP, and ECC issued are included in the Terms of Reference (TOR) of the Detailed Engineering Design; and

The PMO will create an environmental office staffed with Environmental Engineers and other specialists, including environmental consultants who will provide the necessary guidance and technical assistance, and at the same time, together with the office staff, implement the conditions of the ECC and the activities laid out in the EMP.

Environmental compliance monitoring will be contracted to a professional Third Party Monitoring Firm which will monitor compliance of the contractors and the PMO with the ECC conditions and the EMP in accordance with the guidelines of DENR Administrative Order (DAO) 03-30. The Contractors for the Works will be tasked to implement the EMP for the construction phase, while the PMO will implement the EMP during pre-construction and operational phase of the project.

The PMO and the Contractor's implementation of the EMP shall be in coordination with the following entities:

1. EMB Central Office and Regional Offices (Region III and NCR)
2. DENR Forest Management Bureau and Biodiversity Management Bureau (for flora and fauna)
3. DOTC attached agencies Northrail, PNR and LRTA
4. DPWH
5. Third Party Monitoring Firm
6. LGUs of Malolos, Guiguinto, Balagtas, Bocaue, Marilao, Meycauayan, Valenzuela, Malabon, Caloocan and Manila

This Plan shall be updated upon finalization of the Detailed Engineering Design (DED) for the Project.Shown inFigure 9.1is the simplified institutional diagram for the implementation of the IMP.

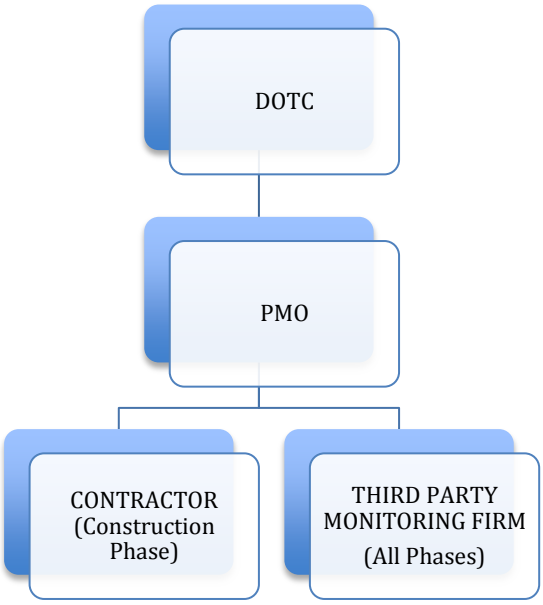


Figure 9.1 Simplified Institutional Plan for Implementing the IMP

9.2.1 Third Party Monitoring Firm

The Third Party Monitoring Firm shall be tasked to undertake monitoring of compliance with ECC conditions as well as the EMoP during Pre-construction and operational phase of the NSCR Project. The TPM Firm shall submit a semi-annual monitoring report for each year.

The Third Party Monitoring Firm shall be responsible for:

i. Monitoring compliance with ECC conditions;
ii. Overseeing the implementation of the IMP by the Contractor/s;
iii. Assisting in the conduct of IEC Meetings as enumerated in the IEC Framework of this EPRMP;
iv. Validate project compliance with the conditions stipulated in the ECC and the IMP;
v. Validate PMO'sconduct of self-monitoring;
vi. Receive complaints, gather relevant information to facilitate determination of validity of complaints or concerns about the project and timely transmit to the Proponent and EMB recommended measures to address the complaint;
vii. Prepare, integrate and disseminate simplified validation reports to community stakeholders;
viii. Coordinate with the Pollution Control Officer (PCO) of Contractors assigned to the Project, to ensure that conditions stipulated in the ECCs are properly complied with,

including the gathering of baseline data on air and water quality, and subsequent monitoring of such;

ix. Notify PMO about any act or activity by the Contractors that are deemed as violations to the stipulations in the ECCs and amendments issued, and recommend immediate courses of action to avoid or mitigate any violation to said stipulations; and

x. Compile monitoring data gathered by the Contractors and supervise preparation of semi-annual monitoring reports to be submitted to the DENR EMB

9.2.3 The Contractor

The Contractor shall be jointly responsible for implementing the IMP, and liable to any and all sanctions and penalties to be incurred by DOTC in relation to non-compliance to conditions set in the ECC. It shall provide the necessary funds for implementing the IMP, as will be stipulated in the "DOTC Environmental Protection Clauses" of the Bid Documents. As previously stated it shall be jointly (with DOTC) responsible for ensuring that all engineering interventions in the approved IMP, RAP, and ECC issued are included in the Terms of Reference (TOR) of the Detailed Engineering Design.

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