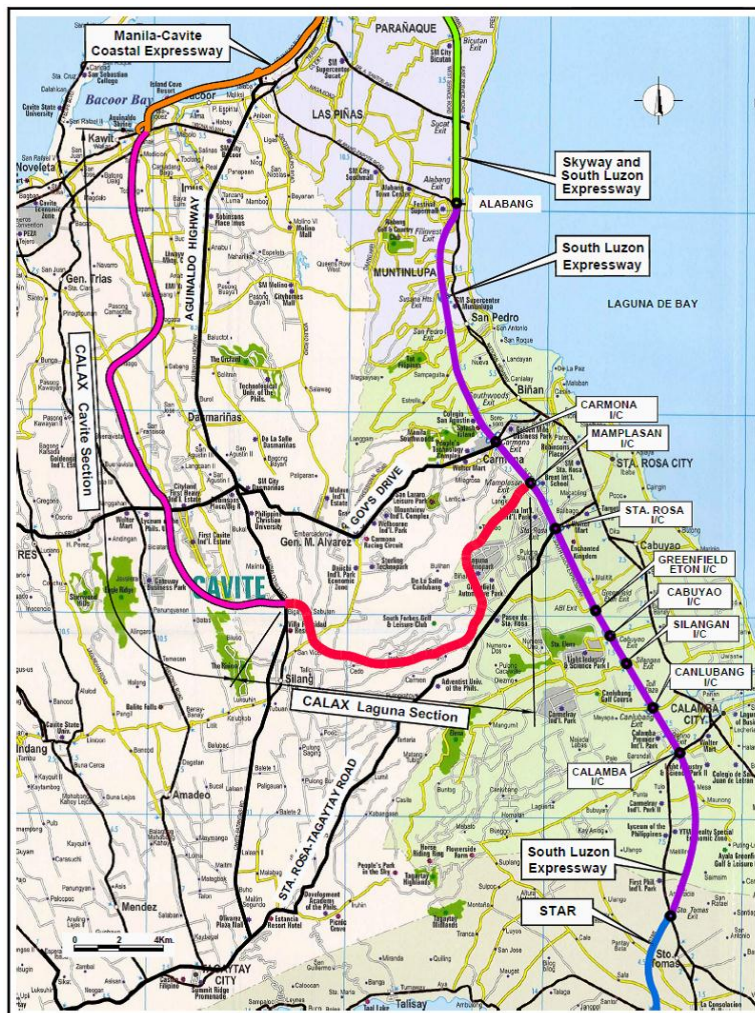




DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS

## ENVIROMENTAL IMPACT STATEMENT (EIS)



### Proposed Cavite-Laguna Expressway (CALAX) Project (Laguna Section)

FINAL REPORT

MAIN TEXT



Engineering International Co., Ltd.

ECOSYSCORP, INC.

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## Abbreviations

|            |                                                                                  |
|------------|----------------------------------------------------------------------------------|
| Aps        | Affected Persons                                                                 |
| ASSHTO     | American Association of State Highway and Transportation Officials               |
| BOD        | Biological Oxygen Demand                                                         |
| CALA       | Cavite-Laguna                                                                    |
| CALAX      | Cavite-Laguna Expressway                                                         |
| CALABARZON | Cavite Laguna Batangas Rizal Quezon                                              |
| CAO        | City Assessor's Office                                                           |
| CAVITEX    | Manila-Cavite Expressway                                                         |
| CHED       | Commission on Higher Education                                                   |
| CIGI       | Common Image Generator Interface                                                 |
| CPDC       | City Planning and Development Coordinator                                        |
| CRIC       | City RAP Implementation Committees                                               |
| DAO        | Department Administrative Order                                                  |
| DAR        | Department of Agrarian Reform                                                    |
| DBE        | Design Basis Earthquake                                                          |
| DED        | Detailed Engineering Design                                                      |
| DENR       | Department of Environment and Natural Resource                                   |
| DENR-EQD   | Department of Environmental and Natural Resources-Environmental Quality Division |
| DENR-FMB   | Department of Environment and Natural Resources Forest Management Bureau         |
| DIA        | Direct Impact Area                                                               |
| DO         | Department Order                                                                 |
| DPWH       | Department of Public Works and Highways                                          |
| ECC        | Environmental Compliance Certificate                                             |
| EIA        | Environment Impact Assessment                                                    |
| EIARC      | Environmental Impact Assessment Review Committee                                 |
| EIS        | Environmental Impact Study                                                       |
| EMB        | Environmental Management Bureau                                                  |
| EMP        | Environmental Management Plan                                                    |
| EMoP       | Environmental Monitoring Plan                                                    |
| EO         | Executive Order                                                                  |
| EPRT       | Emergency Preparedness and Rescue Team                                           |
| EQD        | Environmental Quality Division                                                   |
| ESE        | East South East                                                                  |
| ESH        | Environmental Safety and Health                                                  |

|                 |                                                                    |
|-----------------|--------------------------------------------------------------------|
| ESHO            | Environment and Safety Health Officer                              |
| EVF             | East Valley Fault                                                  |
| EVZ             | East Valley Zone                                                   |
| FCIE            | First Cavite Industrial Estate                                     |
| GDP             | Gross Domestic Product                                             |
| GMA             | General Mariano Alvarez                                            |
| GMA             | Greater Manila Area                                                |
| GOP             | Government of the Philippines                                      |
| Ha              | Hectare                                                            |
| IC              | Interchange                                                        |
| IEC             | Information Education and Communication                            |
| IIA             | Indirect Impact Areas                                              |
| IMP             | Impact Management Plan                                             |
| IUCN            | International Union for Conservation of Nature                     |
| JICA            | Japan International Cooperation Agency                             |
| LARRIP          | Land Acquisition Resettlement and Rehabilitation Indigenous People |
| LC              | Least Concern                                                      |
| LGU             | Local Government Unit                                              |
| LLDA            | Laguna Lake Development Authority                                  |
| MAO             | Municipal Assessor's Office                                        |
| MARO            | Municipal Agrarian Reform Office                                   |
| MCE             | Maximum Considered Earthquake                                      |
| MERALCO         | Manila Electric Company                                            |
| MGB             | Mines and Geosciences Bureau                                       |
| MMDA            | Metro Manila Development Authority                                 |
| MMT             | Multipartite Monitoring Team                                       |
| MMUTIS          | Metro Manila Urban Transportation Integration Study                |
| MOA             | Memorandum of Agreement                                            |
| MPDC            | Municipal Planning and Development Coordinator                     |
| MRIC            | Municipal RAP Implementation Committees                            |
| NAAQS           | National Ambient Air Quality Standards                             |
| NCR             | National Capital Region                                            |
| NE              | North East                                                         |
| NGO             | Non-Government Organization                                        |
| NHCP            | National Historical Commission of the Philippines                  |
| NHI             | National Historical Institute                                      |
| NIA             | National Irrigation Authority                                      |
| NHA             | National Housing Authority                                         |
| NIPAS           | National Integrated Protected Areas System                         |
| NO <sub>2</sub> | Nitrogen Dioxide                                                   |

|                 |                                                                              |
|-----------------|------------------------------------------------------------------------------|
| NPCC            | National Pollution Control Commission                                        |
| NSCB            | National Statistics Coordination Board                                       |
| PAGASA          | Philippine Atmospheric Geophysical and Astronomical Services Administrations |
| PAO             | Provincial Agriculturist Office                                              |
| PAPs            | Project Affected Persons                                                     |
| PAR             | Philippine Area of Responsibility                                            |
| PARO            | Provincial Agrarian Reform Office                                            |
| PCM             | Public Consultation Meeting                                                  |
| PFZ             | Philippine Fault Zone                                                        |
| PHIVOLCS        | Philippine Institute of Volcanology and Seismology                           |
| PMO-BOT         | Project Management Office-Build Operate Transfer                             |
| PMS             | Periodic Service Maintenance                                                 |
| PPFP            | Provincial Physical Framework Plan                                           |
| PSHA            | Probabilistic Seismic Hazard Assessment                                      |
| RA              | Republic Act                                                                 |
| RAP             | Resettlement Action Plan                                                     |
| ROW             | Right-of-Way                                                                 |
| SAFDZ           | Strategic Agriculture and Fisheries Development Zones                        |
| SAMACA          | Samahang mga Magbubukid sa Carmen                                            |
| SDP             | Social Development Plan                                                      |
| SLEX            | South Luzon Expressway                                                       |
| SO <sub>2</sub> | Sulfur Dioxide                                                               |
| STD             | Sexually Transmitted Disease                                                 |
| TMP             | Traffic Management Plan                                                      |
| TSP             | Total Suspended Particles                                                    |
| TSS             | Total Suspended Solid                                                        |
| UPLB            | University of the Philippines Los Baños                                      |
| WB              | World Bank                                                                   |
| WBOP            | World Bank Operational Procedure                                             |
| WVF             | West Valley Fault                                                            |

# EXECUTIVE SUMMARY

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## BACKGROUND AND RATIONALE

Previous studies on the Cavite-Laguna Expressway (CALAX) Project date back in 1996 when the Japan International Cooperation Agency (JICA) conducted the Metro Manila Urban Transportation Integration Study (MMUTIS) and completed in 1999. This study was followed by the CALA Transport Strategy and Short-Term Programs and Policies which was a component of the Cavite-Laguna (CALA) Urban Development and Environmental Management Project of the World Bank (WB) on the same year 1999 the MMUTIS was completed.

The JICA-assisted Feasibility Study and Implementation Support on CALA East-West National Road Project (the 2006 FS) was conducted 2006 on the basis of the above-mentioned studies. In said FS, the CALAX Alignment was proposed. The project was temporarily shelved when private developers in the area disagreed on the alignment.

In 2010, the JICA-assisted High Standard and Highway Network Development Master Plan (2010) and Preparatory Survey for PPP Infrastructure Development Project (2010) recommended CALAX as a **high priority PPP project**. With the completion and operation of the Manila-Cavite Expressway (CAVITEX) in 2011 the implementation of the CALA Expressway Project was again deemed necessary and justified.

## PROJECT DESCRIPTION

The CALA Expressway Project will connect the Manila-Cavite Expressway in the north, through the Provinces of Cavite and Laguna to join with Aguinaldo Highway at Silang, Cavite and then eastward to connect with South Luzon Expressway (SLEX), which will provide onward access to Batangas Port. The proposed alignment encompasses the Municipality of **Silang**, in Cavite, and the Cities of **Santa Rosa** and **Biñan** in the Province of Laguna.

Silang is a “landlocked” 1<sup>st</sup> Class municipality situated on the eastern part of Cavite Province. The town is geographically located at **N14°14’0”, E120°59’0”**, and is approximately **45 kilometers** south of Manila. From its starting point along E. Aguinaldo Highway, the alignment will cross a total of **five (5)** barangays. These are: Brgy. Sabutan, Kaong, Tibig, Munting Ilog, Puting Kahoy, Inchican, and Carmen.

Tagged as the “*Lion City of the South*”, since 1994, Santa Rosa City lies approximately **38 kilometers** south of Manila via the South Luzon Expressway, making it a suburban residential community of Metro Manila. Geographically, the City is located at **N14°16’43”, E121°5’48”**.

Located at geographical coordinates **N14 20’0”, E121°5’0”**, Biñan is a “*first class component city*” in the Philippines. It is one of the **three (3)** cities comprising the 1<sup>st</sup> Congressional District of the Province of Laguna (the Cities of San Pedro and Santa Rosa are the others). The City of Biñan is situated about **34 kilometers** south of Manila. The alignment will traverse a total of **four (4)** barangays in Biñan City namely Biñan, Loma, Malamig, and Timbao.

## **PROCESS DOCUMENTATION OF THE CONDUCT OF EIA**

Primary and secondary information were utilized in the preparation of this EIA Report. The baseline information required in the preparation of this report are established through series of field investigations and ocular inspections. Dissemination of project information was primarily done through conduct of consultation meetings with the affected people, and concerned government agencies and entities.

Secondary data were obtained from various government agencies such as the following offices from the respective LGUs---Cavite and Laguna (Provincial level); and Silang, Biñan, and Sta. Rosa (City/Municipal level):

- Provincial/City/Municipal Planning and Development Office;
- Provincial/City/Municipal Assessor’s Office;
- Provincial/City/Municipal Agriculturist Office; and
- Provincial/City/Municipal Agrarian Reform Office

## THE EIA TEAM

ECOSYSCORP, Inc. is a private Environmental Consulting Firm that specializes in conduct and preparation of environmental researches, Resettlement Action Plan (RAP), and related environmental studies. The company has been involved in numerous private and government infrastructure projects since its incorporation in 1994. *Team Leader Ms. Annabelle N. Herrera* and experts specializing in various fields of environmental disciplines compose the EIA Team.

**Table I** briefly describes the Preparers' field of expertise and the EIA module assigned to each expert.

| Table I Preparers' Field of Expertise and EIA Module Assignment |                                                                |                                                  |
|-----------------------------------------------------------------|----------------------------------------------------------------|--------------------------------------------------|
| Preparers                                                       | Field of Expertise                                             | EIA Module Assignment                            |
|                                                                 | Team Leader, Environmental, Socio-Economic, and RAP Specialist | Socio-Economic                                   |
|                                                                 | Quaternary Geologist                                           | Geology and Geomorphology                        |
|                                                                 | Air Quality Specialist                                         | Air Sampling, and Noise Monitoring and Modelling |
|                                                                 | Mining Engineer, Environmental and RAP Team Member             | Socio-Economic Interviews and Survey             |
|                                                                 | RAP Team Member                                                | Socio-Economic Interviews and Survey             |

## EIA METHODOLOGY

### The Land

Classification of the vegetation cover in the study area is primarily based on field survey undertaken in the areas covered by the proposed CALA Expressway alignment in the Municipality of Silang, Cavite, and the Cities of Santa Rosa and Biñan, Laguna.

Identification of the encountered flora species was done through Gross Morphology. It is a type of plant identification wherein the external features of both vegetative and reproductive features of the species are heavily relied upon, since they are easily observable. The species identified are validated using field guidebooks on Philippine Flora and the “Pictorial Cyclopedia of Philippine Ornamental Plants, 1995”, a guidebook compiled by Domingo A. Madulid and Bookmark Inc.

The bird (avifauna) species in the project area were identified through actual sightings of the birds species commonly found in highly disturbed habitats. The species encountered were recorded and then verified using the photographed compilation of the “Philippine Birds” authored by John Eleuthere DuPont. Local accounts were also used.

### The Water

Water samples were taken from **three (3)** selected rivers crossed by the alignment to establish the physico- chemical properties of the waterways that may be affected by the project. Sta. 1, Malaking Ilog River is located in Brgy. Sabutan, Silang, Cavite. Sampling Sta. 2, Lumbia River is located in Santo Domingo, Santa Rosa City, Laguna, and the sampling station, Sta. 3 Malindig River, is located under the bridge along Laguna Blvd.

Water samples were obtained using a 1-liter sterilized mineral water bottle. Standard water sample preparation procedure was followed. The sample bottles were properly labeled; the caps were securely sealed with scotch tape, and placed in a chest filled with ice to preserve the samples. The samples were later brought to the laboratory for analysis.

Field measurements of pH and temperature were also undertaken. A 400 ml sterilized beaker was filled with samples from the River. Using a portable pH and a laboratory thermometer, on-site measurements were taken. The pH meter was properly calibrated prior to use.

## **The Air**

Ambient air quality sampling in the study area was conducted at **six (6)** selected sites to establish the existing level of air pollutants that may be influenced by the proposed CALA Expressway project. Sites chosen are those adjacent to air pollution sensitive receptor areas. Sampling was undertaken twice in a day to determine the pollutant levels during the morning and afternoon period. The sampling was done in conformity with the National Ambient Air Quality Standards (NAAQS) of the Department of Environment and Natural Resources (DENR).

The methods of analyses of air samples are Pararosaniline Method for SO<sub>2</sub> and Griess Saltzman Method for NO<sub>2</sub>. This method done is by bubbling the ambient air through an absorbing solution in the glass impingers using the AirChek Gas Sampler. For total suspended particulates (TSP), gravimetric method is adopted using a Staplex high-volume sampler with a filter paper that is weigh prior to and after sampling.

## **Noise Level**

Noise level monitoring was done simultaneously with air quality sampling at the same sites. Noise level monitoring was conducted in accordance with the standard monitoring periods specified by guidelines of the Environmental Quality Division (EQD) of the DENR-EMB. Averaging of the noise frequencies received by the portable noise meter within a **10-minute** period was done. The noise meter was properly calibrated prior to sampling.

## **The People**

Socioeconomic survey of project-affected persons was conducted from February 22, 2012 to March 14, 2012. **Four (4)** types of PAPs were interviewed, namely:

- **Type A** - Residential Structure Owner;
- **Type B** - those whose farm land would be affected (landowner/tenant and free occupation of land with permit)
- **Type C** is for Secondary Impact Areas (i.e. youth sector, aged sector, business sector, transport group, residential, women's and NGO/POs); and
- **Type D** for Big Land Developers & Real Estate Companies (the team had a hard time in interviewing Type D respondents due to company protocol).

Included in the survey are questions that will establish basic demographic data and affected persons' socio-economic status. Socio-economic indicators used consist of:

- (i) primary and secondary source of income;
- (ii) household income and expenditures;
- (iii) type of ownership of structure occupied; and
- (iv) type or lighting, water supply, sanitation, solid waste management, and transportation

## **PUBLIC PARTICIPATION**

### **Consultation Meetings**

A total of **14 IEC meetings** were conducted. **Five (5)** of these are with the LGUs--- two (2), at the provincial and **three (3)** city/municipal level; **eight (8)** barangay/PAPs-level and **one (1)** with the officers of SAMACA Farmer's Organization in Brgy. Carmen. Aside from IEC meetings, the Consultant visited the Office of Provincial Assessor of Cavite and Laguna, Municipal Assessor of Silang, City Assessors of Biñan and Sta. Rosa as part of RAP preparation. The project was also presented to the different department and offices of the Local Government Units such as Treasurer's Offices, Provincial Agrarian Reform Office (PARO), National Irrigation Authority (NIA), National Historical Commission of the Philippines (NHCP, formerly NHI), and Department of Agrarian Reform (DAR).

Table II presents the Information Communication Education (IEC) for all project phases of CALA Expressway.

| Table II Information Education and Communication (IEC) for All Project Phases of CALA Expressway                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                         |                                                                                                                                                |                                                                                                                                                                            |                                                                                                           |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| Stakeholder/Sectors                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Major Topics of Concern                                                                                                                                                                 | IEC Scheme/Strategy                                                                                                                            | Information Medium                                                                                                                                                         | Indicative Timeline/Frequency                                                                             |
| <b>PRE-CONSTRUCTION AND CONSTRUCTION PHASES</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                         |                                                                                                                                                |                                                                                                                                                                            |                                                                                                           |
| <ul style="list-style-type: none"> <li>Provincial LGUs of CAVITE and LAGUNA;</li> <li>Municipal LGU of SILANG;</li> <li>City LGUs of BIÑAN and STA. ROSA;</li> <li>Barangay Officials, Farmer's Association, Senior Citizen's Association, Landowners, Homeowner's Association, Women's group of Sabutan, Kaong, Tibig, and Carmen, SILANG;</li> <li>Barangay Officials, Farmer's Association, Senior Citizen's Association, Landowners, Homeowner's Association, Women's group of Biñan, Malamig, Timbao, and Loma of BIÑAN; and</li> <li>Barangay Officials of Barangays Sto. Domingo and Don Jose, Senior Citizens Association, Women's Organization, Youth Organization, Farmers Organization and Transport Group of Don Jose, STA. ROSA</li> </ul> | <ul style="list-style-type: none"> <li>Present Project Description, including alternative alignments study;</li> <li>Present EIA Scoping Matrix</li> <li>Present RAP Process</li> </ul> | <ul style="list-style-type: none"> <li>Group Meeting</li> <li>Focus group discussion</li> </ul>                                                | <ul style="list-style-type: none"> <li>Invitation letters</li> <li>Audio visual presentations</li> <li>Hand outs</li> <li>Comics (English and Tagalog versions)</li> </ul> | <ul style="list-style-type: none"> <li>During conduct of EIA and RAP Preparation February 2012</li> </ul> |
| <ul style="list-style-type: none"> <li>All stakeholders</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <ul style="list-style-type: none"> <li>Post ECC Billboard to announce ECC issuance</li> </ul>                                                                                           | <ul style="list-style-type: none"> <li>Visual; Billboard</li> </ul>                                                                            | <ul style="list-style-type: none"> <li>Billboard</li> </ul>                                                                                                                | <ul style="list-style-type: none"> <li>Prior to start of construction activities</li> </ul>               |
| <ul style="list-style-type: none"> <li>All stakeholders</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <ul style="list-style-type: none"> <li>Construction safety signs, rerouting signs</li> </ul>                                                                                            | <ul style="list-style-type: none"> <li>Visual; Signages must be installed 200m, 100m, and 50 m before location of construction site</li> </ul> | <ul style="list-style-type: none"> <li>Road signs</li> </ul>                                                                                                               | <ul style="list-style-type: none"> <li>Immediately before start of construction activity</li> </ul>       |
| <b>OPERATION PHASE</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                         |                                                                                                                                                |                                                                                                                                                                            |                                                                                                           |
| <ul style="list-style-type: none"> <li>Motorists</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <ul style="list-style-type: none"> <li>Road safety signs (e.g., speed limit, slippery when wet, etc)</li> </ul>                                                                         | <ul style="list-style-type: none"> <li>Every 500 m to 1 km</li> </ul>                                                                          | <ul style="list-style-type: none"> <li>Road signs</li> </ul>                                                                                                               | <ul style="list-style-type: none"> <li>During operation phase</li> </ul>                                  |

## SUMMARY OF BASELINE CHARACTERIZATION

### The Land

#### Land Use and Classification

In Silang, the proposed CALA Expressway alignment will generally traverse agricultural areas. However actual survey conducted revealed that most of these areas are **unproductive agricultural lands** which appear to have transformed into **open grassland land/wasteland** due to unavailability of irrigation system. Patches of marginal pineapple plantations and corn fields are observed in Brgy. Sabutan and Tibig. Farther down southeast, the alignment will traverse through some coffee, banana, and coconut plantations in Brgy. Tibig.

The alignment will also cut across some **residential properties** of Stateland in Brgy. Sabutan, and Extra Ordinary in Brgy. Carmen. On the southeast, it will also pass along prime residential areas such as the Ayala West Grove Heights and South Forbes in Brgy. Inchican. From Brgy. Carmen, Silang Cavite, the alignment will enter Sta. Rosa City through Brgy. Don Jose. The alignment will connect to the existing Nuvali Spine Road and will pass by the **residential developments** of Sta. Rosa Village on the northeast and the Sta. Rosa Estates on the southeast. To the east of the proposed alignment is the Laguna Techno Park, Sta. Rosa City side.

The alignment from the Nuvali Spine Road in Brgy. Don Jose, Santa Rosa City, will then follow the existing Laguna Boulevard in Brgy. Biñan, Biñan City, passing by the Laguna Techno Park on the east, and Sta. Rosa Village and San Jose Village on the west. As the alignment continues to follow the existing road towards northeast, it will pass by Southville in Brgy. Malamig before cutting across the Tamayo Property in Brgy. Timbao. It will then follow the existing Nuvali passing by the Verdana Homes on the northwest and Celina Homes on the east. Towards its terminus, the alignment immediately after Celina Homes will pass along the Greenfields Property at Km 16+150. The proposed CALA Expressway will eventually cut across the Greenfields Property approximately at Km 16+950 and will continue to traverse the said property until it reaches its end section at Km 18+010 in Brgy. Mamlasan.

## Geomorphology

The general morphology of the project area can be described as generally flat on the eastern portions (Sta. Rosa and Biñan), gradually shifts to rolling terrain as it approaches the western side, until it attains an average slope of 18% as it reaches Silang on the west side of the alignment. There are four (4) distinct geomorphic units namely from the east: (i) Lake Coastline, (ii) Alluvial Plain, (iii) Degradation Zone, and (iv) Volcanic Foot Slope. The corresponding morpho-geologic units consist of: (i) Recent sediments underlying the lake coastline, (ii) Pliocene-Pleistocene pyroclastic deposits underlying the alluvial plains, (iii) Pliocene-Pleistocene pyroclastic deposits underlying the degradation zone, and (iv) Pliocene-Pleistocene pyroclastic deposits underlying the volcanic foot slope.

## General Geology

Earthquakes in the region around the project site are influenced by the tectonic features such as the Manila Trench, East Luzon Trench, Philippine Fault Zone, and the West Valley Fault System. Most of the earthquakes plotted in the map belong to **four (4)** clusters, one along the eastern shores of Luzon, around Polilio Island, one on the eastern coast of Samar; another cluster exists on the western coast of Luzon around Mount Pinatubo and the south of Taal Volcano, along the northern shore of Mindoro. Seismicity in these four clusters is influenced mostly by the subduction processes in these sites, as modified by the local volcanic and tectonic structures. The other earthquakes plotted in the map that are not related to the four clusters are generated by the major faults that cut the Philippine archipelago.

Seismicity along the East Luzon Trench is characterized by a sequence of high magnitude earthquakes (larger than 5.5) and their time sequence and spatial distribution link them to the apparent stress partitioning from the Philippine Trench to the faults in northern Luzon. The earthquakes in this area are interpreted to be caused mainly by the convergence between the Benham Plateau and Luzon.

## Geological Hazards

### *The West Valley Fault System*

The proposed Cavite-Laguna Expressway alignment intersects the WVF in the vicinity of Ayala West Grove/South Forbes, approximately between **Km 8+000–8+500** in Brgy. Carmen, Silang, Cavite. This road section cuts on a very gentle slope along the west flank of the Tagaytay Volcanic Slope.

Deeply incised gullies with near vertical walls runs easterly on the northern margin of the Ayala West Grove and South Forbes and at the southern margin of the Extra Ordinary. At the point of intersection, the road runs along the 4-lane well paved, Tagaytay-Sta Rosa Road, constructed in the late 1990's with a very gentle gradient and design speed of approximately **80 kph**. No slope cut exists in the road section thus, no rock fall, land slide and other adverse effect due to slope instability can be expected.

In the event of fault movement, fault rupture is possible resulting to displacement. For Marikina Fault, displacement varies, depending on the site. In the area of Tunasan, Muntinlupa City, displacement of about 1 meter lateral and 0.5 meters vertical.

Based on the study by MMDA-JICA-PHIVOLCS the West Valley Fault can possibly generate a magnitude **7.2** earthquake. By deterministic approach using the Fukushima Tanaka Equation, the estimated Peak Ground Acceleration (PGA) ratio to be experienced by the structures of the project road such as but not limited to the bridges and interchanges, at a given distance. Please refer to Chapter 2, Section 2.1.2 for further details.

The PGA estimate used the possible earthquake magnitude of **6.8, 7.2, and 7.4** for a given fault length of **30 km, 67 km, and 96 km**, respectively, as estimated by *Bautista et al (2000)*. In addition, the possible maximum earthquake magnitude of **M7.7** based on horizontal and vertical displacement measurements along the fault line done by *R.E. Rimando and P.L.K. Knuepfer* (Feb. 2004) were also used. The

estimated magnitudes and fault length of *Bautista* and *Rimando* is summarized as follows:

| Assumed Fault Length           | Possible Magnitude |
|--------------------------------|--------------------|
| Length = 30 km                 | 6.8                |
| Length = 67 km                 | 7.2                |
| Length = 96 km                 | 7.4                |
| (Based on Rimando et al (2004) | 7.7                |

The computation shows that the ground acceleration level decreases as the distance of the project site from the possible hypocenter increases.

#### *Liquefaction Vulnerability*

**Liquefaction is not considered as hazard along the project alignment** since the under laying bedrock are compacted and well consolidated volcanic ejectas. Loose, water saturated sediments susceptible to liquefaction are confined along the coastline of Laguna de Bay and Manila Bay, a far distance from the alignment.

#### *Earthquake-Induced Landslides*

As can be discerned from the earthquake-induced landslides hazard maps of Cavite and Laguna Provinces provided as **Figures 2.1.2-4 and 2.1.2-5**, respectively, in Chapter 2, the proposed **CALA Expressway alignment is not susceptible to such hazard**. Landslides due to earthquake if ever it will occur will be confined on gully walls and possibly at the escarpment at the eastern margin of the volcanic slope. The alignment will not pass along escarpments. Gullies if crossed will be through bridges with engineered abutments founded into the gully floor or imbedded into the gully walls.

### *Rain-Induced Landslides*

Map prepared under the Ready Project shows the road section in Cavite will be on an area with low susceptibility to rain induced landslide while the section in Laguna runs on a terrain not susceptible to rain induced landslide.

The project will have a **low risk to rain induced land slide** due to the following:

- The alignment will run through a gently sloping terrain;
- No slope cut will be made along the alignment;
- Rain induced land slide if ever it will occur will be confined on unstable section of walls of gullies; and
- Bridge crossing will have properly designed abutments founded into the gully floor or imbedded into the gully walls

For details please refer to **Figures 2.1.2-6 and 2.1.2-7** in **Chapter 2**, which present the rain-induced hazard maps for the Provinces of Cavite and Laguna, respectively.

### *Flooding*

The **road alignment has a low susceptibility to flooding** due to the following terrain considerations:

1. Elevation is relatively high about **140 meters** at the Aguinaldo Highway to about **20 meters** above sea level in SLEX. This elevation allows storm water to immediately flow towards Laguna de Bay in Laguna and Manila Bay in Cavite;
2. The alignment crosses a number of deep gullies which acts as a discharge points for engineered drainage lines. These gullies are relatively deep and flows towards the receiving bodies of water (e.g. Laguna de Bay etc);
3. Both sides of the proposed road alignment are developed subdivisions with engineered drainage systems;
4. The developed sections of the alignment already have engineered drainage lines. Flooding at the site can be avoided through:

- Biñan, Carmona, Sta Rosa, and the adjacent cities and municipalities need to have an integrated drainage system;
  - Dumping of garbage on natural water ways must be avoided;
  - Natural water ways must be kept free of informal settlers;
  - Engineered drainage lines both on private and public properties / development have to be regularly cleaned and properly maintained; and
  - Flood alleviation is a community effort and solutions cannot be through recommendations best by application
5. Topographic map and cross section of the road project to indicate the areas of localized flooding cannot be used since these maps are confined within the road alignment. Further, the adjacent areas of the proposed road alignment had already been developed into subdivisions and industrial parks which are private properties with their own drainage system; and
  6. Flash flood cannot be mitigated since the flood water will be coming from the surrounding catchment area where the project has no control or influence. What can be mitigated is the duration of inundation due to flash flood by providing sufficient and adequate drainage system both (e.g. cross drain and storm drain) to hasten for flood water to subside.

The flood hazard maps for the Provinces of Cavite and Laguna are given as **Figures 2.1.2-8** and **2.1.2-8**, respectively (See Chapter 2).

#### *Volcanic Activity (Taal Volcano)*

Given the approximate distance of the project site from Taal Volcano, ash fall is the most likely volcano related hazard that might affect the project site. The level on impact however may be low and dictated by the following:

- Type of eruption;
- the volume of extruded volcanic materials (a function of the type of eruption);
- Height of eruption/ash cloud; and
- Direction of the prevailing wind during the eruption period (more likely if the prevailing wind is the southwest monsoon)

Volcanic ash is pulverized rock to silt and sand size particles by the volcanic activity. This are ejected material, which initially form an eruption column that rise several miles above a volcano. Height of eruption column depends on the type of eruption. The column eventually spread to form a cloud high into the atmosphere. It eventually spread with the plume direction influenced by the prevailing wind direction. For details please refer to **Chapter 2, Section 2.1.2, Table 2.1.2-4 and Figure 2.1.2-10.**

### Pedology

Based on bore hole data along the alignment, the type of soil encountered corresponds to soil materials that are characteristic of **coastal landscapes** and **alluvial plains**, being slightly to highly plastic, due to considerable amount of clay materials. In this report, these are referred to as **Layer A**. **Layer B** is characterized as grayish brown/gray silty sand with little amount of tuff materials, and **Layer C**, which are non-plastic sandy silts are characteristic of soils found in **hilly and mountainous landscapes**.

### Terrestrial Biology

#### Flora

The vegetation cover along the areas traversed by the proposed CALA Expressway alignment can be classified into **two (2)** major types, the **Natural Vegetation**, and the **Cultivated Vegetation**. The Natural Type primarily consists of Secondary Growth and Lowland Grassland, while the Cultivated Type on the other hand is subdivided into Agricultural and Built-Up.

There is **no primary forest growth observed**. The sparsely vegetated landscape serves as a reminder of the past human activities that have dictated the formation of a distinct flora community. Regenerations of tree species typical of a **secondary forest** are very evident along gullies and edges of rivers and creeks. It is important to note that **endangered and/or rare flora species were not encountered in the study area**.

“Kaingin” or slash and burn farming is the oldest method of agricultural practice known to man since the early years of the 20<sup>th</sup> century. Undeniably, it has greatly influenced the formation of vegetative cover not only in the study area, but in the entire country as well. Due to the enormity of the converted forest areas, farmers are unable to till every corner of the expanse, which leads to the evolution of another vegetation community, called the **Lowland Grassland**. Similar to other grassland, vegetation growth in the study area is dictated mainly by **two (2) grass species** – *Saccharum spontaneum* (talahib) and *Imperata cylindrica* (cogon). Although *I. cylindrica* is the more aggressive species of the two, grassland areas traversed by the alignment are dominated by the much taller and coarser *S. spontaneum*.

Among the affected areas, Silang, Cavite represents the biggest agricultural expanse. The town is famous for producing the very sweet medium-sized **pineapple** and the best tasting **robusta coffee** in the whole Province of Cavite. Yellow and green corn varieties are extensively cultivated in Silang, while palay is planted merely in upland areas due to unavailability of irrigated farmlands. Yellow corn variety is the main raw material for animal feeds.

Commercial fruit trees such as papaya, mango, banana, lanzones, jackfruit, rambutan, and coconut are widely grown in the study area. Root crops such as kamote/sweet potato, cassava, potato, and peanut are also cultivated in Silang. Vegetables grown include okra, lettuce, eggplant, tomato, and black pepper.

Cutflowers and ornamentals are generally grown throughout Silang aside from agricultural produce. Anthurium and orchids are the main cut flowers propagated.

### Fauna (Avifauna)

The study area is typical of a disturbed wildlife habitat. Forest areas that will provide habitat to fauna species no longer exist. Species diversity of the remaining vegetation covers which are commonly converged on ravines and edges of rivers and creeks or in scattered patches is poor.

This being the case, comprehensive study on the existing terrestrial fauna was not undertaken. Instead, documentation of the wildlife fauna was based primarily on actual sightings, focusing mainly on avifauna (birds), since this is the only fauna group most likely to be affected by the project. Species encountered were identified and validated using descriptive and photographic handbook guide on Philippine birds.

Significantly, all the encountered bird species according to IUCN classification belong to the **Least Concerned (LC)** category which means, that these *extant species* or lower taxa which have been evaluated but do not qualify for any other category. As such, they do not qualify as **Threatened, Near-Threatened, or Conservation Dependent** (prior to 2001).

Almost all of the species identified are birds ordinarily found in urban, agricultural, and grassland areas, the most common of which is the Eurasian tree sparrow (*Passer montanus*), a species which is believed to have been introduced to the country from China during the 1930s. Associated species with *P. montanus* that are common in the study area include yellow-vented bulbul (*Pycnonotus goiavier*), long-tailed shrike (*Lanius schach*), glossy swiftlet (*Collocalia esculenta*), and pied fantail (*Rhipidura javanica*). Sighting of olive-backed sunbird (*Cinnyris jugularis*), crested myna (*Acridotheres cristatellus*), white-collared kingfisher (*Halcyon chloris*), black-naped oriole (*Oriolus chinensis*), large-billed crow (*Corvus macrorhynchos*) were likewise documented. Local accounts also revealed presence of **two (2)** owl species -- the Philippine endemic scops owl (*Otus megalotis*) and grass owl (*Tyto longimembris*).

Although it was not established if significant bird activities such as mating, roosting, and nesting are performed in the study area, obviously, the existing flora species do not offer sufficient enough food value to the birds keeping the diversity range at the minimum. Consequently, bird species from nearby protected forest areas like the Mt. Makiling Forest Reserve is not expected to migrate in the study area.

It is important to note that during the field survey, there are no threatened, endangered, and/or vulnerable species encountered.

## **The Water**

### River Systems

There are three (3) main river systems draining the area traversed by the alignment. These are the: (i) *Malaking Ilog River*, (ii) *Lumbia River*, and (iii) *Malindig River*. Malaking Ilog is an almost N-S trending, steeply incised river with upstream portions draining the Tagaytay highlands, into the downstream catchment areas in GMA, Cavite. Lumbia and Malindig are being fed by numerous tributaries, and drains the hilly areas of Silang from the southwest, into the lowland areas of Sta. Rosa and Biñan, on the northeast.

### Water Quality

Baseline water quality sampling was undertaken at **three (3)** selected rivers crossed by the proposed CALA Expressway alignment to establish the physico- chemical properties of the waterways that may be affected by the project.

Laboratory results showed that the detected Total Coliform content from **all water samples exceeded** the DENR Standard of **5,000 MPN/100 ml**. Possible sources of coliform bacteria include agricultural run-off, effluent from septic systems sewage discharge, and infiltration of domestic animal fecal matter.

Although all water samples contain lead, the value detected is less than 0.01 mg/L, and is **well within standard limit of DENR**. Dissolved oxygen (DO) levels are within the required DENR Standard of not less than **5.0 mg/L**. The other parameters, namely Total Suspended Solids (TSS), 5-day day BOD range, are also well within DENR Standards for Class C fresh waters.

In terms of physical properties, the rivers are clear and water is freely flowing. The pH level range is between **6.9-8.0**, which is within the desirable limit to provide protection for the life of freshwater fish and bottom dwelling invertebrates.

## The Air

### Air Quality

Ambient air quality sampling in the study area was conducted at **six (6)** selected sites to establish the existing level of air pollutants that may be influenced by the proposed CALA Expressway project. The sites chosen are those adjacent to air pollution sensitive receptor areas. Sampling was undertaken twice in a day to determine the pollutant levels during the morning and afternoon period. The sampling was done in conformity with the National Ambient Air Quality Standards (NAAQS) of the Department of Environment and Natural Resources (DENR).

#### Total Suspended Particulates (TSP)

Result of the monitoring undertaken at all sampling stations showed that the existing TSP levels both in the morning and in the afternoon are **well within the DENR Standard** for a 1 hour sampling period (**300 µg/Ncm**). The average TSP level observed at the sampling sites ranged from **20 µg/Ncm** to **147 µg/Ncm**. The lowest TSP level observed is **20 µg/Ncm**, which was obtained during the morning sampling.

#### Gaseous Pollutants (SO<sub>2</sub> and NO<sub>2</sub>)

The SO<sub>2</sub> levels observed in all the sampling sites **do not exceed the required standard of the DENR (340 µg/Ncm)** for a 1 hour sampling period. The recorded concentration levels ranged between **19 µg/Ncm** to **31 µg/Ncm** are way below the permissible limit.

Similarly, the measured NO<sub>2</sub> concentration levels at the **six (6)** sampling stations are also **well within the 1 hour period of the DENR standard (260 µg/Ncm)**. The concentration level range is between **3 µg/Ncm** to **11 µg/Ncm**.

## Noise Level

Monitoring of the ambient noise level along the noise sensitive receptor areas traversed by the proposed CALA Expressway alignment was concurrently undertaken with the air quality sampling. Both monitoring activities were conducted at the same sampling sites

Generally the recorded average noise levels at the sampling sites established along the proposed alignment are **typical for an urban area** due to the relatively significant traffic volume. The highest noise levels for all monitoring time periods were recorded at Sta. 2, exceeding the DENR standards for both categories. This can be attributed primarily to the significant traffic volume plying the E. Aguinaldo Highway.

The nighttime noise level recorded ranges between **49.6-60.0 dBA**. It can in also be discerned that the **daytime noise levels are within the permissible limits**. The average evening time noise level observed at Sta. 2 (**59.4 dBA**), Sta. 3 (**54.9 dBA**), and Sta. 6 (**55.6 dBA**), are within the DENR standards of **60 dBA** and **65 dBA** for Class B and Class C categories, respectively.

## **The People**

### Socio-Economic Survey

Socioeconomic survey of project-affected persons was conducted from February 22, 2012 to March 14, 2012. **Four (4)** types of PAPs were interviewed, namely:

- **Type A** - Residential Structure Owner;
- **Type B** - those whose farm land would be affected (landowner/tenant and free occupation of land with permit)
- **Type C** is for Secondary Impact Areas (i.e. youth sector, aged sector, business sector, transport group, residential, women's and NGO/POs); and
- **Type D** for Big Land Developers & Real Estate Companies (the team had a hard time in interviewing Type D respondents due to company protocol).

Presented are basic demographic data followed by an assessment of the affected persons' socio-economic status. Their standard of living and socio-economic status are evaluated using the following data and indicators:

- (i) demography and basic information;
- (ii) primary and secondary source of income;
- (iii) household income and expenditures;
- (iv) type of ownership of structure occupied; and
- (v) type of lighting, water supply and sanitation

## Demography and Basic Information

### *Household Population*

There is a total of **32** residential structure owner-respondents (Type A) and **31** landowner/tenant/free occupation with permit respondents (Type B). Results of survey show that for both types, there are **more than one household** per dwelling structure; i.e., Type A – 32 respondents with 44 households, and Type B respondents – 31 respondents with 47 households.

### *Household Structure*

Majority of the respondents have a nuclear (**54%**) structure of household, **19%** are living alone, **22%** are family with extension and **5%** sharing in one structure.

### *Language*

This dialect used by **95%** of the respondents, is Tagalog. This is followed by ‘Ilocano’ (2%), ‘Bicolano’ (2%), and ‘Ilongo’ (2%).

### *Educational Attainment*

In terms of educational attainment, majority of the **male respondents** were able to finish secondary schooling; i.e., **52%** of the respondents were able to finish the secondary education, **30%** primary education and **11%** successfully finished college. Four percent (**4%**) has taken up vocational and postgraduate level while the remaining **3%** was not able to go to school.

In terms of **female respondents**, majority (**41%**) of them are able to finish secondary or high school education, seconded by **24%** primary education. Female respondents who were able to finish college has a greater percentage (**17%**) compared to the male respondents.

Children who were able to finish college education have a high percentage with **32%**, whereas **50%** are still studying. Approximately **18%** of the children are out of school youth.

### Socioeconomic Characteristics

Socioeconomic characteristics of the PAPs are described in this report based on the results of the survey conducted for Type A and B respondents. The Project-affected persons' standard of living and socioeconomic status were evaluated using the following indicators:

- (i) household income and expenditures;
- (ii) type and ownership of structure occupied;
- (iii) source of lighting,
- (iv) source of water supply, and
- (v) type of sanitation facilities

### *Household Income and Expenditures*

#### **Household Income**

The occupations of Project-affected persons interviewed primarily are farming (**43%**) and employment (**24%**). Results show that majority of the affected land is agricultural land and that the main livelihood to be displaced is farm income. When asked if the PAPs have other source of income aside from the primary income mentioned above, majority of them have no (**52%**) other income and are dependent only on farming.

In terms of monthly family income bracket of the Project-affected persons interviewed, **24%** of them are earning between 6,001 to 15,000 and **22%** have

income bracket of 10,001 to 15,000. Five percent (5%) of them are earning 3,000 or less and fall below the annual food threshold for family of **four (4)** in the Provinces of Cavite and Laguna --- **Php46,120** and **Php43,071** respectively based on National Statistical Yearbook 2010 under Region IV-A.

### **Household Expenditures**

Bulk of the household expenditures consist of food (51%), followed by education (25%). The Respondents considered that if farming will be lost from their livelihood, food security problem will arise from their displacement. They believe that having a farmland will sustain their meal by planting backyard vegetables for daily consumption.

### *Land Ownership*

#### **Residential Lands**

The respondents' landownership shows that out of 32 Type A respondents, 27 or **84% owned the land** as well, while the remaining **five (5)** are renting the land where their structures are built.

#### **Farm Lands**

With regards to Type B respondents, 12 or 39% owned the land, **three (3)** are tenants (10%) and 16 (51%) are occupying the farmland with permit from the owner. The said 16 respondents are within Brgy. Carmen. Based on coordination meeting with the SAMACA NGO in Carmen, almost all of the tenants were paid by the developers and signed a waiver in exchange for their farmland. According to said NGO, since the land is not yet used by the developer, the tenants who received payments have been given a permit to continue their farming activity.

### *Structure Ownership*

Out of 32 Type A households interviewed, 27, or **84%** of them own the structure and only **five (5)** are renting.

## *Availability of Social Services*

### **Power and Water Supply**

All the barangays' **power supply** is provided by MERALCO. In terms of **water supply**, majority of the respondents get their water from artesian well for domestic use such as washing of clothes and dishes (**10%**), and from barangay water district (**46%**), while drinking water is being purchased like mineral and distilled water (**48%**).

### **Health**

Health personnel visit all the barangays, but for more modern health facilities the nearest hospitals are located in *poblacions*. There are **five (5)** hospitals in the Municipality of Silang, **one (1)** of which is a private hospital located in Brgy. Sabutan. There are **three (3)** hospitals in Biñan and also **three (3)** major hospitals in Sta. Rosa. Based on the survey interview, **55 out of 63**, or **87%** said that the nearest health facility in the barangay is the health center.

### **Transportation**

The means of transportation going to the above mentioned health facilities are by means of tricycle (**70%**), *pedicab* (**5%**), jeepney (**10%**); others are by walking (**16%**); i.e., those who are near the health center of the barangay.

### **Education**

With regards to educational facilities, elementary schools are available in every barangay. In terms of secondary education, the barangays with educational facilities offering secondary education Sabutan National High School, Kaong National High School, Munting Ilog National High School. There are seven (7) tertiary schools in the Municipality of Silang. Of them there are two (2) public schools namely Cavite State University and Philippine National Police Academy located in Silang Proper.

In the City of Biñan and Sta. Rosa primary educational facilities are also available in every barangay, while secondary education facilities are located in the poblacions of each city. There are eight (8) tertiary educational facilities in Biñan. Polytechnic University of the Philippines is the available tertiary educational facility.

The means of transportation going to the nearest educational facilities in the abovementioned table are tricycles (**81%**), which is the most common means of transportation in each barangay. Around **17%** live near schools and just walk.

### **Sanitation**

All of the respondents have toilet facilities, with **97%** having toilet facilities installed inside their house while the remaining **3%** have them outside their house. Majority of respondents have semi-flush (**95%**) toilet and only **three (3)** has a flush type toilet facility for those living in Brgy. Sabutan, Silang, Cavite and Brgy. Timbao, Biñan, Laguna.

### **Solid Waste Management**

Collection of garbage in barangays is very limited; only (**11%**) and mostly those who are near the *poblacions* area such as Brgy. Sabutan are serviced. The project-affected barangays generally bury (**14%**) or burn (**71%**) their waste in their backyard while **3%** of them throw their trash in the nearby river.

### **Transportation**

The common means of public utility transportation in the project area is **tricycle**. Barangays along the provincial roads are accessible by *jeepneys*.

## River Use

To determine the stakeholders' dependency on rivers found in the project area, several questions were included in the survey of **198** stakeholders<sup>1</sup>. Specifically they were asked the following questions:

- If they wash their clothes in the river;
- If they have laundry business utilizing the river;
- If they bathe in the river; and
- If they engage in fishing in the river

Based on the results of the survey, only **22 out of 198**, or **11%** are using the river for washing clothes. In terms of use of the river for laundry business, only **10 out of 198**, or **10%** are using the river for their laundry business.

When asked if they bathe in the river, **28 out of 198**, or **14%** said “Yes”. It is interesting to note that majority of these are those from Type A (Residential Sector) respondents, particularly from Brgy. Sabutan.

Among all the respondents, the directly impacted show higher percentage of people fishing on the river with **28%** (9 out of 32) and **26%** (8 out of 31) for **Type A** and **Type B**, respectively, compared to only **4%** (6 out of 129) of those who are indirectly affected, **Type C**.

## Project Awareness

There are a total of **199** respondents who were asked on project awareness regarding the proposed Cavite –Laguna Expressway Project (Laguna Section). These consist of:

- (i) 32 Type A respondents (residential structure owners);
- (ii) 31 Type B respondents (PAPs at farm lands);

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<sup>1</sup> Interviewed stakeholders consist of: (i) **32** Type A respondents (residential structure owners); (ii) **31** Type B respondents (PAPs at farm lands); and **135** Type C respondents (indirectly affected respondents from residential, business, youth, transportation, senior, NGO/POs sectors)

- (iii) 135 Type C respondents or the indirectly affected respondents from residential, business, youth, transportation, senior, NGO/POs sectors

Results show that majority (56%) of the respondents are well informed of the project.

The main sources of information were from the LGUs (26%) and Surveyors (21%). According to the Respondents who attended in the IEC, the project has been presented to them since 2004. The surveyors also informed them during their staking of the alignment. Other sources of information include Consultants (JICA-ECOSYSCORP, INC.), neighbors and friends, and relatives who attended the PCMs, and relayed the information to them.

### Social Acceptability

Out of 199 respondents who were asked on their social acceptability on the proposed Cavite –Laguna Expressway Project (Laguna Section), **majority (74%) are in favor** of the Project. Their common reasons are:

- For improvement of accessibility and for the future development of their province;
- Others said that since that this is a government project, they have no other choice but to accept it;

The remaining 26% not in favor of the project worries too much on the loss of their land. The highest percentage of respondents who refuses the project are those losing their dwelling structures.

### Informal Settlers

**There are no identified informal settlers to be affected by the CALAX Project.**

### Farmlands and Livelihood to be Affected

As mentioned in this report, the western section of this project is mostly agricultural land which is located in the municipality of Silang. The loss of livelihood to be mostly affected is farming. Details on **livelihood** to be affected and the corresponding eligibilities and entitlements are presented in the **Resettlement Action Plan (RAP)**.

### **IMPACT IDENTIFICATION, MITIGATION AND ENHANCEMENT**

**Table III** presents a summary of the most significant predicted impacts most likely to affect the Land, Water, Air, and People during the Pre-Construction, Construction, Abandonment/Decommissioning, and Operational Phases of the Proposed CALA Expressway Project. The corresponding mitigation/enhancement of each identified impacts are likewise included in the matrices.

| Table III Summary Impacts Management Plan (1/16) |                                                                                                                                                                                                                                          |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|--------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental Component Likely to be Affected    | Potential Impact                                                                                                                                                                                                                         | Duration and Type of impacts | Mitigation/Enhancement Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>PRE-CONSTRUCTION AND CONSTRUCTION PHASES</b>  |                                                                                                                                                                                                                                          |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>THE LAND</b>                                  |                                                                                                                                                                                                                                          |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Land Use Classification</b>                   | <p>A total of about <b>92.56 ha</b> of <b>non-irrigated</b> agricultural lands (approximately <b>34.5 ha</b> of corn fields and <b>58.06</b> pineapple plantation) will be traversed by the alignment</p> <p>Loss of fertile topsoil</p> | <i>Long-term, Negative</i>   | <ul style="list-style-type: none"> <li>• Just compensation in accordance with the <b>LARRIPP/WBOP 4.12</b> will be accorded to the affected farmland and property owners;</li> <li>• Construction activities will be limited to the required <b>50-60 m</b> ROW limit to minimize crop damage and unwarranted loss of farmlands;</li> <li>• Minimize unnecessary earth moving and related activities; and</li> <li>• Un-recycled/unused topsoil will be replaced/delivered to adjacent farmlands</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Geology</b>                                   |                                                                                                                                                                                                                                          | <i>Long-term, Negative</i>   | <ul style="list-style-type: none"> <li>• Establish seismic hazard characteristics for the project site based on the seismic zone and proximity of the site to active seismic sources, site soil profile characteristics and structure importance factor through: <ul style="list-style-type: none"> <li>➢ Analysis of aerial photographs/radar images of the project site;</li> <li>➢ Geo-resistivity survey to determine the exact location, trend, and zone width of the fault trace/s; and</li> <li>➢ Trenching</li> </ul> </li> <li>• Undertake a site specific Probabilistic Seismic Hazard Assessment (PSHA) for the bridge and fly over components of the project to: <ul style="list-style-type: none"> <li>➢ Estimate the Maximum Considered Earthquake (MCE) defined as the largest earthquake that appears possible along presently recognized faults having <b>2%</b> probability of not being exceeded in <b>50 years</b> corresponding to typical return period of approximately <b>2,500 years</b> at the site; and</li> <li>➢ Estimate the Design Basis Earthquake (DBE) usually defined in practice as the earthquake with a ground motion that has <b>10%</b> probability of being exceeded at least once over a period of <b>50 years</b> and a corresponding statistical return period of <b>475 years</b></li> </ul> </li> </ul> |

**Table III Summary Impacts Management Plan (2/16)**

| Environmental Component Likely to be Affected   | Potential Impact                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Duration and Type of impacts | Mitigation/Enhancement Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>PRE-CONSTRUCTION AND CONSTRUCTION PHASES</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>THE LAND</b>                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Geology</b>                                  | Possible occurrence of rain-induced landslide and soil erosion along cut sections and slope areas                                                                                                                                                                                                                                                                                                                                                                                                                   | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• Suitable angle of repose along cut areas will be maintained;</li> <li>• Slope and pier protection measures will be implemented along cut sections and unstable slopes;</li> <li>• Removal of vegetation and tree cutting will be limited to the required ROW of <b>50-60 m</b>; and</li> <li>• Re-vegetation of identified erosion prone areas with suitable grass species (e.g. vetiver) and other common slope protection plant species will be considered</li> </ul>                                      |
|                                                 | Possible occurrence of earthquake-induced landslides                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <i>Long-term, Negative</i>   | <ul style="list-style-type: none"> <li>• If ever, occurrence of earthquake-induced will be confined on gully walls and possibly at the escarpment at the eastern margin of the volcanic slope;</li> <li>• The alignment will not pass along escarpments; and</li> <li>• Bridges crossing gullies will have well-engineered abutments founded into the gully floor or imbedded into the gully walls</li> </ul>                                                                                                                                         |
|                                                 | <p>Occurrence of ash fall due to Taal Volcano activity:</p> <ul style="list-style-type: none"> <li>• Ash can clog drainage;</li> <li>• Fine ash is extremely slippery, hampering driving and walking;</li> <li>• Volcanic ash is gritty, abrasive and corrosive and can trouble infants, the elderly and those with respiratory ailments. ;</li> <li>• Ash can abrade and damage machinery and sensitive electronic/electrical equipment; and</li> <li>• Long-term exposure to wet ash can corrode metal</li> </ul> | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• Volcanic ash accumulation along the project roadway should be cleared immediately;</li> <li>• Vulnerable people must wear face mask or cover their nose &amp; mouth with damp handkerchief or cloth;</li> <li>• Public buildings and critical infrastructures are most vulnerable. Identify and organize ash clearing teams to monitor and clear ash accumulation;</li> <li>• Closely monitor the bulletin of PHIVOLCS and heed their advice; and</li> <li>• Issue warning bulletin to road users</li> </ul> |

| Table III Summary Impacts Management Plan (3/16) |                                                                                                                                                                                                                                                                                                                                                                           |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|--------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental Component Likely to be Affected    | Potential Impact                                                                                                                                                                                                                                                                                                                                                          | Duration and Type of impacts | Mitigation/Enhancement Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>PRE-CONSTRUCTION AND CONSTRUCTION PHASES</b>  |                                                                                                                                                                                                                                                                                                                                                                           |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>THE LAND</b>                                  |                                                                                                                                                                                                                                                                                                                                                                           |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Geology</b>                                   | <p>Occurrence of volcanic smog due to Taal Volcano eruption:</p> <ul style="list-style-type: none"> <li>• Generally associated with eruption clouds/ash fall;</li> <li>• Can aggravate respiratory problems; and</li> <li>• Can form acid rain that can corrode metals and contaminate drinking water if collected or sourced from rainwater catchment systems</li> </ul> | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• Closely monitor the bulletin of PHIVOLCS and heed their advice; and</li> <li>• Issue warning bulletin to road users</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Flooding</b>                                  | Possible aggravation of existing localized flooding at adjacent areas of the alignment                                                                                                                                                                                                                                                                                    | <i>Long-term, Negative</i>   | <ul style="list-style-type: none"> <li>• The alignment crosses a number of deep gullies that flow towards the receiving bodies of water (e.g. Laguna de Bay etc.);</li> <li>• Existing drainage systems at executive subdivisions and developed areas adjacent to the CALA Expressway alignment accommodate storm water discharge from the road;</li> <li>• Dumping of garbage along the natural waterways must be prohibited; and</li> <li>• Regular de-clogging of existing drainage lines on both private and public properties/development areas adjacent to the alignment</li> </ul>                                                                                                                            |
| <b>Terrestrial Biology (Flora)</b>               | Minimal loss of natural and cultivated vegetation                                                                                                                                                                                                                                                                                                                         | <i>Long-term, Negative</i>   | <ul style="list-style-type: none"> <li>• Unavoidable but loss of vegetation is expected to be minimal;</li> <li>• Just compensation in accordance with the <b>LARRIPP/WBOP 4.12</b> will be accorded to the farmers for loss of agricultural crops;</li> <li>• "Permit To Cut" will be secured prior to any tree cutting activities;</li> <li>• Limit tree cutting within the required <b>ROW of 50-60 m</b>;</li> <li>• Balling/relocation of trees will be carefully undertaken;</li> <li>• Undertake reforestation activities at area/s designated by the DENR-FMB Region IV-A; and</li> <li>• Strict implementation of tree planting along National Roads as per <b>DPWH D.O. 131, Series of 1995</b></li> </ul> |

| Table III Summary Impacts Management Plan (4/16) |                                                                                                                                           |                              |                                                                                                                                                                                                                                                                                                                                                                                                                        |
|--------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental Component Likely to be Affected    | Potential Impact                                                                                                                          | Duration and Type of impacts | Mitigation/Enhancement Measures                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>PRE-CONSTRUCTION AND CONSTRUCTION PHASES</b>  |                                                                                                                                           |                              |                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>THE LAND</b>                                  |                                                                                                                                           |                              |                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Terrestrial Biology (Fauna)</b>               | Temporary disturbance to wildlife movements and activities, particularly avifauna (bird)                                                  | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• Significant bird activities such as feeding and nesting can be temporarily performed at adjacent forest patches and grassland areas;</li> <li>• Education of workers will be educated on protection and conservation of wildlife fauna, especially birds; and</li> <li>• Bird poaching will be strictly prohibited</li> </ul>                                                 |
| <b>THE WATER</b>                                 |                                                                                                                                           |                              |                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Surface Hydrology</b>                         | Possible decrease in water flow rate of the waterways crossed by the alignment due to impediment caused by construction spoils and debris | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• Provision of nets at bridge construction sites to prevent falling of debris into the waterways;</li> <li>• Temporary rechanneling of stream flow along major waterways such as Malaking Ilog River, Lumbia River, and Malindig River; and</li> <li>• Regular hauling and disposal of construction spoils and debris to the designated dumpsites</li> </ul>                    |
| <b>Groundwater</b>                               | Possible contamination of groundwater table due to oil seepage and indiscriminate disposal of toxic chemicals (i.e. paints and used oils) | <i>Long-term, Negative</i>   | <ul style="list-style-type: none"> <li>• Motor pool area will be located away from existing groundwater sources; and</li> <li>• Provision of storage facilities for used oils and other toxic wastes in the motor pool area ; and</li> <li>• Regular disposal of hazardous wastes will be handled by DENR-accredited company and will be disposed to DENR-approved sites</li> </ul>                                    |
| <b>Water Quality</b>                             | Possible increase in the present level of total coliform content of the waterways                                                         | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• Provision of temporary sanitation facilities, particularly portable toilets and garbage bins at all construction sites, temporary field offices, and workers' camp sites;</li> <li>• Strict implementation of proper waste segregation;</li> <li>• Regular hauling and disposal of solid and domestic wastes generated by the workers to the designated dumpsites;</li> </ul> |

| Table III Summary Impacts Management Plan (5/12) |                                                                                                                                                  |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental Component Likely to be Affected    | Potential Impact                                                                                                                                 | Duration and Type of impacts | Mitigation/Enhancement Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>PRE-CONSTRUCTION AND CONSTRUCTION PHASES</b>  |                                                                                                                                                  |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>THE WATER</b>                                 |                                                                                                                                                  |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Water Quality</b>                             | Possible increase in the present level of total coliform content of the waterways                                                                | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• Daily inspection of the workers' camp sites, temporary field offices, and all construction areas; and</li> <li>• Twice a year coliform level monitoring along selected waterways crossed by the alignment</li> </ul>                                                                                                                                                                                                                     |
|                                                  | Possible increase in the siltation level of the waterways due to surface run-off                                                                 | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• Earth moving activities and related construction works along cut and slope areas and bridge sites will be cautiously undertaken to minimize soil disturbance;</li> <li>• Provision of temporary silt traps along the waterways;</li> <li>• Re-vegetation of exposed slopes and open construction areas adjacent to the waterways; and</li> <li>• TSS level monitoring along selected waterways will be conducted twice a year</li> </ul> |
|                                                  | Possible increase in pH level of the waterways due to concrete spillage                                                                          | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• Close supervision of concrete pouring and road surfacing at bridge construction sites;</li> <li>• Installation of nets at bridge construction sites; and</li> <li>• Washing of transit mixers and related construction equipment along the waterways will be strictly prohibited</li> </ul>                                                                                                                                              |
|                                                  | Possible increase in the oil & grease level of the waterways due to oil spillage from heavy equipment and machineries during bridge construction | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• Strict compliance to the Periodic Service Maintenance (PMS) of the construction equipment and machineries;</li> <li>• Washing of construction equipment and machineries along the waterways will be strictly prohibited; and</li> <li>• On-site repair and maintenance of the construction equipment will be strictly prohibited</li> </ul>                                                                                              |

| Table III Summary Impacts Management Plan (6/16) |                                                                                                                                                                                                             |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental Component Likely to be Affected    | Potential Impact                                                                                                                                                                                            | Duration and Type of impacts | Mitigation/Enhancement Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>PRE-CONSTRUCTION AND CONSTRUCTION PHASES</b>  |                                                                                                                                                                                                             |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>THE AIR</b>                                   |                                                                                                                                                                                                             |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Air Quality</b>                               | Possible increase in the TSP level at the construction site and adjacent dust sensitive receptor areas such as residential, schools, and hospitals due to dust re-suspension                                | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• Regular spraying of water at exposed and cleared construction areas;</li> <li>• Strict enforcement of the <b>20 kph</b> speed limit along the construction areas, particularly at dust sensitive receptor areas;</li> <li>• Temporary stockpiles of un-recycled materials and construction spoils will be covered with tarpaulin or sack materials;</li> <li>• Regular hauling and disposal of construction spoils to areas duly-approved by the DENR and/or concerned LGUs;</li> <li>• Delivery and hauling trucks will be provided with tarpaulin or sack materials; and</li> <li>• Conduct a quarterly TSP monitoring at dust sensitive receptor areas during the pre-construction and construction phases</li> </ul> |
|                                                  | Possible increase in the concentration levels of SO <sub>2</sub> and NO <sub>2</sub> due to exhaust gas emissions from various construction vehicles, equipment, and machineries                            | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• PMS of construction equipment and machineries, and vehicles will be strictly complied with to ensure these are in good working condition at all times;</li> <li>• Daily routine check-up of construction vehicles, equipment, and machineries must be strictly complied with; and</li> <li>• Quarterly SO<sub>2</sub> and NO<sub>2</sub> sampling at air pollution sensitive areas will be conducted during the pre-construction and construction phases of the project</li> </ul>                                                                                                                                                                                                                                       |
| <b>Noise Level and Vibration</b>                 | <p>Possible increase in the noise level due to operation of various construction equipment and machineries</p> <p>Possible incidence of ground vibration due to foundation works and related activities</p> | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• Bored piles using a special boring equipment will be adopted during foundation works instead of pile driving to prevent ground vibration;</li> <li>• Installation of noise suppressors to construction equipment and machineries to maintain noise generated at permissible level;</li> <li>• High noise generating construction activities will be scheduled and undertaken during daytime only;</li> </ul>                                                                                                                                                                                                                                                                                                             |

| Table III Summary Impacts Management Plan (7/16) |                                                                                                                                                                                                             |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|--------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental Component Likely to be Affected    | Potential Impact                                                                                                                                                                                            | Duration and Type of impacts | Mitigation/Enhancement Measures                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>PRE-CONSTRUCTION AND CONSTRUCTION PHASES</b>  |                                                                                                                                                                                                             |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>THE AIR</b>                                   |                                                                                                                                                                                                             |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Noise Level and Vibration</b>                 | <p>Possible increase in the noise level due to operation of various construction equipment and machineries</p> <p>Possible incidence of ground vibration due to foundation works and related activities</p> | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• Installation of temporary noise barriers at noise sensitive receptor areas such as residential, schools, hospitals, and places of worships to maintain noise level at permissible limit; and</li> <li>• Strict compliance to the PMS of the construction equipment and machineries</li> </ul>                                                                                                    |
| <b>THE PEOPLE</b>                                |                                                                                                                                                                                                             |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Assets and Income</b>                         | <p>Displacement of residential and commercial structures within the ROW</p> <p>Loss of properties/farmlands and livelihood</p>                                                                              | <i>Long-term, Negative</i>   | <ul style="list-style-type: none"> <li>• A final Resettlement Action Plan (RAP) with full consensus with the PAPs, and inventories of land and other properties will be prepared prior to implementation of the project;</li> <li>• PAPs will be compensated in accordance with <b>LARRIPP/ WBOP 4.12</b> for loss of assets and source of livelihood;</li> <li>• Limit construction within the required ROW of <b>50-60 m</b></li> </ul> |
|                                                  | Loss of commercial crops like pineapple, coffee, coconut, papaya, cassava, and banana                                                                                                                       | <i>Long-term, Negative</i>   | <ul style="list-style-type: none"> <li>• Prepare a final RAP with full consensus with the PAPs, prior to implementation of the project; and</li> <li>• Just compensation in accordance with <b>LARRIPP/ WBOP 4.12</b> will be accorded to PAPs for loss of crops</li> </ul>                                                                                                                                                               |
|                                                  | Disturbance to agricultural activities along the proposed CALA Expressway alignment                                                                                                                         | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• Provision of temporary farm crossings at affected farmlands; and</li> <li>• Disturbance compensation in accordance with <b>LARRIPP/ WBOP 4.12</b> will be accorded to the PAPs;</li> </ul>                                                                                                                                                                                                       |
|                                                  | Accidental filling up of farmlands adjacent to the construction areas                                                                                                                                       | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• Locate temporary stockpiles of construction materials, construction spoils and debris away from agricultural lands; and</li> <li>• In case of accidental filling up, damage compensation in accordance with <b>LARRIPP/ WBOP 4.12</b> will be accorded to the affected farmers</li> </ul>                                                                                                        |

| Table III Summary Impacts Management Plan (8/16) |                                                                                                                                                                                                                                                                                                                                                                   |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
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| Environmental Component Likely to be Affected    | Potential Impact                                                                                                                                                                                                                                                                                                                                                  | Duration and Type of impacts | Mitigation/Enhancement Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>PRE-CONSTRUCTION AND CONSTRUCTION PHASES</b>  |                                                                                                                                                                                                                                                                                                                                                                   |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>THE PEOPLE</b>                                |                                                                                                                                                                                                                                                                                                                                                                   |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Temporary Employment</b>                      | Generation of temporary employment to qualified residents in the direct and indirect impact areas                                                                                                                                                                                                                                                                 | <i>Short-term, Positive</i>  | <ul style="list-style-type: none"> <li>Qualified workers <b>duly endorsed</b> by the barangay captains from the impact areas will be given priority in hiring during implementation of the project</li> </ul>                                                                                                                                                                                                                                                                                                 |
| <b>Basic Social Service Utilities</b>            | <p>Interruption of water supply in areas serviced by the wells located in Brgy. Sabutan, Silang, Cavite</p> <p>Possible interruption of power supply and telecommunication service</p>                                                                                                                                                                            | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>Prompt restoration of affected wells in Brgy. Sabutan;</li> <li>Prompt relocation and full restoration of affected basic service utilities to their normal functions to avoid inconvenience to the public; and</li> <li>Proper notification of affected residents to enable them to undertake the necessary measures to minimize effect of interruption</li> </ul>                                                                                                     |
| <b>Social Service Facilities</b>                 | Increase in demand of basic social service facilities such as health centers and places of worships due to in-migration of workers                                                                                                                                                                                                                                | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>Provision of basic social service facilities such as health care center, eating spaces, and places of worships at the work sites</li> </ul>                                                                                                                                                                                                                                                                                                                            |
| <b>Occupational Health and Safety</b>            | <p>Long-term exposure of workers, especially heavy equipment operators to high noise level may lead to hearing impairment</p> <p>Long-term exposure of workers, especially heavy equipment operators to exhaust gas emissions may result to upper respiratory ailments</p> <p>Direct contact of workers handling toxic materials may lead to chronic diseases</p> | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>Provision of adequate Personal Protective Equipment (PPE) such as ear muffs, gas/protective masks, hard hats, safety boots, safety gloves, reflectorized vests, and other related safety gears to workers;</li> <li>Wearing of the provided PPEs will be strictly implemented;</li> <li>Personnel will be trained on safety procedures and educated on health standards;</li> <li>Personnel will be comprehensively trained on handling of toxic materials;</li> </ul> |

| Table III Summary Impacts Management Plan (9/16)       |                                                                                                                                                                                                                                                                                                                                                                   |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental Component Likely to be Affected          | Potential Impact                                                                                                                                                                                                                                                                                                                                                  | Duration and Type of impacts | Mitigation/Enhancement Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>PRE-CONSTRUCTION AND CONSTRUCTION PHASES</b>        |                                                                                                                                                                                                                                                                                                                                                                   |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>THE PEOPLE</b>                                      |                                                                                                                                                                                                                                                                                                                                                                   |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Occupational Health and Safety</b>                  | <p>Long-term exposure of workers, especially heavy equipment operators to high noise level may lead to hearing impairment</p> <p>Long-term exposure of workers, especially heavy equipment operators to exhaust gas emissions may result to upper respiratory ailments</p> <p>Direct contact of workers handling toxic materials may lead to chronic diseases</p> | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• Provision of medical clinic and first aid station facilities supervised by a registered in the work areas and field offices;</li> <li>• Formulate an Emergency Response Plan (ERP) to quickly respond to any type of emergency situation within the construction area;</li> <li>• Regular conduct of medical check-up of workers;</li> <li>• Strict compliance to the PMS of the heavy equipment, machineries, and vehicles;</li> <li>• Provision of an emergency vehicle on stand-by within the construction areas at all times</li> </ul>                                                                                                                                                                                         |
| <b>Waste Management, Sanitation, and Public Health</b> | <p>Possible spread of communicable diseases due to improper wastes management</p> <p>Potential spread of communicable diseases in the receiving communities due to in-migration of workers</p> <p>Possible spread of sexually transmitted diseases (STDs)</p>                                                                                                     | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• Provision of adequate temporary sanitation facilities such as portable toilets and trash bins at all construction sites, workers' camps, and field offices;</li> <li>• Strict enforcement of proper waste segregation scheme;</li> <li>• Regular hauling and disposal of domestic and solid wastes generated by the workers to the designated dumpsites;</li> <li>• Daily inspection of workers' camps and field offices to ensure good housekeeping;</li> <li>• Strict medical screening of migrant workers during hiring period;</li> <li>• Regular medical check-up of workers; and</li> <li>• Group consultations will be undertaken to promote awareness among the community on how to prevent transmission of STDs</li> </ul> |

| Table III Summary Impacts Management Plan (10/16) |                                                                                                                                                                                                                                  |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
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| Environmental Component Likely to be Affected     | Potential Impact                                                                                                                                                                                                                 | Duration and Type of impacts | Mitigation/Enhancement Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>PRE-CONSTRUCTION AND CONSTRUCTION PHASES</b>   |                                                                                                                                                                                                                                  |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>THE PEOPLE</b>                                 |                                                                                                                                                                                                                                  |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Public Safety</b>                              | Safety of pedestrians and residents near the construction areas                                                                                                                                                                  | <i>Short-term, negative</i>  | <ul style="list-style-type: none"> <li>• All excavation areas will be enclosed with metal sheets and barriers will be installed at the construction areas to limit access to the public, especially children;</li> <li>• Provision of pedestrians crosswalks at critical construction areas such as built-up areas, schools, places of worships, and hospitals;</li> <li>• Provision of adequate lighting and reflectorized warning signs within the construction sites to ensure safety of public, especially during nighttime; and</li> <li>• Designation of well-trained traffic aides and flagmen at critical construction sites</li> </ul>                                                                                                                                              |
| <b>Safety of Motorists</b>                        | <p>Safety of motorists plying the major and minor roads crossing the alignment</p> <p>Safety of motorists at bridge and interchange construction sites</p>                                                                       | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• Installation of adequate lighting and reflectorized warning signs along the entire construction sites, particularly bridge sites and interchange locations to ensure safety of motorists, especially during nighttime;</li> <li>• Strict implementation of the approved Traffic Management Plan (TMP) and re-routing schemes along major roads, bridge sites and interchange locations;</li> <li>• Designation of well-trained traffic aides and flagmen along road intersections, bridge sites, interchange locations, and other critical construction sites to direct traffic and assist motorists; and</li> <li>• Parking of idle construction equipment and vehicles along the roads will be prohibited, especially during nighttime</li> </ul> |
| <b>Traffic</b>                                    | <p>Possible traffic congestion along major and minor roads intersected by the proposed CALA Expressway alignment and other surrounding arterial roads</p> <p>Traffic congestion at bridge and interchange construction sites</p> | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• Strict implementation of the traffic measures indicated in the approved Traffic Impact Assessment (TIA) to minimize traffic congestion;</li> <li>• Strict implementation of the approved TMP and re-routing schemes along major roads, bridge sites, interchange locations, and other busy construction areas;</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                           |

| Table III Summary Impacts Management Plan (11/16) |                                                                                                                                                                                                                                  |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
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| Environmental Component Likely to be Affected     | Potential Impact                                                                                                                                                                                                                 | Duration and Type of impacts | Mitigation/Enhancement Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>PRE-CONSTRUCTION AND CONSTRUCTION PHASES</b>   |                                                                                                                                                                                                                                  |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>THE PEOPLE</b>                                 |                                                                                                                                                                                                                                  |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Traffic</b>                                    | <p>Possible traffic congestion along major and minor roads intersected by the proposed CALA Expressway alignment and other surrounding arterial roads</p> <p>Traffic congestion at bridge and interchange construction sites</p> | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• Limit parking/waiting time of construction vehicles and equipment along major roads and busy areas; and</li> <li>• Delivery and transport of fabricated construction materials will be done during nighttime</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>DEMOBILIZATION/DECOMMISSIONING PHASE</b>       |                                                                                                                                                                                                                                  |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>THE LAND</b>                                   |                                                                                                                                                                                                                                  |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Geology</b>                                    | <p>Stability of cut slopes, landslide and erosion prone areas</p>                                                                                                                                                                | <i>Long-term, Negative</i>   | <ul style="list-style-type: none"> <li>• The Contractor must ensure that: <ul style="list-style-type: none"> <li>➢ Re-vegetation of the exposed and cleared slopes is in place;</li> <li>➢ Slope and pier protection with retaining structures are in place; and</li> <li>➢ Angle of repose along cut sections are maintained</li> </ul> </li> <li>• Conduct a joint site inspection between the Environmental Safety and Health Officer (ESHO) of the Contractor, representatives from the DPWH, representatives from the concerned LGUs, representatives from the DENR Region IV-A, and community leaders of affected barangays will be undertaken to ensure that protection measures are in place</li> </ul> |
| <b>Terrestrial Biology (Flora)</b>                | <p>Replacement of cut trees</p> <p>Revegetation of cut slopes and embankment areas, and landscaping of areas stripped of vegetation cover</p> <p>Tree planting along the National Roads/newly constructed CALA Expressway</p>    | <i>Long-term, Positive</i>   | <ul style="list-style-type: none"> <li>• The Contractor must ensure that: <ul style="list-style-type: none"> <li>➢ The survival rate of the tree species introduced is established;</li> <li>➢ Revegetation of the cut slopes and embankment areas is in place;</li> <li>➢ Landscaping of areas stripped of vegetation cover is in place; and</li> <li>➢ The survival rate of the trees planted along the National Roads is established</li> </ul> </li> </ul>                                                                                                                                                                                                                                                  |

| Table III Summary Impacts Management Plan (12/16) |                                                                                                                                                                                                                               |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
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| Environmental Component Likely to be Affected     | Potential Impact                                                                                                                                                                                                              | Duration and Type of impacts | Mitigation/Enhancement Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>DEMOBILIZATION/DECOMMISSIONING PHASE</b>       |                                                                                                                                                                                                                               |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>THE LAND</b>                                   |                                                                                                                                                                                                                               |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Terrestrial Biology (Flora)</b>                | <p>Replacement of cut trees</p> <p>Revegetation of cut slopes and embankment areas, and landscaping of areas stripped of vegetation cover</p> <p>Tree planting along the National Roads/newly constructed CALA Expressway</p> | <i>Long-term, Positive</i>   | <ul style="list-style-type: none"> <li>Conduct a joint site inspection between the ESHO of the Contractor, DPWH representatives, representatives from the concerned LGUs, representatives of DENR Region IV-A, and community leaders of affected barangays to ensure that reforestation, re-vegetation, and tree planting activities are in place</li> </ul>                                                                                                                                                                                                                                                                                                                        |
| <b>THE WATER</b>                                  |                                                                                                                                                                                                                               |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Surface Hydrology</b>                          | Possible impediment of water flow of waterways due to abandoned construction spoils and debris                                                                                                                                | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>The Contractor must ensure that all temporary stockpiles of construction spoils and debris are totally removed from the construction areas and are properly disposed to the designated dumpsites and not abandoned in the construction areas; and</li> <li>Conduct a joint site inspection between the ESHO of the Contractor, DPWH representatives, representatives from the Solid Waste Management and Disposal Office of the concerned LGUs, representatives of DENR Region IV-A, and community leaders of affected barangays ensure that all bridge sites are free from construction spoils and debris</li> </ul>                        |
| <b>Groundwater</b>                                | Possible contamination of water tables due to abandoned used oils and other toxic materials                                                                                                                                   | <i>Long-term, Negative</i>   | <ul style="list-style-type: none"> <li>Ensure complete closure of the motorpool;</li> <li>Complete and proper dismantling of the temporary storage facilities in the motorpool area;</li> <li>Ensure that all toxic wastes such hauled and disposed to site/s duly approved by DENR Region IV-A; and</li> <li>Conduct a joint site inspection between ESHO of the Contractor, DPWH representatives, representatives from the Solid Waste Management and Disposal Office of the concerned LGUs, representatives of DENR Region IV-A, and community leaders of affected barangays to ensure that the motorpool area is completely closed and no toxic wastes are abandoned</li> </ul> |

| Table III Summary Impacts Management Plan (13/16) |                                                                                    |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
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| Environmental Component Likely to be Affected     | Potential Impact                                                                   | Duration and Type of impacts | Mitigation/Enhancement Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>DEMOBILIZATION/DECOMMISSIONING PHASE</b>       |                                                                                    |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>THE WATER</b>                                  |                                                                                    |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Water Quality</b>                              | Possible contamination of the waterways due to abandoned domestic and solid wastes | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>The Contractor must ensure that: <ul style="list-style-type: none"> <li>➤ All temporary sanitation facilities are dismantled and removed from the construction sites; and</li> <li>➤ All remaining solid and domestic wastes are properly disposed to the designated dumpsites and not abandoned at the work sites;</li> </ul> </li> <li>Conduct a joint site inspection between the ESHO of the Contractor, representatives from DPWH, representatives from the Solid Waste Management and Sanitation Office of the concerned LGUs, and community leaders of affected barangays to ensure that all temporary sanitation facilities are dismantled and no wastes are abandoned at the work sites</li> </ul> |
|                                                   | Possible siltation of the waterways crossed by the CALA Expressway alignment       | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>The Contractor must ensure that all remaining stockpiles of un-recycled soil materials and construction spoils are properly disposed to the designated dumpsites; and</li> <li>Conduct a joint site inspection between the ESHO of the Contractor, DPWH representatives, representatives from the Solid Waste Management and Disposal Office of the concerned LGUs, and community leaders of affected barangays to ensure that no stockpiles of un-recycled soil materials and construction spoils are abandoned</li> </ul>                                                                                                                                                                                 |
| <b>THE PEOPLE</b>                                 |                                                                                    |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Basic Social Service Utilities</b>             | Extended interruption of water and power supplies, and telecommunication lines     | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>The Contractor must ensure that the displaced wells in Brgy. Sabutan, Silang, Cavite are relocated and restored to normal function;</li> <li>Prompt relocation and restoration to normal functions of water and power supplies, and telecommunication lines must be ensured by the Contractor;</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                   |

| Table III Summary Impacts Management Plan (14/16)      |                                                                                     |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------------------------------------------|-------------------------------------------------------------------------------------|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental Component Likely to be Affected          | Potential Impact                                                                    | Duration and Type of impacts | Mitigation/Enhancement Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>DEMOBILIZATION/DECOMMISSIONING PHASE</b>            |                                                                                     |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>THE PEOPLE</b>                                      |                                                                                     |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Basic Social Service Utilities</b>                  | Extended interruption of water and power supplies, and telecommunication lines      | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• Conduct a joint site inspection between the ESHO of the Contractor, representatives from the concerned utility companies, representatives from the concerned LGUs, representative from the DPWH, and leaders of affected communities to ensure replacement, relocation, and complete restoration of affected utility service facilities</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Waste Management, Sanitation, and Public Health</b> | Possible spread of communicable diseases due to abandoned solid and domestic wastes | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• The Contractor must ensure that: <ul style="list-style-type: none"> <li>➢ All temporary sanitation facilities are dismantled and removed from the construction sites, workers' camps, and field offices immediately after construction works are completed; and</li> <li>➢ All remaining solid and domestic wastes are properly disposed to the designated dumpsites</li> </ul> </li> <li>• Conduct a joint site inspection between the ESHO of the Contractor, representatives from DPWH, representatives from the Solid Waste Management and Sanitation Office of the concerned LGUs, and community leaders of affected barangays to ensure that all temporary sanitation facilities are completely dismantled and no wastes are abandoned</li> </ul> |
| <b>Illegal Settlement</b>                              | Permanent and illegal settlement at workers camps and field offices                 | <i>Long-term, Negative</i>   | <ul style="list-style-type: none"> <li>• Ensure complete closure of all temporary facilities such as bunk houses and field offices; and</li> <li>• Conduct a joint site inspection between the ESHO of the Contractor, representatives from DPWH, concerned LGUs, and community leaders of affected barangays to ensure complete closure of workers' camps and temporary field offices</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                |

| Table III Summary Impacts Management Plan (15/16) |                                                                                                                                                                                                                             |                              |                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental Component Likely to be Affected     | Potential Impact                                                                                                                                                                                                            | Duration and Type of impacts | Mitigation/Enhancement Measures                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>OPERATIONAL PHASE</b>                          |                                                                                                                                                                                                                             |                              |                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>THE LAND</b>                                   |                                                                                                                                                                                                                             |                              |                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Land Use</b>                                   | Possible conversion of <b>marginally utilized</b> agricultural lands adjacent to the newly constructed CALA Expressway, particularly in Brgy. Kaong, Sabutan, Tibig, Carmen, and Inchican in Silang, Cavite into other uses | <i>Long-term, Negative</i>   | <ul style="list-style-type: none"> <li>Concerned LGUs must pass necessary ordinances and strictly implement such to support existing legislations prohibiting illegal conversion of agricultural lands into other uses</li> </ul>                                                                                                                                                                                      |
| <b>THE AIR</b>                                    |                                                                                                                                                                                                                             |                              |                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Air Quality</b>                                | Possible increase in TSP level in areas along the newly constructed CALA Expressway due to increase in vehicular traffic volume                                                                                             | <i>Long-term, Negative</i>   | <ul style="list-style-type: none"> <li>Continuous monitoring of the survival rate of the trees planted along the newly constructed CALA Expressway, that act not only as natural sieves for re-suspended dust particles, but also enhance aesthetics of the road sides; and</li> <li>Strict implementation of the Philippine Clean Air Act and Anti-Smoke Belching Law by the concerned government agencies</li> </ul> |
|                                                   | Possible increase in the level of gaseous air contaminants such as SO <sub>2</sub> and NO <sub>2</sub> due to increase in vehicular traffic volume                                                                          | <i>Long-term, Negative</i>   | <ul style="list-style-type: none"> <li>Continuous monitoring of the survival rate of the trees planted along the newly constructed CALA Expressway. Trees absorb gaseous air pollutants and convert them into oxygen through transpiration process; and</li> <li>Strict implementation of the Philippine Clean Air Act and Anti-Smoke Belching Law by the concerned government agencies</li> </ul>                     |
| <b>Noise Level</b>                                | Possible increase in the present level of noise along the newly constructed CALA Expressway, particularly at noise sensitive receptor areas due to increase in volume of vehicular traffic                                  | <i>Long-term, Negative</i>   | <ul style="list-style-type: none"> <li>The “No Blowing of Horns” at noise sensitive receptor areas such as schools, hospitals, and places of worships will be strictly enforced;</li> <li>If necessary, adequate noise barriers will be installed at noise sensitive receptors adjacent to the CALA Expressway such as residential areas, schools, hospitals, and places of worships</li> </ul>                        |

| Table III Summary Impacts Management Plan (16/16) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|---------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental Component Likely to be Affected     | Potential Impact                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Duration and Type of impacts | Mitigation/Enhancement Measures                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>THE PEOPLE</b>                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Economy</b>                                    | <p>The newly constructed CALAX Expressway will:</p> <ul style="list-style-type: none"> <li>➤ Provide fast, safe, comfortable and reliable means of transport in Cavite and Laguna Provinces;</li> <li>➤ Decongest traffic of roads in Cavite and Laguna Provinces;</li> <li>➤ Support economic development by providing better transport access to economic/industrial zones in the area; and</li> <li>➤ Support sound urbanization in the areas traversed by the CALA Expressway</li> </ul> | <i>Long-term, Positive</i>   | <ul style="list-style-type: none"> <li>• Periodic inspection and maintenance of the newly constructed CALA Expressway based on standard DPWH inspection and maintenance procedures for roads and bridges will be undertaken to maximize optimum service to road users</li> </ul>                                                                                                                                                             |
| <b>Road Safety</b>                                | Safety of motorists plying the newly constructed CALA Expressway                                                                                                                                                                                                                                                                                                                                                                                                                             | <i>Long-term, Negative</i>   | <ul style="list-style-type: none"> <li>• Road signs and markings, information display board, and streetlights, especially along bridges and interchanges will be properly maintained; and</li> <li>• Periodic inspection and maintenance of the newly constructed CALA Expressway based on standard DPWH inspection and maintenance procedures for roads and bridges will be undertaken to maximize optimum service to road users</li> </ul> |

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# Chapter 1

## Project Description

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# 1 PROJECT DESCRIPTION

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## 1.1 PROJECT LOCATION AND AREA

### 1.1.1 Project Location

The proposed CALA Expressway alignment encompasses the Municipality of Silang, in Cavite, and the Cities of Santa Rosa and Biñan in the Province of Laguna. (See Figures 1.1.1-1 and 1.1.1-2).

Silang is a “landlocked” 1<sup>st</sup> Class municipality situated on the eastern part of Cavite Province. The town is geographically located at **N14°14’0”**, **E120°59’0”**, and is approximately **45 kilometers** south of Manila. It is bounded on the north by the City of Dasmariñas and the Municipalities of General Trias and General Mariano Alvarez (GMA), on the west by the Municipality of Amadeo, and the City of Tagaytay on the south. From its starting point along E. Aguinaldo Highway, the alignment will cross a total of **six (6) barangays**. These are Brgy. Sabutan, Kaong, Tibig, Munting Ilog, Inchican, and Carmen.

Tagged as the “*Lion City of the South*”, since 1994, Santa Rosa City lies approximately **38 kilometers** south of Manila via the South Luzon Expressway, making it a suburban residential community of Metro Manila. Geographically, the City is located at **N14°16’43”**, **E121°5’48”**, bounded on the north by Biñan City, on the east by Laguna de Bay, and on the south by the Municipality of Cabuyao. Here in Santa Rosa City, **only** the southwestern barangay of Santo Domingo will be traversed by the alignment.

Located at geographical coordinates **N14 20’0”**, **E121°5’0”**, Biñan is a “*first class component city*” in the Philippines. It is one of the **three (3)** cities comprising the 1<sup>st</sup> Congressional District of the Province of Laguna (the Cities of San Pedro and Santa Rosa are the others). The City of Biñan is situated about **34 kilometers** south of Manila. It is bounded on the north by San Pedro City, on the south by Santa Rosa City, and on the west by the Municipality of Carmona, Cavite. On the eastern and northern horizon lies the Laguna de Bay, the largest lake in the country. The alignment will traverse a total of

**five (5)** barangays in Biñan City namely Biñan, Loma, Malamig, Timbao, and Mamplasan.

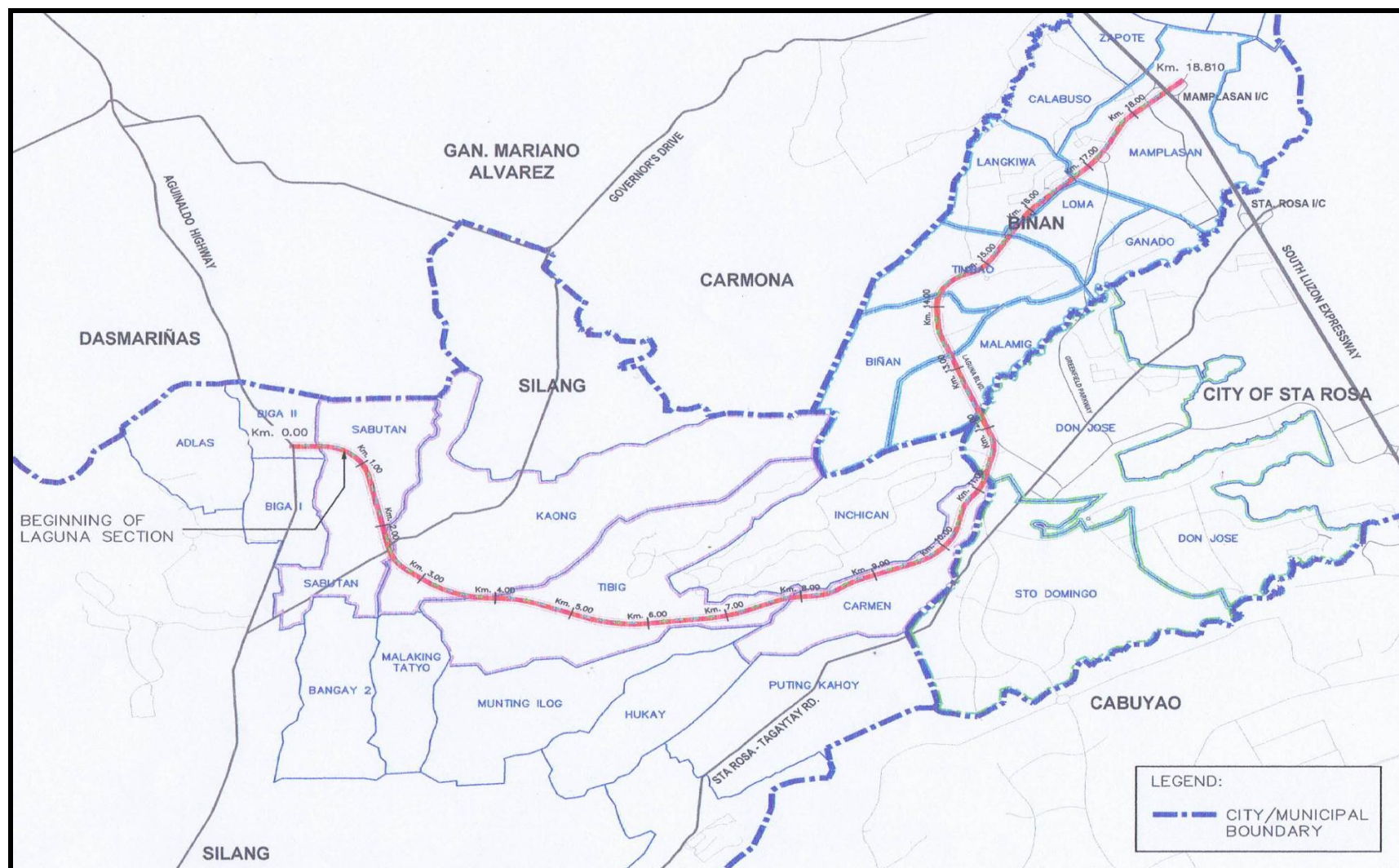


Figure 1.1.1-1a Project Area and Location



Figure 1.1.1-2 Project Site Political Boundary Map

### **1.1.2 Rationale for Selection of Primary and Secondary Impact Areas**

The primary and secondary impact areas were selected based on the types of potential impacts of the proposed expressway to the affected communities. Primary or Direct Impact Areas (DIA) are areas to be directly affected by the CALA Expressway alignment where acquisition of private properties for the ROW and displacement of residential and commercial structures would be required.

On the other hand, the Secondary or Indirect Impact Areas (IIA) are those to be indirectly affected by the noise and vibration disturbance, air pollution, and inconvenienced due to various construction activities during the project implementation. Illustrated in **Figure 1.1.2-1** are the areas to be directly and indirectly affected by the proposed CALA Expressway alignment.

### **1.1.3 Site Conditions**

Site conditions can be classified into four (4) sections as follows;

#### **(1) Western Section: Km. 0+000 – Km. 6+000 (L=6.0 km.)**

This area is currently cultivated agricultural lands, however, many lands have been already acquired by large scale land developers such as Stateland Corp., Cathay Land Corp., etc.

Land developers will implement residential and commercial development in their lands, therefore, this western section will be urbanized in the near future.

#### **(2) Middle Section: Km. 6+000 – Km. 11+000 (L=5.0 km.)**

All lands of this area have already been acquired by Extra Ordinary Development Corp., although the lands are still cultivated agricultural lands. Extra Ordinary Development Corp. will start residential and commercial development in the near future, thus the area will be urbanized.

#### **(3) Eastern Section: Km 11+000 – Km. 17+000 (L=6.0 km.)**

The expressway will utilize existing road right-of-way of Laguna Blvd., which has a 60mm ROW. Laguna Blvd. is still a private road owned by Ayala Corp.. Eastern side of Laguna Blvd. is the existing industrial area where many factories are in operation.

Western side of Laguna Blvd. is residential area with various subdivisions. The Government will purchase 60m ROW from Ayala Corp.

**(4) End Section: Km. 17+000 – Km. 18+300 (L=1.3 km.)**

The land of this section is owned by Greenfield Development Corp. Land is currently idle lands. Greenfield Development Corp. will develop this area as a commercial and residential area, therefore, this area will be urbanized in the near future.

**Figure 1.1.3-1** shows the photos of the site condition.

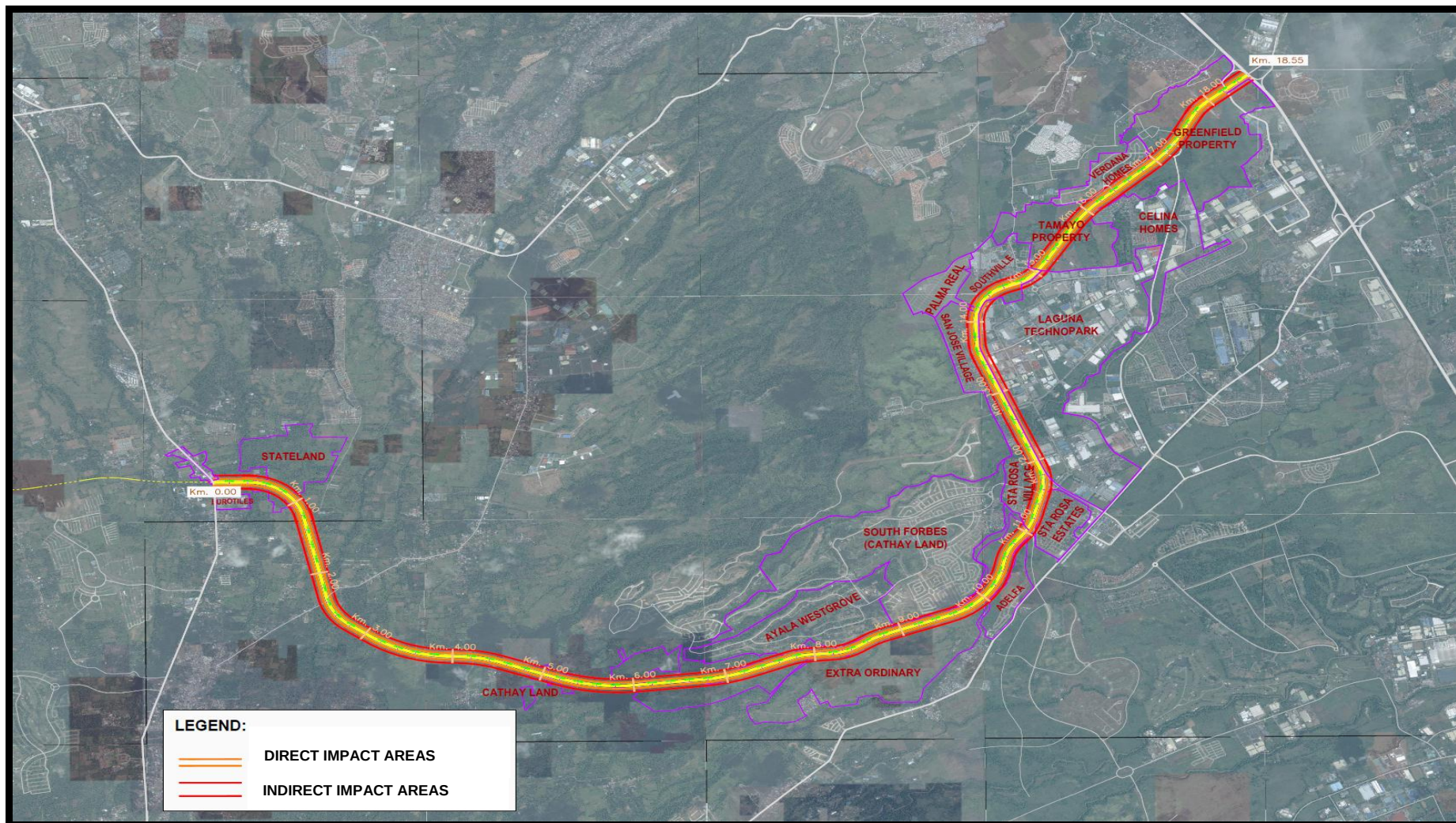
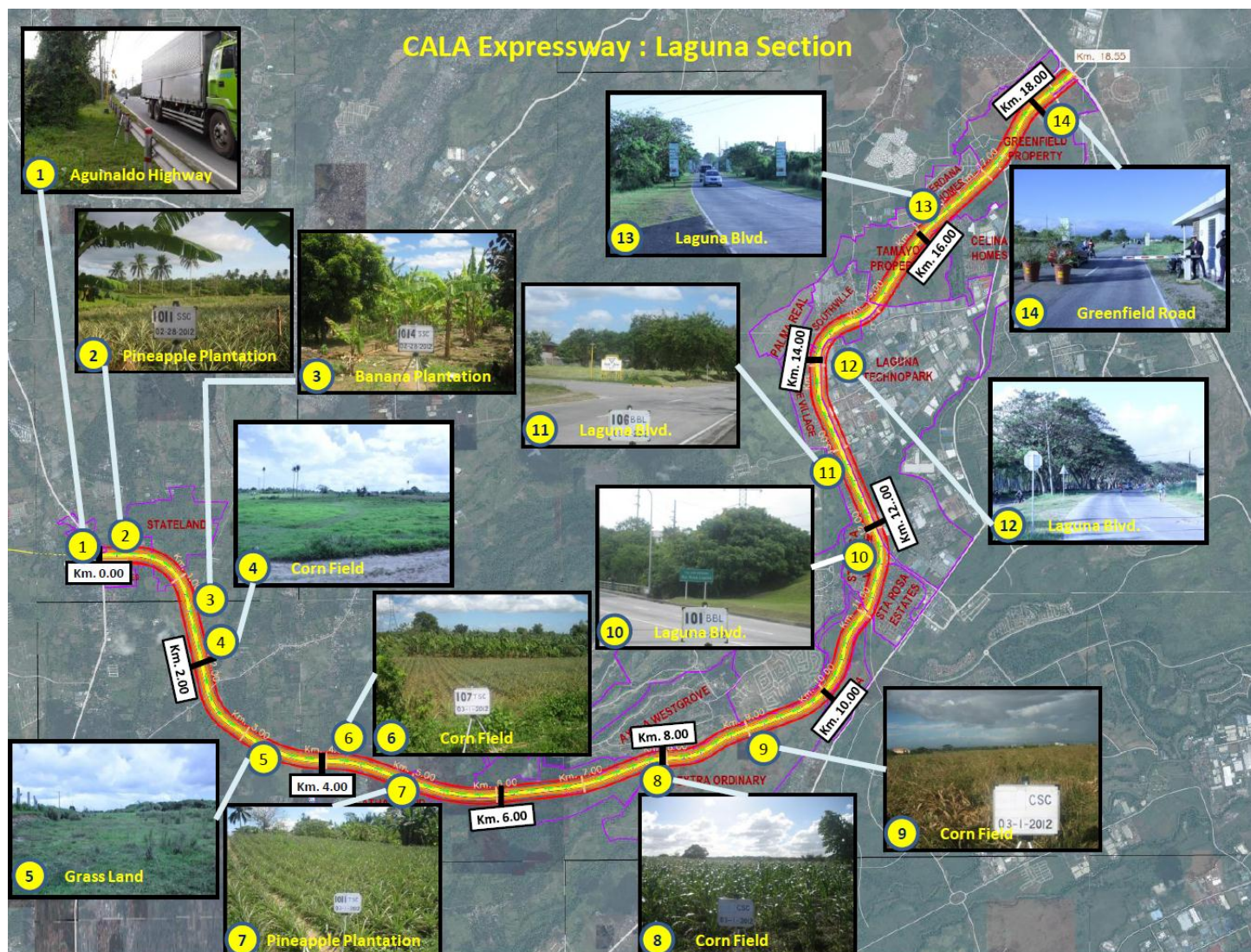


Figure 1.1.2-1 Direct and Indirect Impact Areas



**Figure 1.1.3-1 Site Condition**

## 1.2 PROJECT RATIONALE

Cavite and Laguna are neighboring provinces of Metro Manila. Both provinces are rapidly urbanizing to accommodate spilled over population from Metro Manila. Population growth rates of Cavite and Laguna are quite high (**4.76%** per annum in the Cavite and **3.34%** per annum in the Laguna) from 2000 to 2007. Economic activities, particularly manufacturing industry, are also quite active. Thus, two provinces are within socio-economic activities of Metro Manila.

In spite of rapid urbanization, the road network development was not so significant, only widening of Aguinaldo Highway and Governor's Drive to a 4-lane road was made and a portion of Daang Hari Road was constructed in the last 20 years. Road network development was lagged behind the rapid urbanization. There are several Provincial Roads however, are still 2-lane roads.

Insufficient road network development is now resulting in traffic congestions of national roads and most of provincial roads.

High capacity roads which allows fast, safe, comfortable and reliable means of transport is highly needed in the areas to reduce traffic congestions in Cavite and Laguna Provinces.

Many economic zones/industrial estates have already been operated and will be further developed, taking advantages of the Provinces' proximity to Metro Manila. Both Cavite and Laguna are now the center of manufacturing industry in the Philippines contributing to economic development of the country and generation of a lot of job opportunities.

Various real estate companies (land developers) are developing commercial and residential areas in Cavite and Laguna. They have already acquired lands and some areas have been developed and have been sold out or are selling lands/lots they developed. It is expected that their lands will be sold out within 10 to 15 years and will be fully urbanized.

Above development will stimulate economic and social activities in the two provinces, thus transport network to support such economic and social activities is definitely needed.

As mentioned, urbanization of the areas is led by the private sector, particularly by land developers. With the lack of land development master plan by the Government, and developers only plan within their own properties and transport access to/from their properties is only made to the existing roads and/or existing expressway.

Sound urbanization should be guided/lead by the proper road network. National road network in the area of Laguna section is quite scarce, thus CALAX is needed to be planned to guide/lead sound urbanization of the area.

The area of Laguna section lacks public roads which are only Aguinaldo Highway, Governor's Drive and Sta. Rosa–Tagaytay Road. Instead, there are many private roads developed by land developers, most of which are not open to the general public and only these cars allowed by the land owners can pass. Thus, the development of public roads which can be used by the general public is needed.

There are two expressways in Cavite and Laguna Provinces, namely SLEX and CAVITEX, however they are functioning individually and the expressway network is not formed yet. If something happens and traffic of an expressway becomes interrupted, travelers have no other choice but to select/use the congested road.

The road transportation network of Cavite and Laguna has failed to catch up with the region's rapid growth, thus resulting in increasing traffic congestion. Since this growth has been closely intertwined with Metro Manila, the congestion is more severe on roads that link the provinces to the national capital. This north-south pattern is likely to continue over the medium term – with congestion getting worse before it gets better for that reason the CALA Expressway project is proposed to seek for the following objectives:

The traffic congestion in Cavite and Laguna is rapidly increasing together with the continuous growth of the CALA Region. This congestion is more severe on the road that has a direct link in Metro Manila. The deteriorating traffic condition in the area is being addressed by the Philippine Government in coordination with international donor agencies such as JICA and the World Bank.

For this reason the CALA Expressway Project was proposed and seeks for the following objective:

- To alleviate the traffic congestion in the CALA area;
- To improve the living environment of local residents;
- To promote dispersion of urban function of Metro Manila; and
- To improve the investment in the given area concerning its strategic location for the international port in Batangas City

### 1.3 PROJECT ALTERNATIVES

#### 1.3.1 Design Criteria and Standards

Table 1.3.1-1 shows the proposed geometric design criteria for CALA Expressway.

**Table 1.3.1-1 Proposed Geometric Design Criteria for the CALA Expressway (1/2)**

|                                                   |                               |
|---------------------------------------------------|-------------------------------|
| <b>DESIGN SPEED</b>                               | 100 km/h CALA Expressway      |
| <b>HORIZONTAL ALIGNMENT</b>                       |                               |
| Desirable Minimum Radius (m)                      | 700                           |
| Minimum Radius (m)                                | 460                           |
| Exceptional Minimum Radius (m)                    | 380                           |
| Minimum Curved Length (m)                         | 170                           |
| Minimum Transition Curve Length (m)               | 85                            |
| Minimum Radius allowed to omit a Transition Curve |                               |
| Desirable Minimum Radius (m)                      | 3,000                         |
| Minimum Radius                                    | 1,500                         |
| <b>VERTICAL ALIGNMENT</b>                         |                               |
| Maximum Grade (%)                                 | 3                             |
| Exceptional Maximum Grade (%)                     | 6                             |
| Critical Lengths for Exceptional Grade (m)        | 4%: 700<br>5%: 500<br>6%: 400 |

**Table 1.3-1 Proposed Geometric Design Criteria for the CALA Expressway (2/2)**

|                              |        |
|------------------------------|--------|
| <b>VERTICAL ALIGNMENT</b>    |        |
| Vertical Curve Radius        |        |
| Crest: Desirable minimum (m) | 10,000 |

|                                                  |       |
|--------------------------------------------------|-------|
| Minimum (m)                                      | 6,500 |
| SaG: Desirable minimum (m)                       | 4,500 |
| Minimum (m)                                      | 3,000 |
| Minimum Vertical Length (m)                      | 85    |
| Minimum Stopping Site Distance (m)               | 160   |
| Normal Crossfall (Cement Concrete Surfacing) (%) | 2.00  |
| Vertical Clearance (m)                           | 5.10  |

### 1.3.2 Review of the 2006 Feasibility Study

#### 1.3.2.1 Proposed Alignment by the 2006 FS

CALAX was studied in the JICA-assisted Feasibility Study and Implementation Support on the CALA East-West National Project.

The alignment recommended by the 200 FS is shown in **Figure 1.3.2-1**.

The recommended alignment starts at Eton/Greenfield Interchange (IC) of SLEX and goes westwards crossing Sta. Rosa – Tagaytay Road and reaches to Aguinaldo Highway. From there, it goes north-east direction and ends at Governor’s Drive.



Figure 1.3.2-1 CALA Expressway Alignment Recommended by the 2006 FS

#### 1.3.2.2 Objection to the Proposed Alignment by the Land Developers

Many land developers such as Eton Properties Philippines, Inc., Greenfield Development Corporation, and University of Sto. Tomas, etc., purchased the lands in the corridor from SLEX and Sta. Rosa – Tagaytay Road.

DPWH undertook the stakeholders meeting in 2006 and 2007 in order to realize the project, however, most land developers did not agree to the proposed alignment because their land development plan is severely affected. Thus, DPWH suspended the further actions for implementation.

Thus, the proposed alignment is required to be re-studied.

#### 1.3.2.3 Engineering Concept

CALAX was planned as a national road and not as an access-controlled expressway, thus no toll facilities were planned, although grade separations at intersections with major roads were planned.

### 1.3.3 Alignment Study of CALA Expressway (Laguna Section)

#### 1.3.3.1 Characteristics of Laguna Section Area

##### Land Area Acquired by Private Land Developers

Land area acquired by the private land developers is shown in **Figure 1.3.3-1**. Most of the lands of the project area have been purchased and owned by the large scale land developers (real estate companies).

There are many economic zones/industrial estates along SLEX and Governor's Drive. Residential subdivisions were and will be developed in the project area. Mixed uses area such as residential subdivision/commercial complexes/leisure facility (mostly golf courses) also widely occupy the project area. Areas along SLEX (4 to 5 km. areas from SLEX) has been and/or being developed.

Since land developments by private companies are quite active in the project area, most of the project area will be fully urbanized in 15 to 20 years.

### Road Network in the Study Area

Road network in the project area is shown in **Figure 1.3.3-2**. Major roads are as follows:

- South Luzon Expressway (8-lane, toll road)
- Aguinaldo Highway (4-lane, national road)
- Governor's Drive (4-lane, national road)
- Sta. Rosa-Tagaytay Road (2 to 4-lane, National Road)

As shown above, national road network density is quite scarce. Private roads are providing access to the project area, however, there are following problems; ① Some of private roads are limited to vehicles with sticker sold by the private land developers, thus usage of private roads are limited and not for general public. ② Private roads are developed to provide access to each land developer's area, thus, continuity of road is not always good. Sometimes, it is not possible to go from one land developer's area to another.

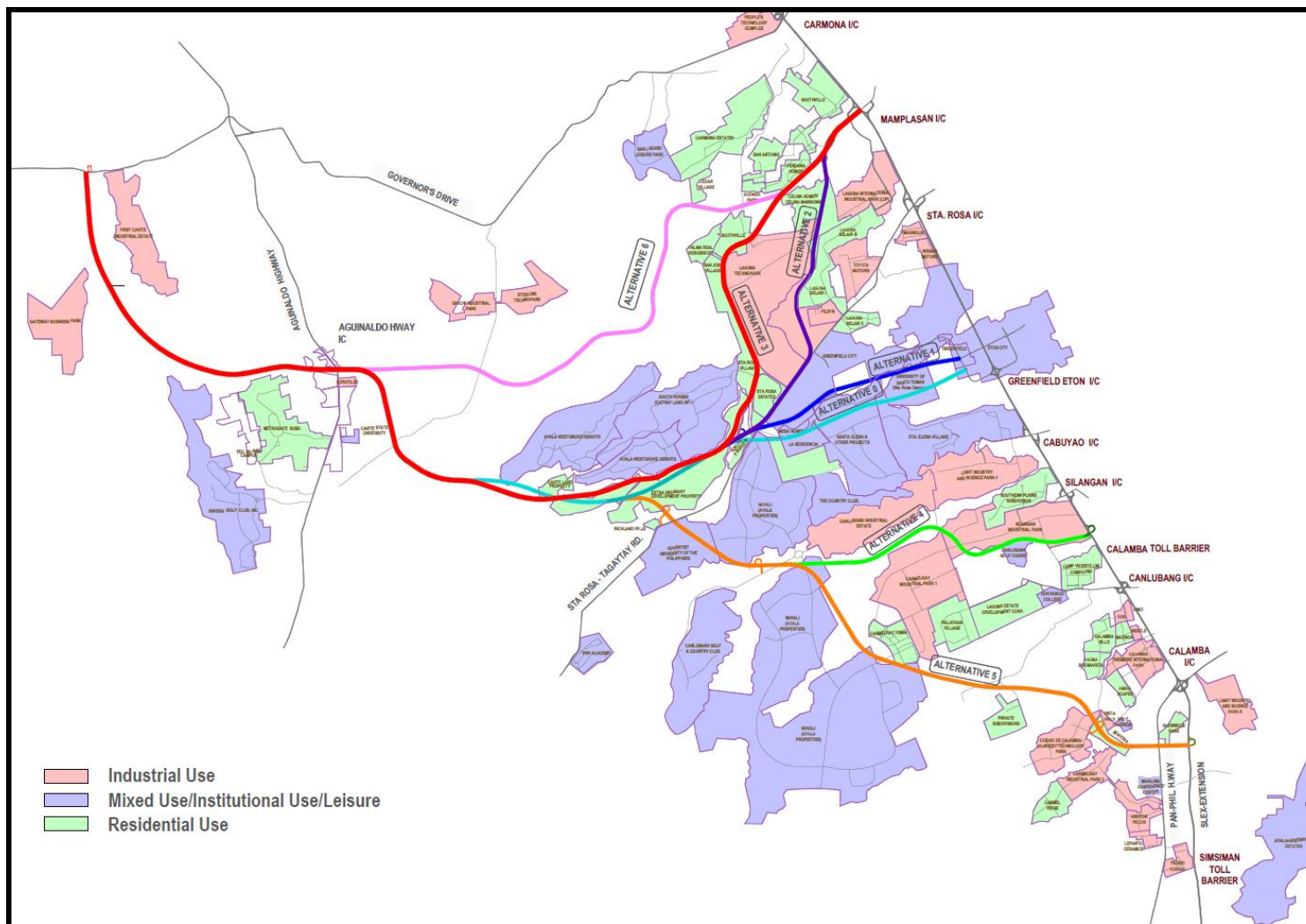


Figure 1.3.3-1 Land Area Acquired by Private Land Developers

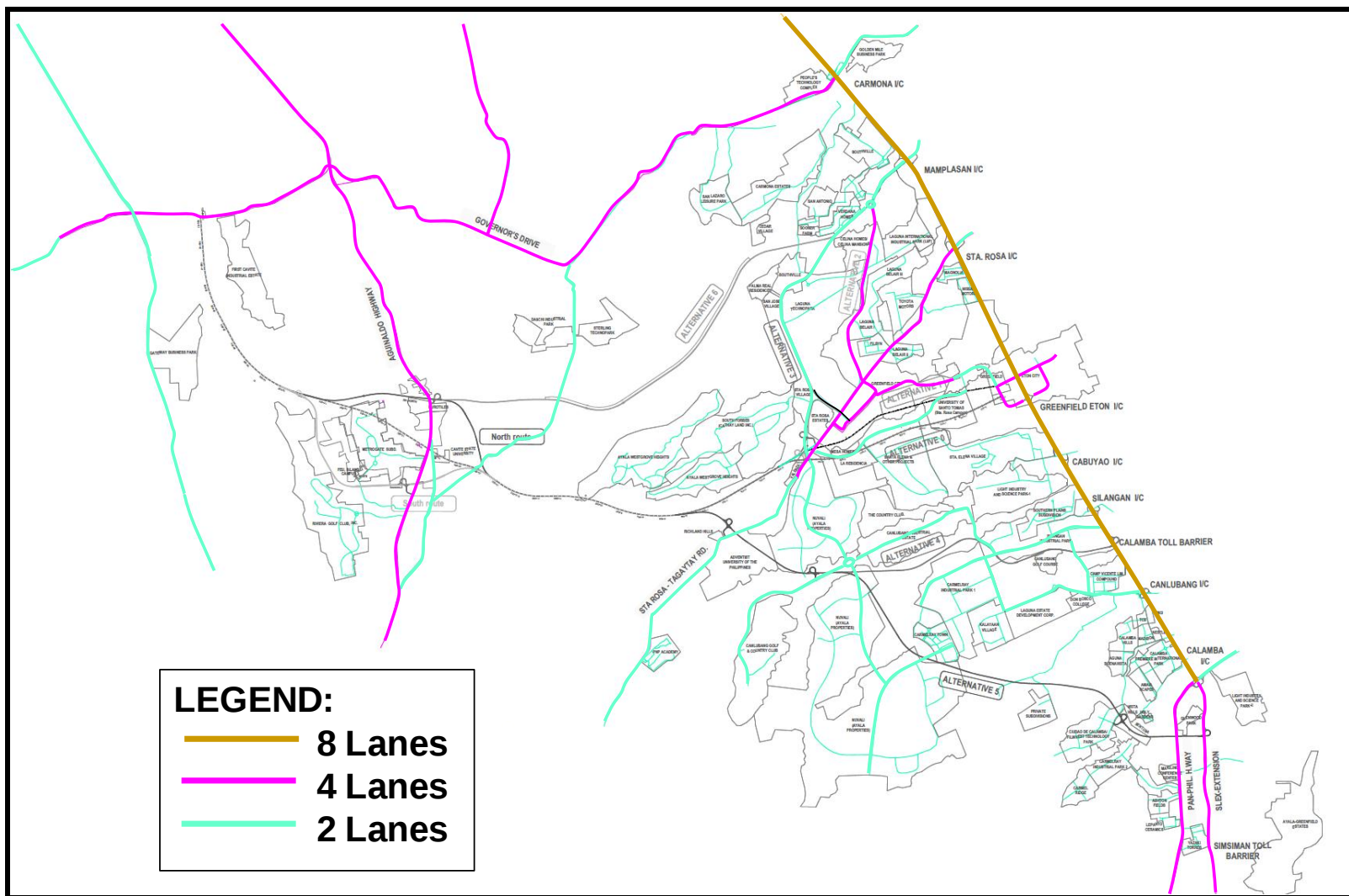


Figure 1.3.3-2 Road Network in the Study Area

### Characteristics of the Project Area

Schematic development condition of the project area is shown in **Figure 1.3.3-3**.

Characteristics are summarized as follows:

- ❖ Most of the lands of the area have been acquired by big private investors.
- ❖ Along SLEx, industrial zones and commercial, residential development is rapidly progressing.
- ❖ Even in remote areas from SLEx, housing lots are on sale.
- ❖ All developments are planned to have access to SLEx, which will be congested in the near future.
- ❖ Also, many developments plan to have access to Sta. Rosa-Tagaytay Road which is already experiencing traffic congestion

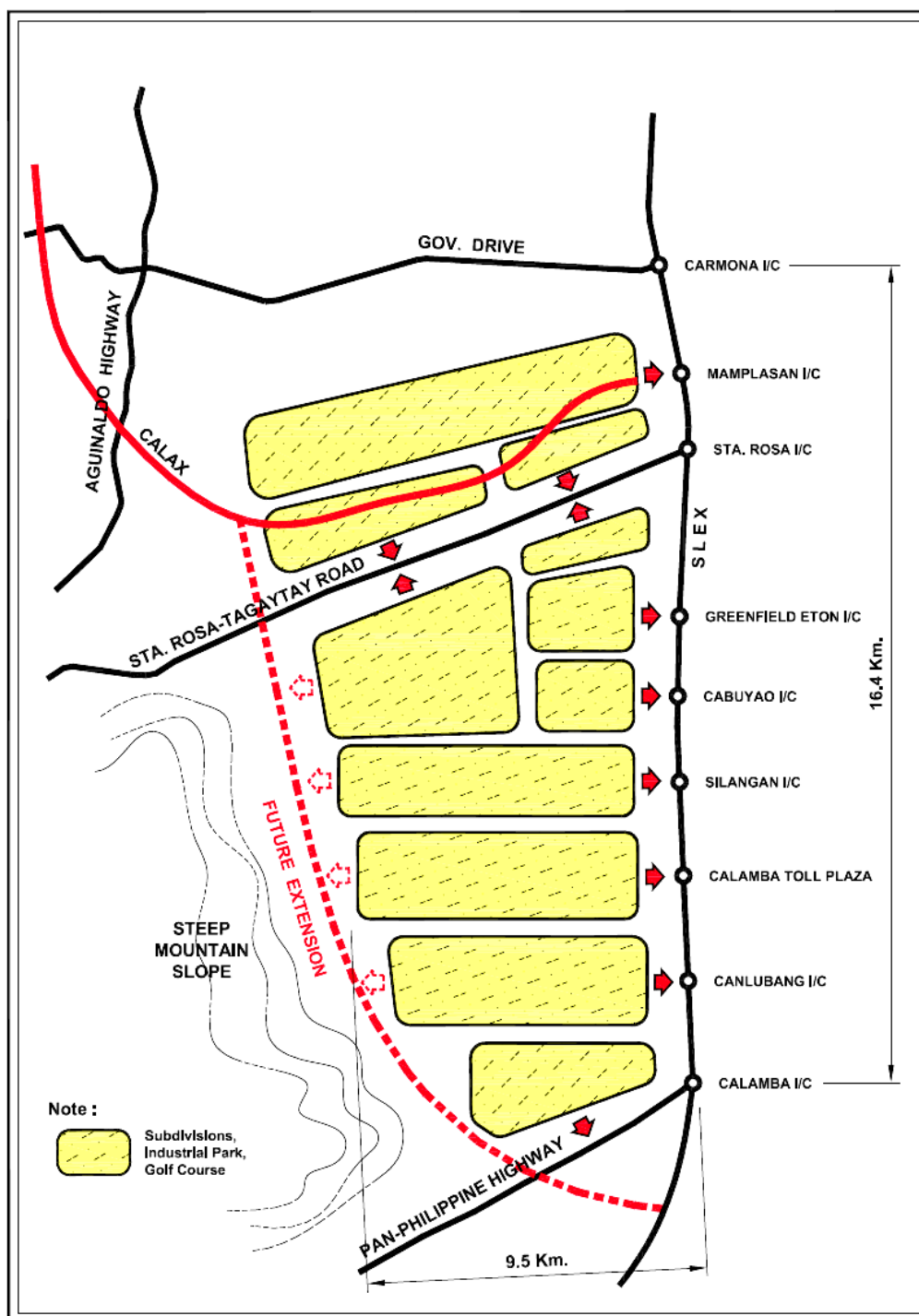


Figure 1.3.3-3 Schematic Development Condition

### 1.3.3.2 Procedure of Alignment Study

Alignment study was undertaken in accordance with the following steps;

- |        |   |                                                                                                                       |
|--------|---|-----------------------------------------------------------------------------------------------------------------------|
| Step-1 | : | Selection of the beginning point of Laguna Section (connection point of Cavite and Laguna sections).                  |
| Step-2 | : | Selection of the end point at SLEx.                                                                                   |
| Step-3 | : | Selection of the alignment to connect the beginning point and end point. Various alternative alignments were studied. |

### 1.3.3.3 Selection of the Beginning Point of Laguna Section (Connection Point of Cavite and Laguna Sections) STEP 1

**Three (3)** alternative alignments were developed focusing on minimization of social impact (or dislocation of people) as shown in **Figure 1.3.3-4**.

- |               |                                                                                                     |
|---------------|-----------------------------------------------------------------------------------------------------|
| Alternative-1 | :Alignment Recommended by the 2006 FS                                                               |
| Alternative-2 | :North Alignment to minimize social impact in the northern area of Silang Municipality town proper. |
| Alternative-3 | :South Alignment to minimize social impact in the southern area of Silang Municipality town proper. |

**Three (3)** alternative alignments were evaluated as shown in **Table 1.3.3-1** and Alternative-2 was recommended due to the following reasons:

- Alternative-2 achieves minimum social impact; and
- Alternative-2 achieves minimum cost

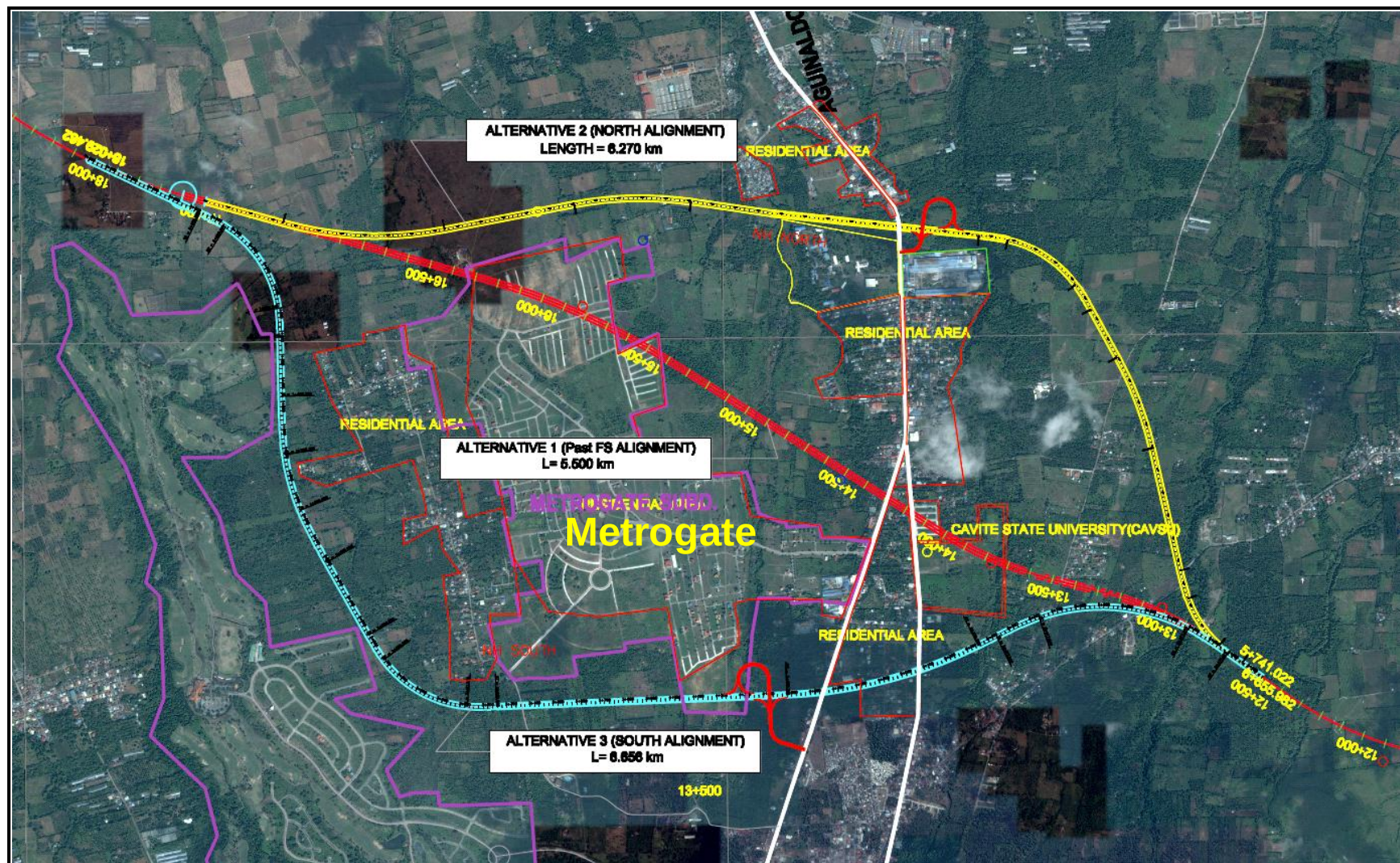


Figure 1.3.3-4 Alternative Alignments of Beginning Point of CALA Expressway Laguna Section

TABLE 1.3.3-1 EVALUATION OF ALTERNATIVE ALIGNMENTS AT BEGINNING POINT



| Alternatives     |                                 |                                    | Alternative 1                                         |   | Alternative 2                                                           |   | Alternative 3                                                           |   |
|------------------|---------------------------------|------------------------------------|-------------------------------------------------------|---|-------------------------------------------------------------------------|---|-------------------------------------------------------------------------|---|
| Concept          |                                 |                                    | Alignment proposed by 2006 FS                         |   | To minimize social impacts in the northern area of Silang Municipality. |   | To minimize social impacts in the southern area of Silang Municipality. |   |
| Road Length (km) |                                 |                                    | 5.50                                                  |   | 6.27                                                                    |   | 6.66                                                                    |   |
| Evaluation       | Cost (Billion Pesos)            | Construction                       | 0.798                                                 | △ | 0.910                                                                   | ○ | 0.966                                                                   | △ |
|                  |                                 | ROW                                | 0.414                                                 |   | 0.213                                                                   |   | 0.354                                                                   |   |
|                  |                                 | Total                              | 1.212<br>(1.00)                                       |   | 1.123<br>(0.93)                                                         |   | 1.320<br>(1.09)                                                         |   |
|                  | Connection to Aguinaldo Highway |                                    | Difficult due to no appropriate area for interchange. | X | Easy to connect by trumpet type of interchange.                         | ○ | Easy to connect by trumpet type of interchange.                         | ○ |
|                  | Social Impact                   | No. of Residential Houses affected | 38                                                    | X | 17                                                                      | ○ | 44                                                                      | X |
|                  |                                 | No. of Large Buildings affected    | 2 (Cavite State University)                           |   | 0                                                                       |   | 0                                                                       |   |
|                  | Natural Environment             |                                    | • Same condition                                      | ○ | • Same condition                                                        | ○ | • Same                                                                  | ○ |

|  |            |                                                        |  |                                                        |  |                                                                     |  |
|--|------------|--------------------------------------------------------|--|--------------------------------------------------------|--|---------------------------------------------------------------------|--|
|  |            | among<br>alternatives.<br><br>• No serious<br>problem. |  | among<br>alternatives.<br><br>• No serious<br>problem. |  | condition<br>among<br>alternatives.<br><br>• No serious<br>problem. |  |
|  | Evaluation | ○ 1<br>△ 1<br>X 2                                      |  | ○ 4<br>△ 0<br>X 0<br><b>Recommended</b>                |  | ○ 2<br>△ 1<br>X 1                                                   |  |

#### 1.3.3.4 Selection of the End Point at SLEX (STEP 2)

##### Existing Interchange Interval along SLEX

Many interchanges have been built along SLEX. **Table 1.3.3-2** and **Figure 1.3.3-5** show the existing interchanges in the project area along SLEX from Carmona Interchange to Simsiman Toll Barrier.

**TABLE 1.3.3-2 EXISTING INTERCHANGES IN PROJECT AREA ALONG SLEX**

| Name of Interchange                       | Interval of Interchanges (km) |
|-------------------------------------------|-------------------------------|
| Carmona I/C                               |                               |
|                                           | 2.53                          |
| Mamplasan I/C                             |                               |
|                                           | 2.33                          |
| Sta. Rosa I/C                             |                               |
|                                           | 4.00                          |
| Greenfield/Eton I/C                       |                               |
|                                           | 1.48                          |
| Cabyao I/C                                |                               |
|                                           | 1.46                          |
| Silang I/C                                |                               |
|                                           | 1.40                          |
| Calamba Toll Barrier (removed at present) |                               |
|                                           | 0.80                          |
| Canlubang I/C                             |                               |
|                                           | 2.40                          |
| Calamba I/C                               |                               |
|                                           | 4.00                          |
| Simsiman Toll Barrier                     |                               |

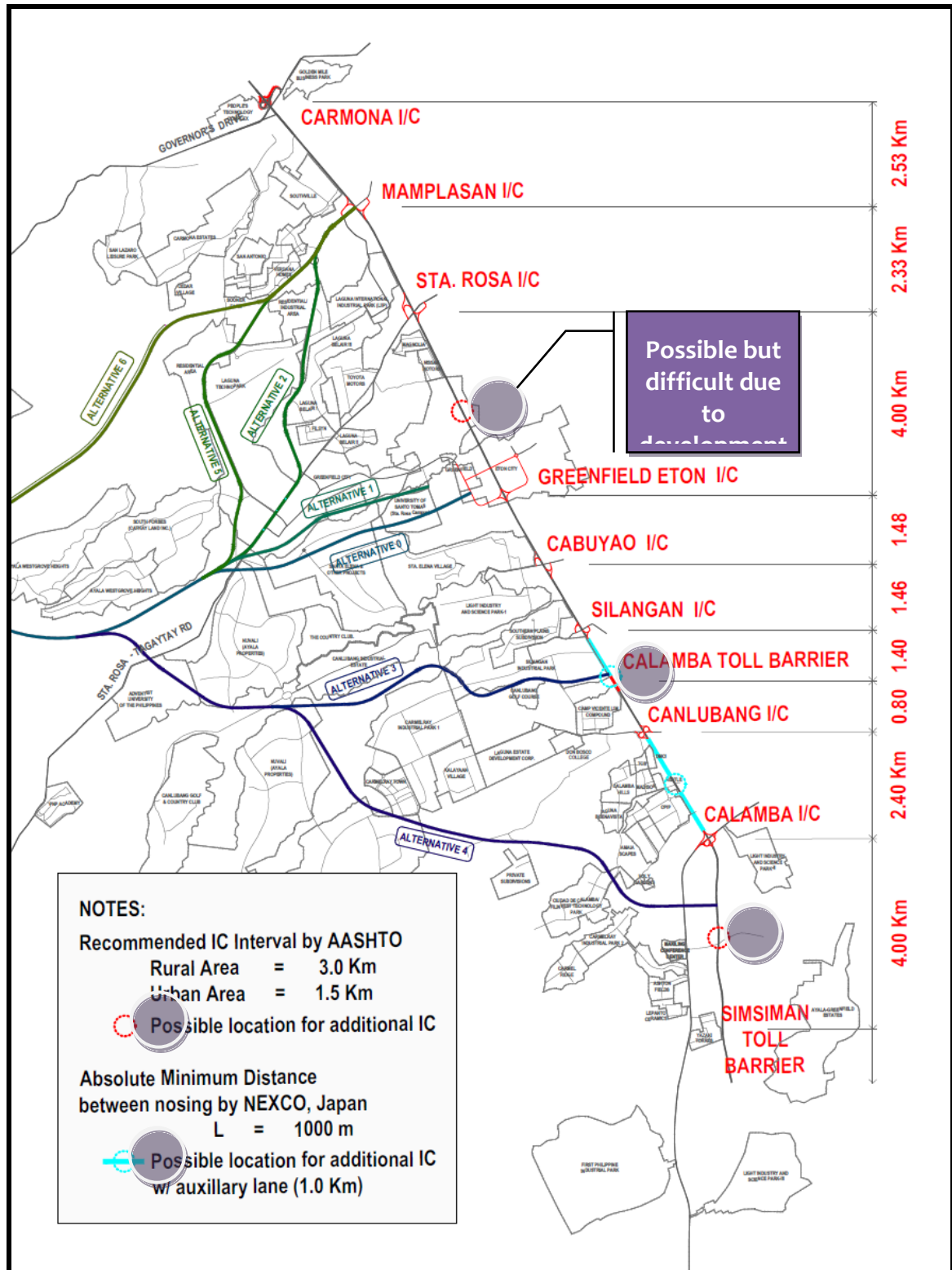


Figure 1.3.3-5 Existing Interchanges in the Study Area Along SLEX

### Standard Minimum Interval Between Interchanges

Standard minimum interval between interchanges is recommended by AASHTO, as follows:

#### **MINIMUM INTERVAL BETWEEN INTERCHANGES**

- |              |   |        |
|--------------|---|--------|
| • Rural Area | = | 3.0 km |
| • Urban Area | = | 1.5 km |

In the Philippines, 2.0 km. is adopted for the minimum interval between interchanges.

When additional lane along the main line of expressway is added as an auxiliary lane, minimum nose to nose distance of 1 km. is accepted in Japan.

### Possible Location to Construct New Interchange

Possible locations to construct new interchange between existing interchanges are as follows:

#### **POSSIBLE LOCATION FOR NEW INTERCHANGE**

- |                                                                                                                                                                                                                            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"><li>• Between Sta. Rosa I/C and Greenfield/Eton IC</li><li>• Between Calamba I/C and Simsiman Toll Barrier</li><li>• At Calamba Toll Barrier (now removed) with auxiliary lane</li></ul> |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Among the **three (3)** candidate locations, however, to construct new interchange between Sta. Rosa I/C and Greenfield/Eton I/C is quite difficult due to the following (see **Figure 1.3.3-6**):

- Eton Properties is now developing “South Lake Project”
- CALAX needs to be an elevated expressway over Sta. Rosa-Tagaytay Road, however, it has only 20 m road right-of-way and cannot accommodate an elevated expressway.
- Some other developments by Greenfield Development Corporation is on-going

Remaining candidate locations for new interchange are as follows:

- Between Calamba I/C and Simsiman Toll Barrier
- At Calamba Toll Barrier which was removed at present

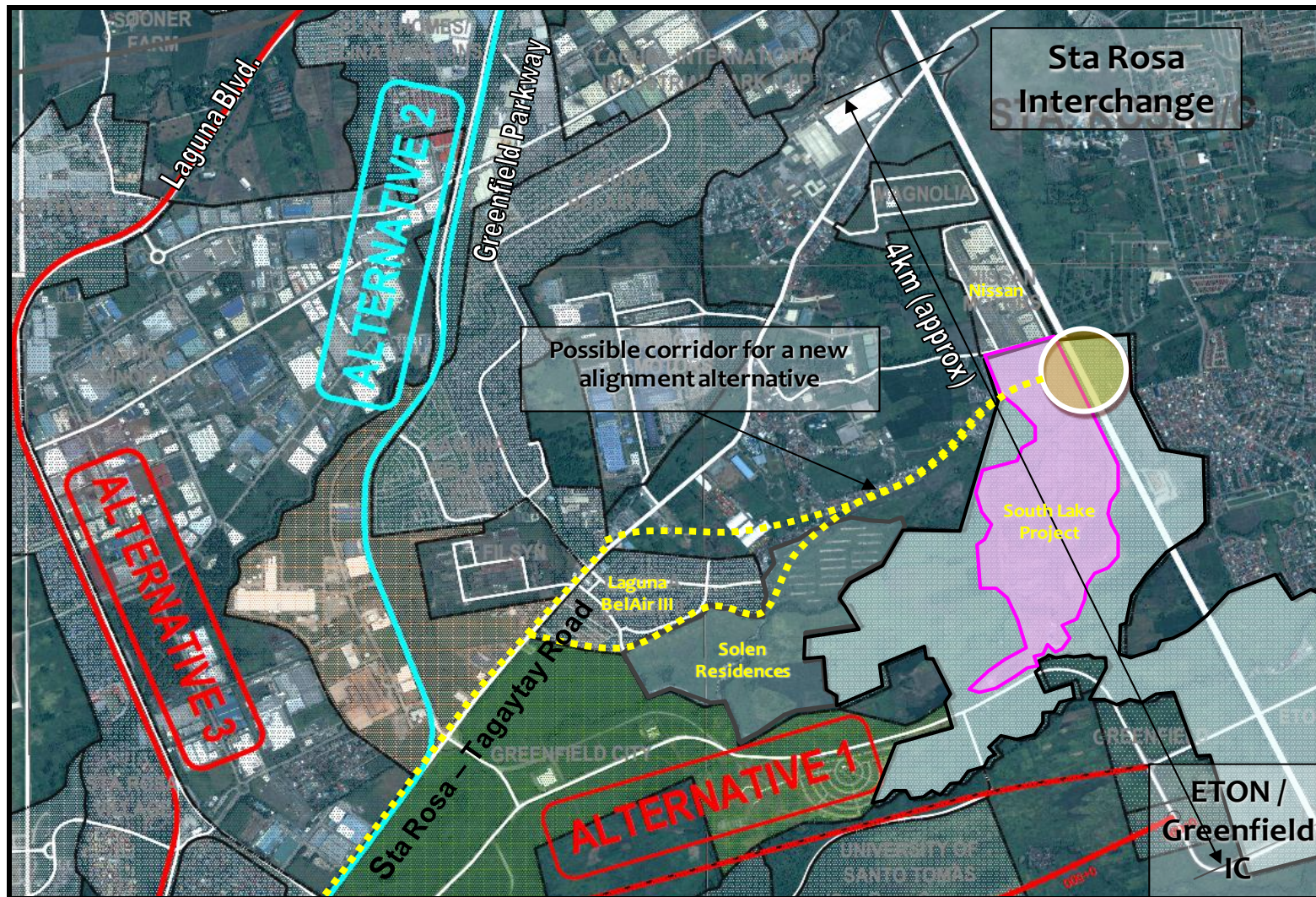


Figure 1.3.3-6 Development Condition between Sta. Rosa I/C and Eton/Greenfield I/C

## Connection with Existing SLEX Interchanges

There are **two (2)** methods to connect CALAX with the existing SLEX Interchanges.

- a. CALAX is directly connected with SLEX at existing SLEX interchange. In this case, existing SLEX interchange must be converted to achieve direct connection between 2 expressways (this type is called as “Junction” in Japan). This requires drastic conversion of an existing interchange.
- b. CALAX and SLEX are indirectly connected through a public road between CALAX and SLEX. Improvement of an existing interchange is required such as installation of additional toll booths, improvement of intersections, and widening of some portions of ramps.

### *Direct Connection by Converting Existing Interchange*

**Two (2)** examples are shown in **Figure 1.3.3-7**.

#### Example-1

- Existing road is to be shifted (which is quite difficult due to ROW acquisition) to maintain accessibility to neighboring establishments of an existing interchange.
- Another interchange is needed at about 2 km away from SLEX to provide accessibility to existing establishments near the existing interchange.

#### Example-2

- Wide road right-of-way of about 60 m is required (which is also difficult due to ROW acquisition)
- Diamond type of interchange is to be constructed at about 2 km from SLEX and U-turn slots are also needed to provide accessibility to existing establishments near the existing interchange.

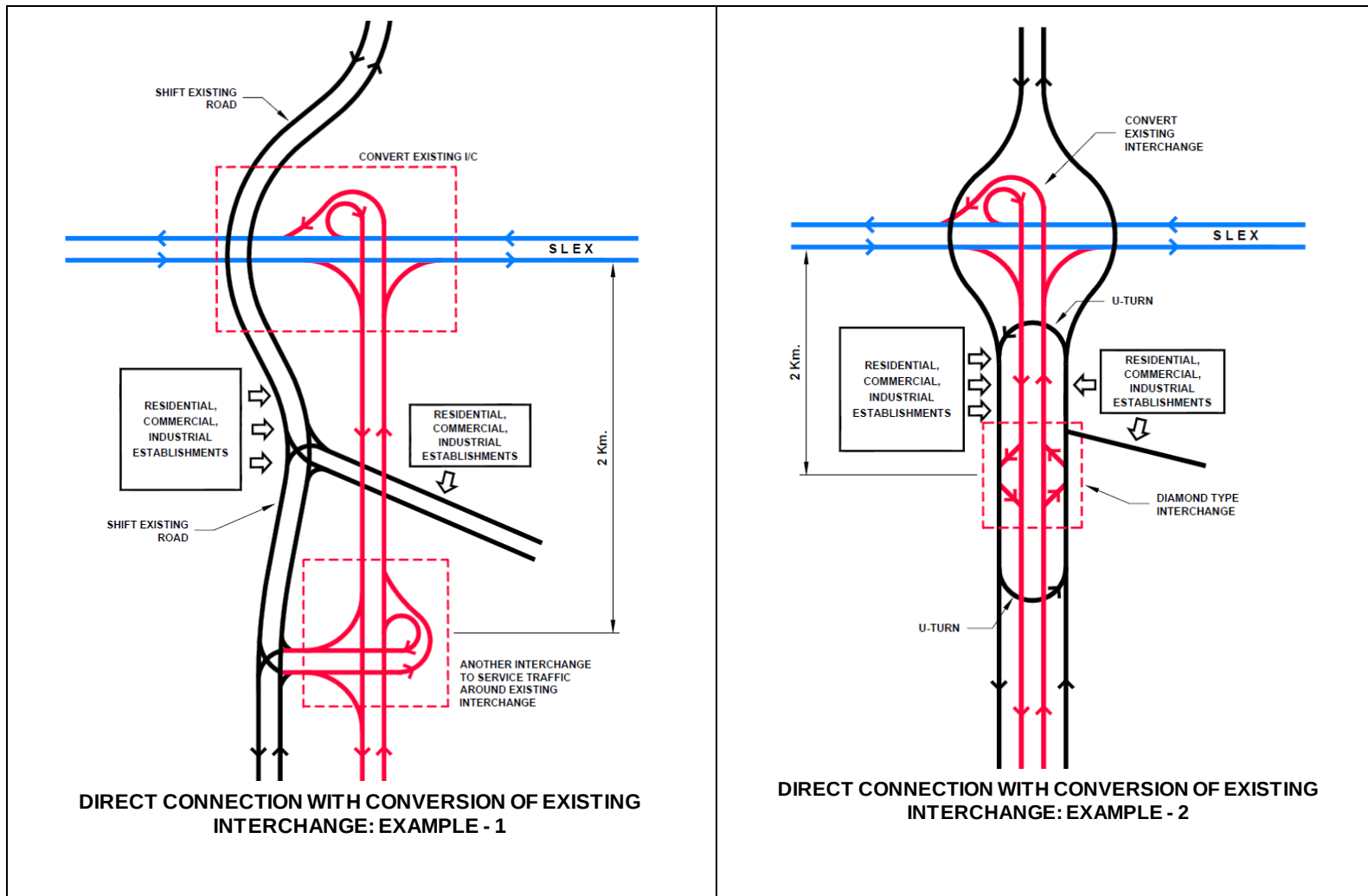


Figure 1.3.3-7 Examples of Direct Connection

### *In-Direct Connection by Improving Existing Interchange*

In-direct connection means CALAX and SLEX is not directly connected; instead both expressways are connected via short section of public road. CALAX will end before reaching to SLEX and a gap between two expressways is connected by a public road as shown in **Figure 1.3.3-8**.

### *Demerit of this Scheme*

- Continuity of travel on an expressway is interrupted; and
- Travel speed at the public road section is reduced, thus transport efficiency is affected.

### *Merit of this Scheme*

- Existing and future establishments near the existing SLEx interchange can enjoy the present level of accessibility even during construction/improvement;
- No extensive ROW acquisition is needed;
- In case of Direct Connection Case, temporary closure of the existing interchange is required, however, this scheme does not require temporary closure of existing interchange; and
- Civil work cost is much cheaper than the direct connection scheme

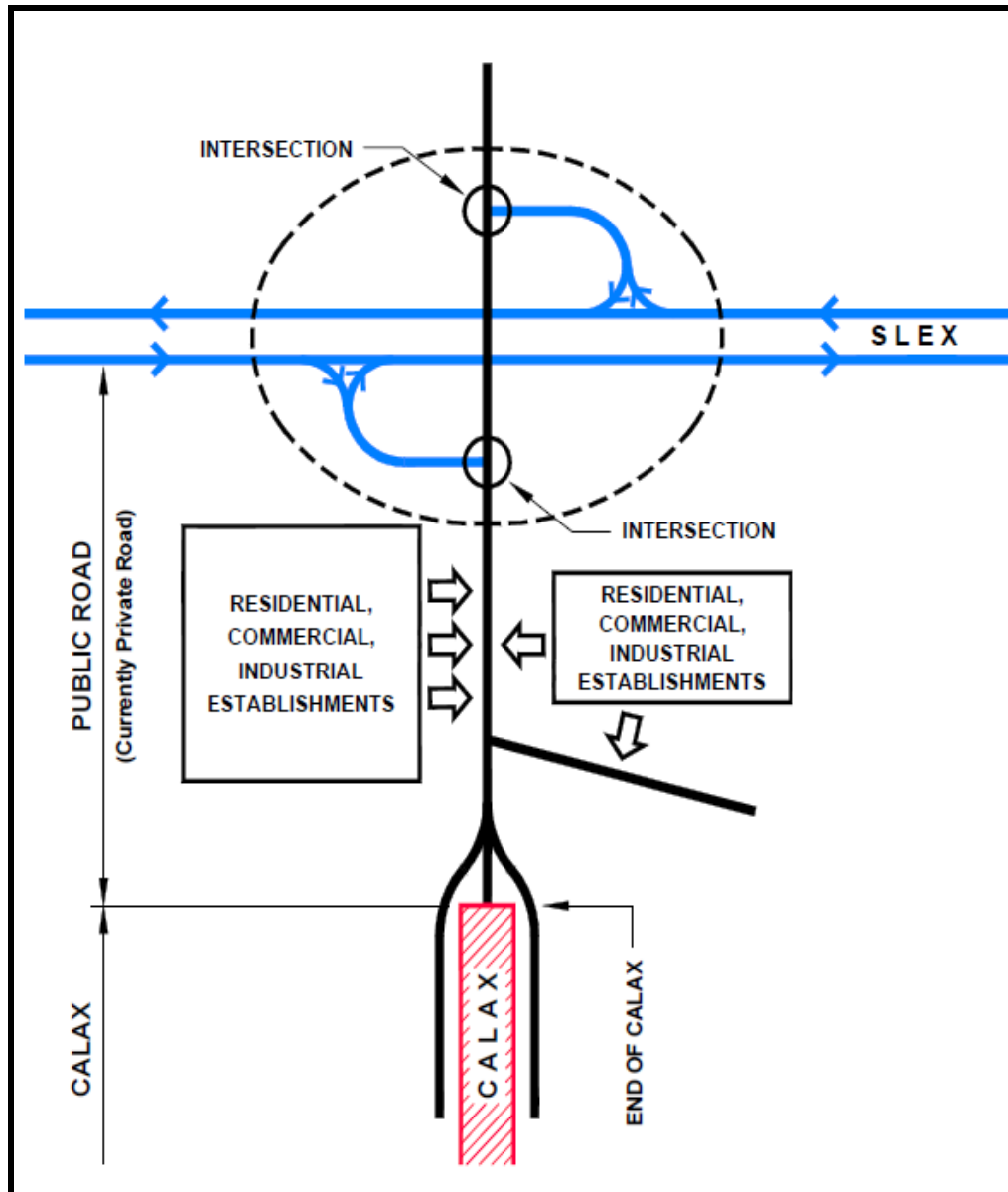


Figure 1.3.3-8 Indirect Connection Via Public Road to Existing Interchange

### 1.3.3.5 Alternative Alignments and Evaluation (STEP 3)

The beginning section was selected as discussed in **Section 1.3.3.3**. The end point has several alternatives as discussed in **Section 1.3.3.4** and the following points were selected as an alternative end point:

#### Alternative End Points (Connection with SLEX)

- Existing Mamplasan Interchange
- Existing Eton/Greenfield Interchange
- Old Calamba Toll Barrier
- New Location between Calamba Interchange and Simsiman Toll Barrier

#### *Alternative Alignments*

Six (6) alternatives were developed as shown in **Figure 1.3.3-9**.

#### **Alternative-1**

- This is the revised alignment of the 2006 FS and connected with the existing Eton/Greenfield Interchange;
- This route is the second shortest alignment among the alternatives; and
- Intended to capture generated traffic from the on-going and future development areas

#### **Alternative-2**

- End point is Mamplasan Interchange;
- Intended to utilize the existing private road of Greenfield Parkway (ROW width is 40 m.); and

- Intended to capture generated traffic from the existing, on-going and future development areas

### **Alternative-3**

- Same concept as Alternative-2 above; and
- Intended to utilize the existing private road of Laguna Blvd. (ROW width is 60 m.)

### **Alternative-4**

- End point is Calamba Toll Barrier which was shifted to Simsiman Toll Barrier of SLEx Extension, and new interchange is constructed; and
- Intended to capture generated traffic from the existing, on-going and future development areas.

### **Alternative-5**

- End point is located at about the middle point between Calamba Interchange and Simsiman Toll Barrier and new interchange is constructed;
- This is the longest route among the alternatives;
- Intended to capture traffic from the existing, on-going and future development areas; and
- Generated traffic from the developing areas can utilize both CALAX and SLEX

### **Alternative-6**

- This is the shortest route among the alternatives. However, it has to pass through steep slope areas; and
- This route functions as a bypass route of Governor's Drive

Each alignment of alternatives is shown in **Figures 1.3.3-10 (1) to (6)**.

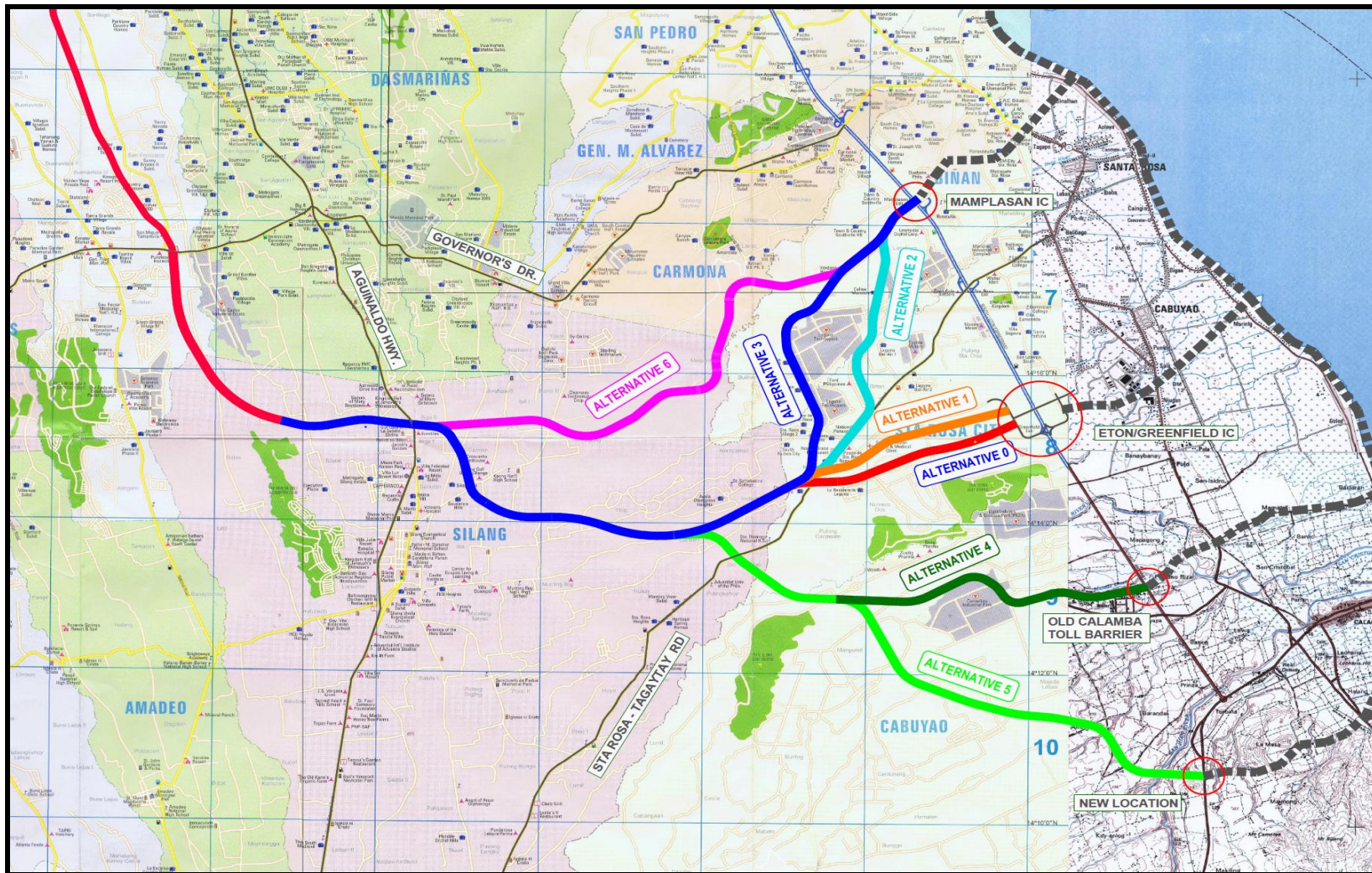


Figure 1.3.3-9 Alternative Alignments

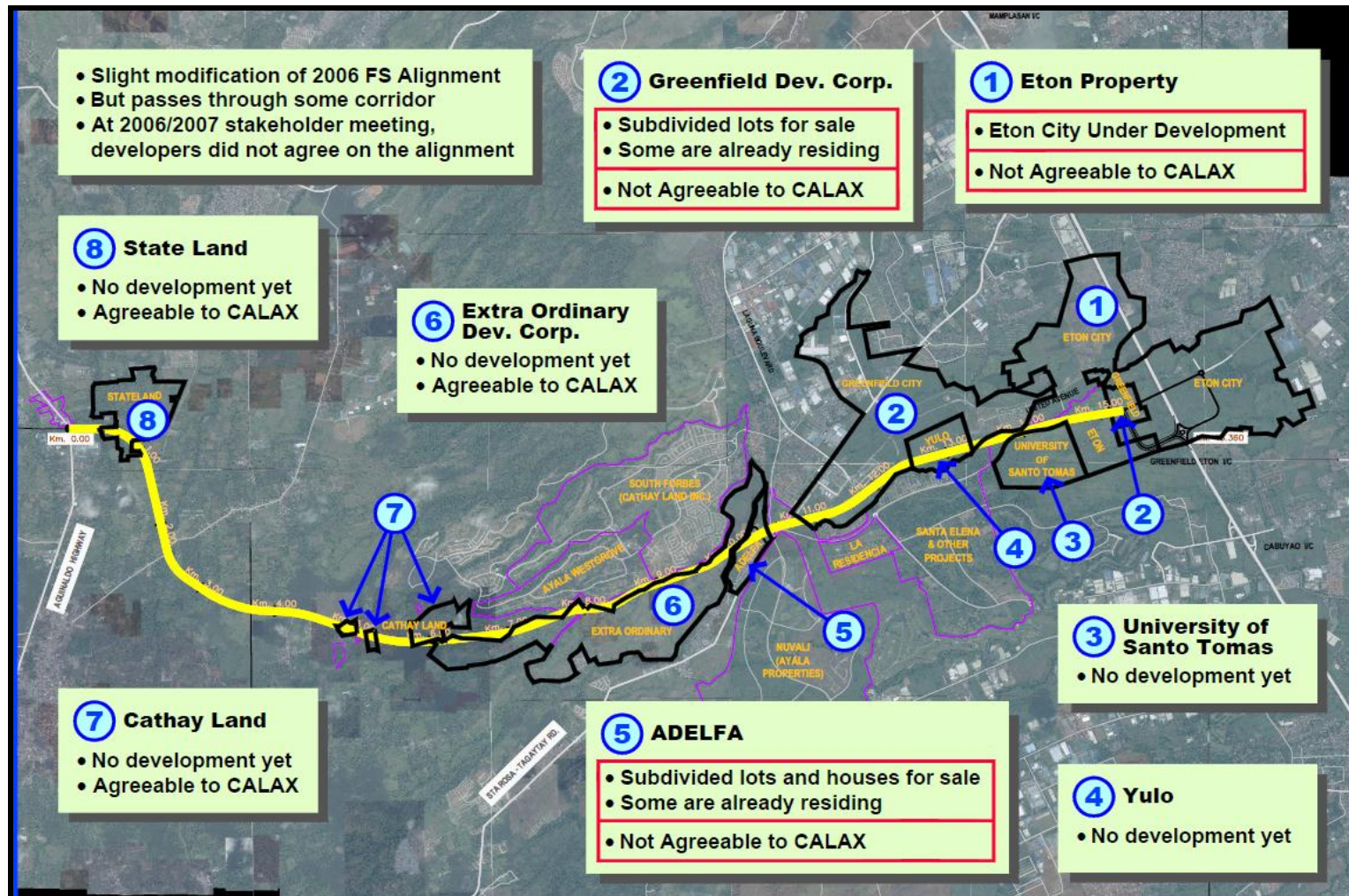


Figure 1.3.3-10 (1) Alternative Alignment 1

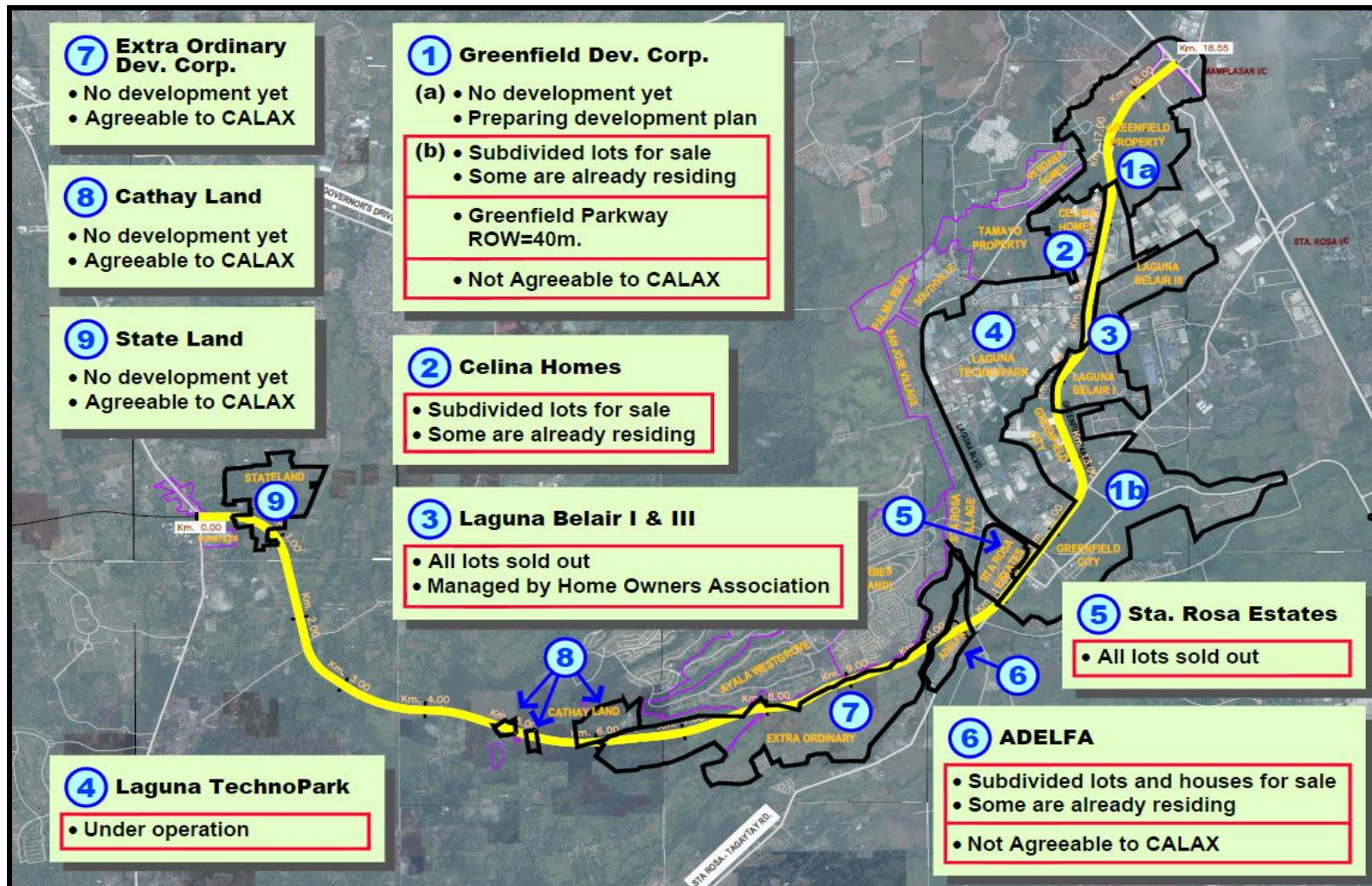


Figure 1.3.3-10 (2) Alternative Alignment 2

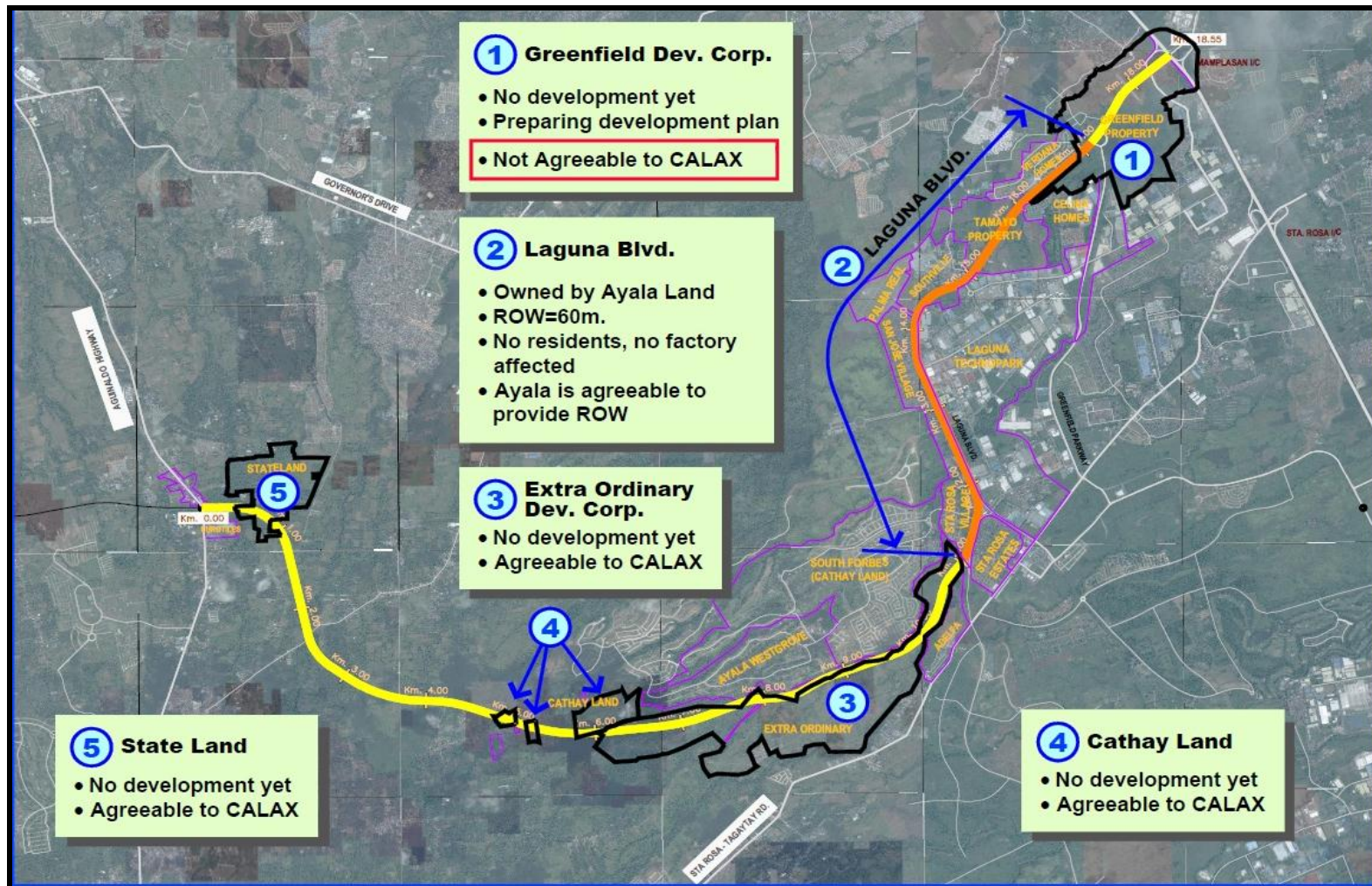
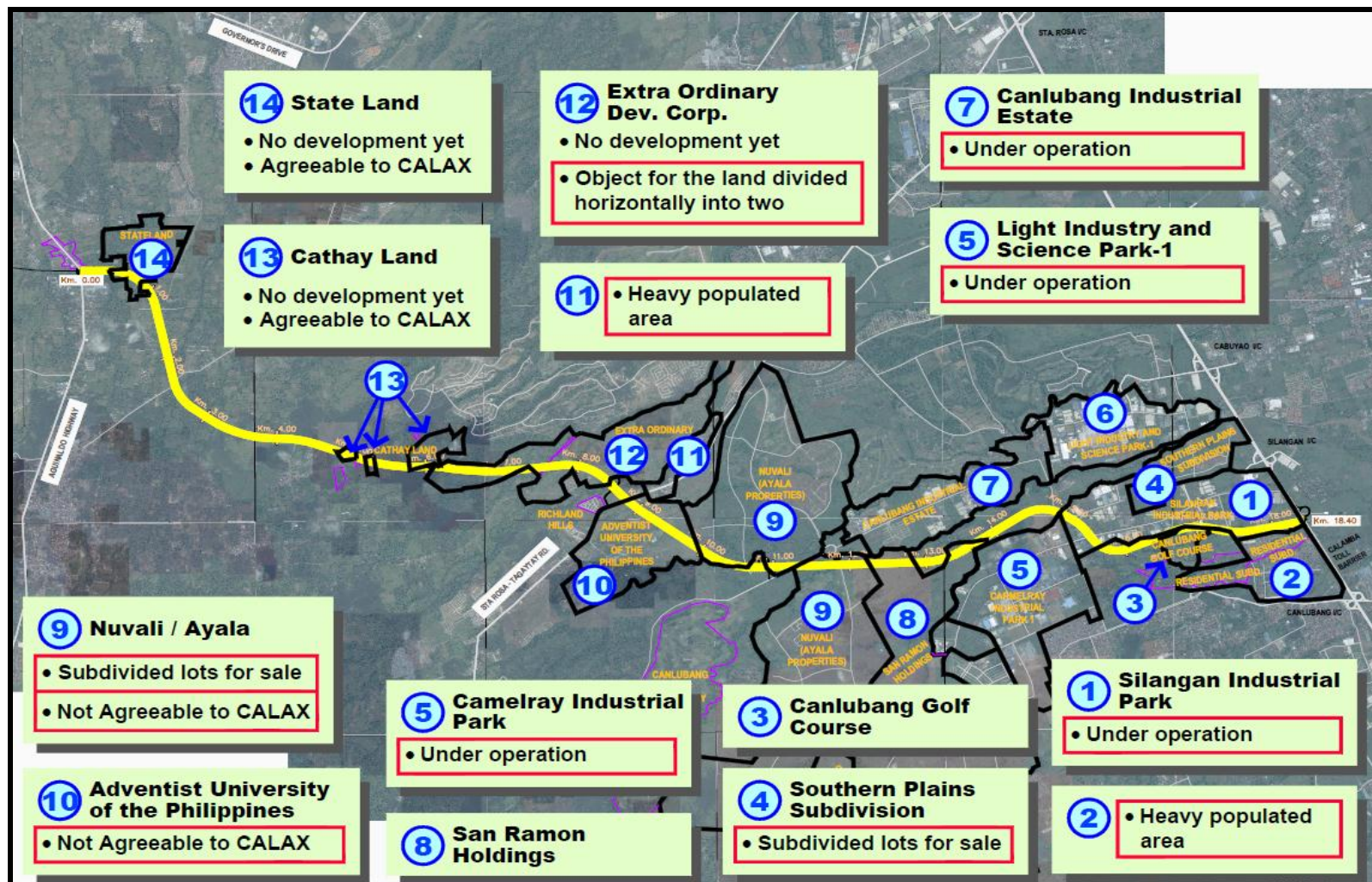


Figure 1.3.3-10 (3) Alternative Alignment 3



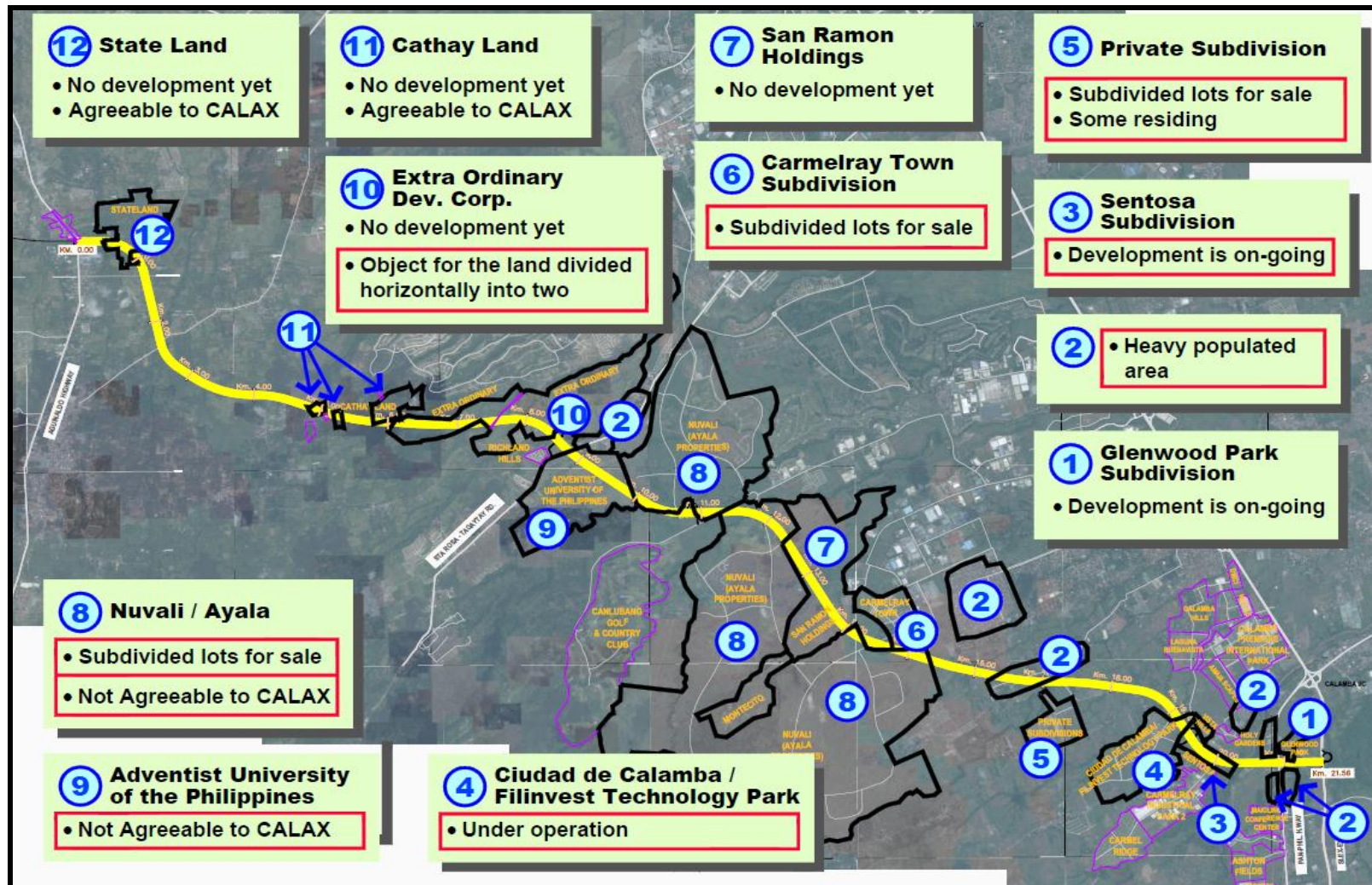


Figure 1.3.3-10 (5) Alternative Alignment 5

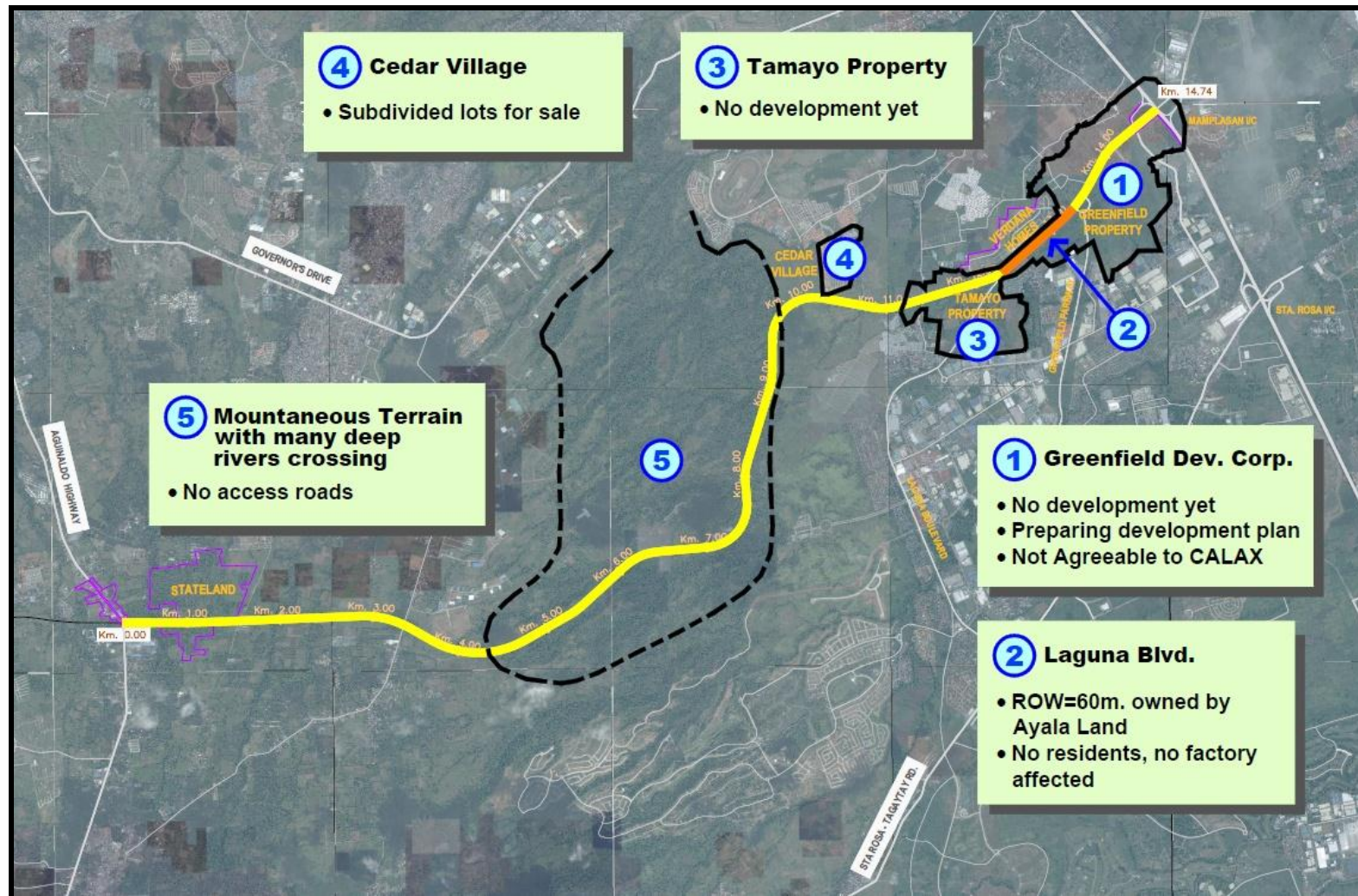


Figure 1.3.3-10 (6) Alternative Alignment 6

### Civil Work Component and Cost Estimate

Civil work component of each alternative is shown in **Table 1.3.3-3**. Since all alternatives pass through urbanized/to be urbanized area, viaduct type was planned.

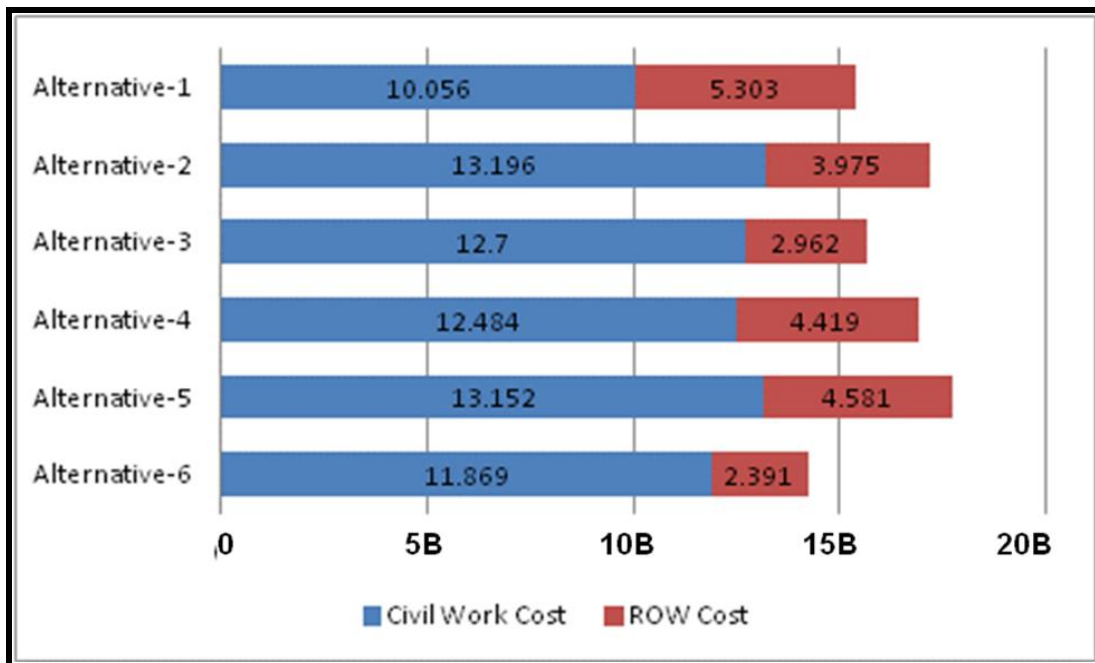
**TABLE 1.3.3-3 CIVIL WORK COMPONENT OF ALTERNATIVES**

| Alternative | Length (km.)   | Cost (Million Pesos) |               |               |               | No. of IC |
|-------------|----------------|----------------------|---------------|---------------|---------------|-----------|
|             |                | Roadway              | Bridge        | MSE Wall      | Viaduct       |           |
| 1           | 16.4<br>(100%) | 10.20<br>(62%)       | 1.49<br>(9%)  | 2.90<br>(18%) | 1.81<br>(11%) | 3         |
| 2           | 18.6<br>(100%) | 10.00<br>(54%)       | 1.09<br>(6%)  | 2.40<br>(13%) | 5.11<br>(27%) | 4         |
| 3           | 18.6<br>(100%) | 10.50<br>(81%)       | 1.09<br>(6%)  | 2.20<br>(12%) | 4.81<br>(26%) | 4 + 1/2   |
| 4           | 18.4<br>(100%) | 10.80<br>(59%)       | 1.69<br>(9%)  | 1.60<br>(9%)  | 4.31<br>(23%) | 3         |
| 5           | 21.6<br>(100%) | 13.40<br>(62%)       | 2.09<br>(10%) | 3.00<br>(14%) | 3.11<br>(14%) | 3         |
| 6           | 14.8<br>(100%) | 8.58<br>(58%)        | 3.29<br>(22%) | 1.60<br>(11%) | 1.33<br>(9%)  | 3         |

Civil work cost and right-of-way acquisition cost were roughly estimated and shown in **Table 1.3.3-4** and **Figure 1.3.3-11**.

**TABLE 1.3.3-4 ESTIMATED COST OF ALTERNATIVES**

| Alternative | Length (km.) | Cost (Million Pesos) |                  |                  | Cost per Km (Million Pesos) |     |       |
|-------------|--------------|----------------------|------------------|------------------|-----------------------------|-----|-------|
|             |              | Civil Work           | ROW              | Total            | Civil Work                  | ROW | Total |
| 1           | 16.4         | 10,056<br>(65.5%)    | 5,303<br>(34.5%) | 15,359<br>(100%) | 613                         | 323 | 937   |
| 2           | 18.6         | 13,196<br>(76.2%)    | 3,975<br>(23.8%) | 17,171<br>(100%) | 709                         | 214 | 923   |
| 3           | 18.6         | 12,700<br>(80.5%)    | 2,962<br>(19.5%) | 15,662<br>(100%) | 683                         | 159 | 842   |
| 4           | 18.4         | 12,484<br>(74.2%)    | 4,419<br>(25.8%) | 16,903<br>(100%) | 678                         | 240 | 919   |
| 5           | 21.6         | 13,152<br>(74.2%)    | 4,581<br>(25.8%) | 17,733<br>(100%) | 609                         | 212 | 821   |
| 6           | 14.8         | 11,869<br>(83.2%)    | 2,391<br>(16.8%) | 14,260<br>(100%) | 802                         | 162 | 964   |



**Figure 1.3.3-11 Cost Estimate of Alternatives**

### Traffic Volume Attracted to Expressway

Traffic volume in 2020 was estimated as shown in **Table 1.3.3-5**.

**TABLE 1.3.3-5 TRAFFIC VOLUME ATTRACTED TO CALAX (YEAR 2020)**

| Alternative | Length (km) | Traffic Volume which Enter CALAX per Day | Average Section Traffic Volume per Day | Vehicle-km per Day | Average Trip Distance (km) |
|-------------|-------------|------------------------------------------|----------------------------------------|--------------------|----------------------------|
| 1           | 16.4        | 48,500                                   | 36,800                                 | 609,100            | 12.6                       |
| 2           | 18.6        | 53,900                                   | 31,400                                 | 548,100            | 10.2                       |
| 3           | 18.6        | 57,600                                   | 34,300                                 | 576,800            | 10.0                       |
| 4           | 18.4        | 58,500                                   | 30,600                                 | 591,300            | 10.1                       |
| 5           | 21.6        | 52,200                                   | 28,500                                 | 643,200            | 12.3                       |
| 6           | 14.8        | 37,100                                   | 27,100                                 | 434,200            | 11.7                       |

### Characteristics of Alternatives

Characteristics of alternatives are summarized in **Table 1.3.3-6**.

**TABLE 1.3.3-6 CHARACTERISTICS OF ALTERNATIVES**

| Alternatives                                                    |                   | Alternative 1                                                  | Alternative 2                                                                                    | Alternative 3                                                                                 | Alternative 4                         | Alternative 5                         | Alternative 6                                                    |
|-----------------------------------------------------------------|-------------------|----------------------------------------------------------------|--------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|---------------------------------------|---------------------------------------|------------------------------------------------------------------|
| Expressway Distance (km)                                        |                   | 16.4                                                           | 18.6                                                                                             | 18.6                                                                                          | 18.4                                  | 21.6                                  | 14.8                                                             |
| SLEX Connection                                                 |                   | • Greenfield/ Eton Interchange (direct or indirect connection) | • Mamplasan Interchange (direct or indirect connection)                                          | • Existing Mamplasan Interchange (direct or indirect connection)                              | • New Interchange (direct connection) | • New Interchange (direct connection) | • Existing Mamplasan Interchange (direct or indirect connection) |
| Road Structure                                                  | Road Section      | 10.2 km                                                        | 10.0 km                                                                                          | 10.5 km                                                                                       | 10.8 km                               | 13.4 km                               | 8.6 km                                                           |
|                                                                 | Bridge/ Viaduct   | 3.3 km                                                         | 6.2 km                                                                                           | 5.9 km                                                                                        | 6.0 km                                | 5.2 km                                | 4.6 km                                                           |
|                                                                 | MSE Wall          | 2.9 km                                                         | 2.4 km                                                                                           | 2.2 km                                                                                        | 1.6 km                                | 3.0 km                                | 1.6 km                                                           |
| Cost (M Php)                                                    | Civil Work        | 10,056                                                         | 13,196                                                                                           | 12,700                                                                                        | 12,484                                | 13,152                                | 11,869                                                           |
|                                                                 | ROW               | 5,303                                                          | 3,975                                                                                            | 2,962                                                                                         | 4,419                                 | 4,581                                 | 2,391                                                            |
|                                                                 | Total             | 15,359                                                         | 17,171                                                                                           | 15,662                                                                                        | 16,903                                | 17,733                                | 14,260                                                           |
| Estimated Traffic Volume (2020)                                 | Volume (veh/ day) | 48,500                                                         | 53,900                                                                                           | 57,600                                                                                        | 58,500                                | 52,200                                | 37,100                                                           |
|                                                                 | Veh.-km.          | 609,100                                                        | 548,100                                                                                          | 576,800                                                                                       | 591,300                               | 643,200                               | 434,200                                                          |
| Cost Performance                                                |                   | 39.7                                                           | 31.9                                                                                             | 36.8                                                                                          | 35.0                                  | 36.3                                  | 30.4                                                             |
| Utilization of Private Road ROW which is to be acquired by DPWH |                   | -                                                              | Greenfield Parkway<br>W = 40 m<br>L = 4.4 km<br>(1/4 of total length, but widening is required.) | Laguna Blvd.<br>W = 60 m<br>L = 6.2 km<br>(1/3 of total length, and no widening is required.) | -                                     | -                                     | -                                                                |
| Residential Subdivision Affected                                | Already Residing  | 1.4 km                                                         | 3.5 km (one-side)<br>1.8 km (both-side)                                                          | -                                                                                             | -                                     | -                                     | -                                                                |

| Alternatives                                 |                         | Alternative 1                                                                                                                                                        | Alternative 2                                                                                                                                                                          | Alternative 3                                                                                                                                                                          | Alternative 4                                                                                                                                                                | Alternative 5                                                                                                                                                                                        | Alternative 6                                                                                                                               |
|----------------------------------------------|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
|                                              | Lots for Sale           | 2.2 km                                                                                                                                                               | -                                                                                                                                                                                      | -                                                                                                                                                                                      | 2.8 km                                                                                                                                                                       | 6.2 km                                                                                                                                                                                               | 1.0 km                                                                                                                                      |
| Industrial Estate Affected                   | Under Operation         | -                                                                                                                                                                    | 1.0 km (one-side only)                                                                                                                                                                 | -                                                                                                                                                                                      | 2.2 km                                                                                                                                                                       | 0.2 km                                                                                                                                                                                               | -                                                                                                                                           |
| University Affected                          |                         | University of Sto. Tomas (UST)                                                                                                                                       | -                                                                                                                                                                                      | -                                                                                                                                                                                      | Adventist University of the Philippines (AUP)                                                                                                                                | Adventist University of the Philippines (AUP)                                                                                                                                                        | -                                                                                                                                           |
| Status of Land Development of Each Developer | People already residing | <ul style="list-style-type: none"> <li>Adelfa /Fine Properties Inc.</li> </ul>                                                                                       | <ul style="list-style-type: none"> <li>VALENZA</li> <li>Sta. Rosa Estate</li> <li>Greenfield City</li> <li>Laguna Bel-Air I &amp; II</li> </ul>                                        | <ul style="list-style-type: none"> <li>Ayala Land Corp. (only Private Road ROW will be utilized, thus no one will be dislocated.</li> </ul>                                            | -                                                                                                                                                                            | -                                                                                                                                                                                                    | <ul style="list-style-type: none"> <li>Ayala Land Corp. (only Private Road ROW will be utilized, thus no one will be dislocated.</li> </ul> |
|                                              | Lots for sale           | <ul style="list-style-type: none"> <li>Greenfield Development Corp.</li> <li>MESSA Homes</li> </ul>                                                                  | <ul style="list-style-type: none"> <li>Greenfield Development Corp.</li> </ul>                                                                                                         | -                                                                                                                                                                                      | <ul style="list-style-type: none"> <li>Ayala/Nuvali Properties Inc.</li> </ul>                                                                                               | <ul style="list-style-type: none"> <li>Ayala/Nuvali Properties, Inc.</li> <li>Sentosa, Inc.</li> <li>Greenwood Park, Inc.</li> </ul>                                                                 | <ul style="list-style-type: none"> <li>Tamayo Property, Inc.</li> </ul>                                                                     |
|                                              | No Development Yet      | <ul style="list-style-type: none"> <li>Stateland, Inc.</li> <li>Cathay Land, Inc.</li> <li>Extraordinary Development Corporation</li> <li>Eton Properties</li> </ul> | <ul style="list-style-type: none"> <li>Stateland Inc.</li> <li>Cathay Land, Inc.</li> <li>Extraordinary Development Corporation</li> <li>Greenfield Development Corporation</li> </ul> | <ul style="list-style-type: none"> <li>Stateland Inc.</li> <li>Cathay Land, Inc.</li> <li>Extraordinary Development Corporation</li> <li>Greenfield Development Corporation</li> </ul> | <ul style="list-style-type: none"> <li>Stateland Inc.</li> <li>Cathay Land, Inc.</li> <li>Extraordinary Development Corporation</li> <li>San Ramon Holdings, Inc.</li> </ul> | <ul style="list-style-type: none"> <li>Stateland Inc.</li> <li>Cathay Land, Inc.</li> <li>Extraordinary Development Corporation</li> <li>San Ramon Holdings, Inc.</li> <li>Carmelray Town</li> </ul> | <ul style="list-style-type: none"> <li>Stateland Inc.</li> <li>Greenfield Development Corporation</li> </ul>                                |
| Industrial Estate in operation               |                         |                                                                                                                                                                      | <ul style="list-style-type: none"> <li>Laguna Techno Park</li> </ul>                                                                                                                   | <ul style="list-style-type: none"> <li>Laguna Techno Park (property is not affected)</li> </ul>                                                                                        | <ul style="list-style-type: none"> <li>Silangan Industrial Park</li> </ul>                                                                                                   | <ul style="list-style-type: none"> <li>Filinvest Technology Park</li> </ul>                                                                                                                          |                                                                                                                                             |

## Evaluation of Alternatives

Two (2) evaluation methods were tested to evaluate alternatives as follows:

**Method-1** : Relative superiority of an alternative (**Table 1.3.3-7**).

All evaluation items were equally evaluated.

Relative superiority among alternatives

Good : ○

Medium: △

Bad : X

Superiority of an alternative was evaluated by number of  
“Good, O”

**Method-2** : Evaluation by Weight Method.

Evaluation items were given weight.

Each item was also rated. An alternative which got highest points

was recommended.

### *Method-1 : Relative Superiority Evaluation*

#### **a) Contribution to improvement of accessibility to the Project Area and Area Development**

- Whether CALAX passes through an existing, on-going or proposed development area;
  - More than 70% of section ..... ○
  - 50% to 70% ..... △
  - Less than 50% ..... X

#### **b) Connection with SLEX**

- Direct Connection ..... ○
- Direct Connection is possible, but quite expensive ... △

**c) Traffic Volume Attracted**

When higher traffic is attracted, it contributes more to reduce traffic congestion of public roads and the project is economically and financially feasible, thus an alternative which attract higher traffic is evaluated better than other alternatives.

- More than 50,000 veh./day ..... ○
- 40,000 to 50,000 veh/day ..... △
- Less than 40,000 veh/day ..... X

**d) Cost (Civil Work Cost + ROW Acquisition Cost)**

Smaller cost is better for the project. When the smallest cost is set as 1.00, increase rate of other Alternative was evaluated as follows:

**Cost Ratio**

- 1.0 to 1.10 ..... ○
- 1.10 to 1.20 ..... △
- Over 1.20 ..... X

**e) Impact on Natural Environment**

Major natural environmental impact of this project will be soil erosion and loss of greenery.

**e-1) Soil Erosion**

The project area is prone from slight to moderate soil erosion, depending on the gradient of land slope. Since slope cutting will affect soil erosion, thus evaluation indicator used is the volume of slope cutting.

- Large scale of slope cut (over 500,000 m<sup>3</sup>) required ..... X
- Medium scale of slope cut (200,000 to 500,000 m<sup>3</sup>) required ... △
- Small scale of slope cut (less than 200,000 m<sup>3</sup>) required ..... ○

**e-2) Loss of Greenery**

Loss of greenery is evaluated as the quantity of cut trees.

A large number of trees are cut ..... X  
Medium number of trees are cut ..... Δ  
Small number of trees are cut ..... ○

**f) Social Impact**

Evaluation by the number of houses to be affected.

10 or less houses ..... ○  
10 to 30 houses ..... Δ  
Over 30 houses ..... X

**g) Cost Performance**

Cost performance = veh.km/cost in Million Php

High Efficiency over 35 ..... ○  
Medium Efficiency 30 to 35 ..... Δ  
Low Efficiency less than 30 ..... X

**h) Easiness of Implementation (ROW Acquisition)**

Development status of properties of land development companies is different and can be classified as follows:

- (a) Lots were sold out and some people are already residing;
- (b) Lots are being sold; and
- (c) No development is made yet

Those who bought a lot sold by the land development companies were not informed that an expressway will be built and their properties may be affected by the project. Therefore, it will take a longer time to negotiate with these people,

and DPWH will have a hard time to acquire the road right-of-way. Evaluation was made as follows:

- Lots are not affected or land development has not started yet ....○
- Some lots are being sold ..... Δ
- Many lots have been sold out or are being sold  
and some people are already residing ..... X

**i) Easiness of Construction**

This was evaluated as follows:

- Wide construction space is available, existing traffic is not disturbed, and access road for construction needed, but its construction is easy. ...  
○
- Above conditions become rather severe .....  
Δ
- Construction of access road itself is difficult due to terrain, and construction can start only at the beginning side and end side ...  
X

**TABLE 1.3.3-7 EVALUATION OF ALTERNATIVES: METHOD-1**

| Evaluation Item |                                              | Alternatives                              |   |                                           |   |                                           |   |                                           |   |                                           |   |                                          |   |
|-----------------|----------------------------------------------|-------------------------------------------|---|-------------------------------------------|---|-------------------------------------------|---|-------------------------------------------|---|-------------------------------------------|---|------------------------------------------|---|
|                 |                                              | 1                                         |   | 2                                         |   | 3                                         |   | 4                                         |   | 5                                         |   | 6                                        |   |
| a)              | Contribution to improvement of accessibility | Pass through development area             | ○ | Pass through development area             | ○ | Pass through development area             | ○ | Pass through development area             | ○ | Pass through development area             | ○ | Pass through steep slope area            | X |
| b)              | Connection with SLEX                         | Indirect                                  | △ | Direct or indirect                        | △ | Direct or indirect                        | △ | Direct                                    | ○ | Direct                                    | ○ | Direct or indirect                       | △ |
| c)              | Traffic Volume Attracted                     | 48,500                                    | △ | 53,900                                    | ○ | 57,600                                    | ○ | 58,500                                    | ○ | 52,200                                    | ○ | 37,100                                   | X |
| d)              | Cost                                         | 15,359<br>(1.08)                          | ○ | 17,171<br>(1.20)                          | X | 15,662<br>(1.10)                          | ○ | 16,903<br>(1.19)                          | △ | 17,333<br>(1.24)                          | X | 14,260<br>(1.00)                         | ○ |
| e)              | Impact on Natural Environment                | Medium Scale<br>(380,000 m <sup>3</sup> ) | △ | Medium Scale<br>(380,000 m <sup>3</sup> ) | △ | Medium Scale<br>(380,000 m <sup>3</sup> ) | △ | Medium Scale<br>(380,000 m <sup>3</sup> ) | △ | Medium Scale<br>(380,000 m <sup>3</sup> ) | △ | Large Scale<br>(750,000 m <sup>3</sup> ) | X |
|                 | Slope Cutting<br>Tree Cutting                | Medium Number                             | △ | Medium Number                             | △ | Medium Number                             | △ | Medium Number                             | △ | Medium Number                             | △ | Large Number                             | X |
| f)              | Social Impact                                | 20 houses                                 | △ | 30 houses                                 | △ | 10 houses                                 | ○ | 40 houses/factory                         | X | 60 houses                                 | X | 10 houses                                | ○ |
| g)              | Cost Performance                             | 39.7                                      | ○ | 31.9                                      | △ | 36.8                                      | ○ | 34.9                                      | △ | 36.3                                      | ○ | 30.4                                     | △ |
| h)              | Easiness of Implementation (ROW acquisition) | 3.6 km                                    | X | 6.3 km                                    | X | -                                         | ○ | 5.0 km                                    | X | 6.4 km                                    | X | 1.0 km                                   | △ |
| i)              | Easiness of Construction                     | Easy                                      | ○ | Easy                                      | ○ | Easy                                      | ○ | Easy                                      | ○ | Easy                                      | ○ | Difficult                                | X |
| Evaluation      |                                              | ○ : 4<br>△ : 5<br>X : 1                   |   | ○ : 3<br>△ : 5<br>X : 2                   |   | ○ : 7<br>△ : 3<br>X : 0<br>[Recommended]  |   | ○ : 4<br>△ : 4<br>X : 2                   |   | ○ : 5<br>△ : 2<br>X : 3                   |   | ○ : 2<br>△ : 3<br>X : 5                  |   |

## Method-2 : Evaluation by Weight Method

Weight of each evaluation item and rating method is shown in **Table 1.3.3-8**.

Evaluation of alternatives is shown in **Table 1.3.3-9**.

**TABLE 1.3.3-8 EVALUATION CRITERIA: METHOD-2**

| Evaluation Item |                                              | Weight | Rating Method                                                                                                                                                                             |
|-----------------|----------------------------------------------|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| a)              | Contribution to improvement of accessibility | 5      | <ul style="list-style-type: none"> <li>Relative Rating</li> <li>Good ..... 5</li> <li>Fair ..... 4</li> <li>Bad ..... 3</li> </ul>                                                        |
| b)              | Connection with SLEX                         | 2.5    | <ul style="list-style-type: none"> <li>Direct connection ..... 2.5</li> <li>Direct connection is possible, but very expensive ..... 1.5</li> <li>Indirect connection ..... 1.0</li> </ul> |
| c)              | Traffic Volume                               | 10     | Max : 58,000 ..... 10<br>Min : 37,100 ..... 5<br>In-between, pro-rated.                                                                                                                   |
| d)              | Cost                                         | 25     | Min : 14,260 ..... 25<br>Max : 17,733 ..... 10<br>In-between, pro-rated.                                                                                                                  |
| e)              | Impact on Environment                        |        |                                                                                                                                                                                           |
|                 | Soil Erosion(Slope cutting)                  | 7.5    | <ul style="list-style-type: none"> <li>Relative rating</li> <li>Medium scale ..... 7.5</li> <li>Large scale ..... 2.0</li> </ul>                                                          |
|                 | Loss of Greenery (Tree cutting)              | 7.5    | <ul style="list-style-type: none"> <li>Relative rating</li> <li>Medium number ..... 7.5</li> <li>Large number ..... 2.0</li> </ul>                                                        |
| f)              | Social Impact                                | 15     | Min : 10 ..... 15<br>Max : 60 ..... 5<br>In-between, pro-rated.                                                                                                                           |
| g)              | Cost Performance                             | 10     | Max : 39.7 ..... 10<br>Min : 30.4 ..... 5                                                                                                                                                 |
| h)              | Easiness of Implementation (ROW acquisition) | 15     | Min : 0 km ..... 15<br>Max : 6.4 km ..... 5<br>In-between, pro-rated.                                                                                                                     |
| i)              | Easiness of Construction                     | 2.5    | <ul style="list-style-type: none"> <li>Relative rating</li> <li>Easy ..... 2.5</li> <li>Difficult ..... 1.0</li> </ul>                                                                    |
| Total           |                                              | 100    |                                                                                                                                                                                           |

**TABLE 1.3.3-9 EVALUATION OF ALTERNATIVES: METHOD-2**

| Evaluation Item    |                                              | Weight       | Alternatives                           |       |                                        |       |                                        |       |                                        |       |                                        |       |                                       |       |
|--------------------|----------------------------------------------|--------------|----------------------------------------|-------|----------------------------------------|-------|----------------------------------------|-------|----------------------------------------|-------|----------------------------------------|-------|---------------------------------------|-------|
|                    |                                              |              | 1                                      |       | 2                                      |       | 3                                      |       | 4                                      |       | 5                                      |       | 6                                     |       |
| a)                 | Contribution to improvement of accessibility | 5.0          | Pass through development area          | 5.00  | Pass through development area          | 5.00  | Pass through development area          | 5.00  | Pass through development area          | 5.00  | Pass through development area          | 5.00  | Pass through steep slope area         | 3.00  |
| b)                 | Connection with SLEX                         | 2.5          | Indirect                               | 1.00  | Direct or indirect                     | 1.50  | Direct or indirect                     | 1.50  | Direct                                 | 2.50  | Direct                                 | 2.50  | Direct or indirect                    | 1.50  |
| c)                 | Traffic Volume Attracted                     | 10.0         | 48,500                                 | 7.66  | 53,900                                 | 8.93  | 57,600                                 | 9.79  | 58,500                                 | 10.00 | 52,200                                 | 8.53  | 37,100                                | 5.00  |
| d)                 | Cost                                         | 25.0         | 15,359                                 | 20.25 | 17,171                                 | 12.43 | 15,662                                 | 18.94 | 16,903                                 | 13.58 | 17,733                                 | 10.00 | 14,260                                | 25.00 |
| e)                 | Soil Erosion (Slope Cutting)                 | 7.5          | Medium Scale (380,000 m <sup>3</sup> ) | 7.50  | Medium Scale (380,000 m <sup>3</sup> ) | 7.50  | Medium Scale (380,000 m <sup>3</sup> ) | 7.50  | Medium Scale (380,000 m <sup>3</sup> ) | 7.50  | Medium Scale (380,000 m <sup>3</sup> ) | 7.50  | Large Scale (750,000 m <sup>3</sup> ) | 2.00  |
|                    | Loss of Greenery (Tree Cutting)              | 7.5          | Medium Number                          | 7.50  | Medium Number                          | 7.50  | Medium Number                          | 7.50  | Medium Number                          | 7.50  | Medium Number                          | 7.50  | Large Number                          | 2.00  |
| f)                 | Social Impact                                | 15.0         | 20 houses                              | 13.00 | 30 houses                              | 11.00 | 10 houses                              | 15.00 | 40 houses/factory                      | 9.00  | 60 houses                              | 5.00  | 10 houses                             | 15.00 |
| g)                 | Cost Performance                             | 10.0         | 35.5                                   | 10.00 | 31.9                                   | 5.81  | 36.8                                   | 8.44  | 35.0                                   | 7.47  | 36.3                                   | 8.17  | 22.4                                  | 5.00  |
| h)                 | Easiness of Implementation (ROW acquisition) | 15.0         | 3.6 km                                 | 10.63 | 6.3 km                                 | 5.16  | -                                      | 15.00 | 5.0 km                                 | 7.19  | 6.4 km                                 | 5.00  | 1.0 km                                | 13.44 |
| i)                 | Easiness of Construction                     | 2.5          | Easy                                   | 2.50  | Easy                                   | 2.50  | Easy                                   | 2.50  | Easy                                   | 2.50  | Easy                                   | 2.50  | Difficult                             | 1.00  |
| <b>Total Score</b> |                                              | <b>100.0</b> | <b>85.04</b>                           |       | <b>67.33</b>                           |       | <b>91.17</b><br><b>[Recommended]</b>   |       | <b>72.24</b>                           |       | <b>61.70</b>                           |       | <b>74.94</b>                          |       |

## Recommendation

Results of evaluation by both methods show that Alternative-3 is the most preferable alternative. Advantages of Alternative-3 are as follows:

- Cost is within 10% increase compared to the minimum cost alternative (Alternative-6). (Alternative-6 attracts least traffic). Second lowest alternative (Alternative-1) and Alternative-3 is almost the same cost.
- High traffic volume is attracted. Alternative-3 attracts the 2<sup>nd</sup> highest traffic. Highest is Alternative-4 and difference is 900 vehicle per day (or 1.6% difference).
- Social impact in terms of dislocation of people is the smallest.
- Since this alternative utilizes the 60m ROW of existing private road (for about 1/3 of the total expressway length), implementation in terms of ROW acquisition is the easiest and the fastest.
- Other alternatives affect people who have newly acquired a lot from the private land developers. When they bought their lots, they were not informed that their lots will be affected in the future by this project. Therefore, their life plan will have a drastic change. On the part of DPWH, ROW acquisition negotiation will take time.

In view of the above, **Alternative-3** was **recommended**.

### **1.3.4 Estimated Traffic on Expressway**

#### **1.3.4.1 Existing Traffic Volume**

**FIGURE 1.3.4-1** shows the traffic volumes of the road network in Cavite area and some portions of Laguna province. The number denotes vehicles. The following were observed regarding the captured traffic volume:

- Traffic volume at the section of SLEX inside Metro Manila is extremely high compared to the sections outside of Metro Manila indicating that there are high numbers of vehicles using the expressway having their OD within Metro Manila.

- There is also a very high volume of vehicles between Metro Manila and coastal towns of Cavite which is served by the Manila-Cavite Expressway. These towns along with other towns within the periphery of Metro Manila are functioning as residing place of workers in the capital.
- Likewise, traffic volume at the trunk roads like Aguinaldo Highway and Governor's Drive is also high especially at the sections of these roads passing urban areas like in Dasmariñas City and Gen. M. Alvarez, and Carmona. Through traffic and local traffic like jeepneys and tricycles merges at this road section.

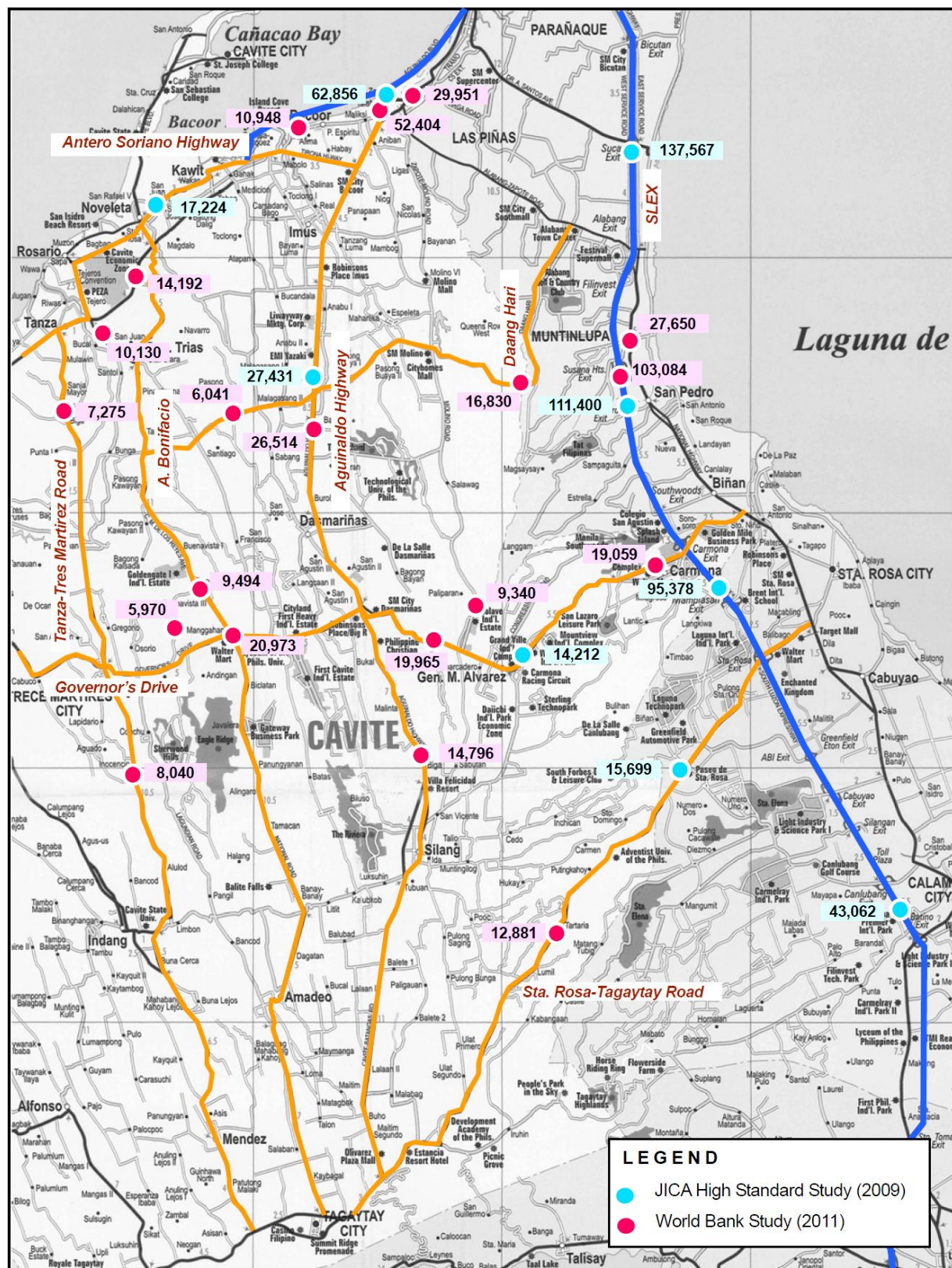
#### **1.3.4.2 Existing Travel Speed**

The travel time of selected routes are depicted in **FIGURE 1.3.4-2**. General observation appears that serious traffic congestion is experienced while the national road is passing a city center or the area has substantial number of economic zones and industrial parks. Congestion is also experienced when a road is about to merge with another important road.

#### **1.3.4.3 Toll Rate vs. Revenue**

In order to set the proper toll rate of CALAX, the traffic volume and the amount of revenue are estimated by traffic assignment model. **FIGURE 1.3.4-3** shows the result of traffic assignment of toll rate in year 2011.

- In case of toll free, total traffic volume to enter CALAX is 69,316 vehicles/day
- The toll rate for getting higher revenue is about 4 to 15 Peso/km and the amount of revenue is about 3.7 and 4.2 million Peso/day. Although maximum amount of revenue is 10 peso case, traffic volume to enter CALAX is only 19,819 vehicle /day which is about 30% of toll free case.
- The desirable toll rate for attractive to motorist and higher revenue is 4.0 Peso/km. Total traffic volume to enter CALAX is 41,567 vehicle/day (60% of toll free case). This toll rate is the almost same as that of Manila Cavite Toll Expressway (herein CAVITEX) phase-1 and it is cheaper than that of other new present expressways such as CAVITEX Phase-2 and Skyway Phase-2. Most motorists may still accept the 4.0 peso/km in year 2011.



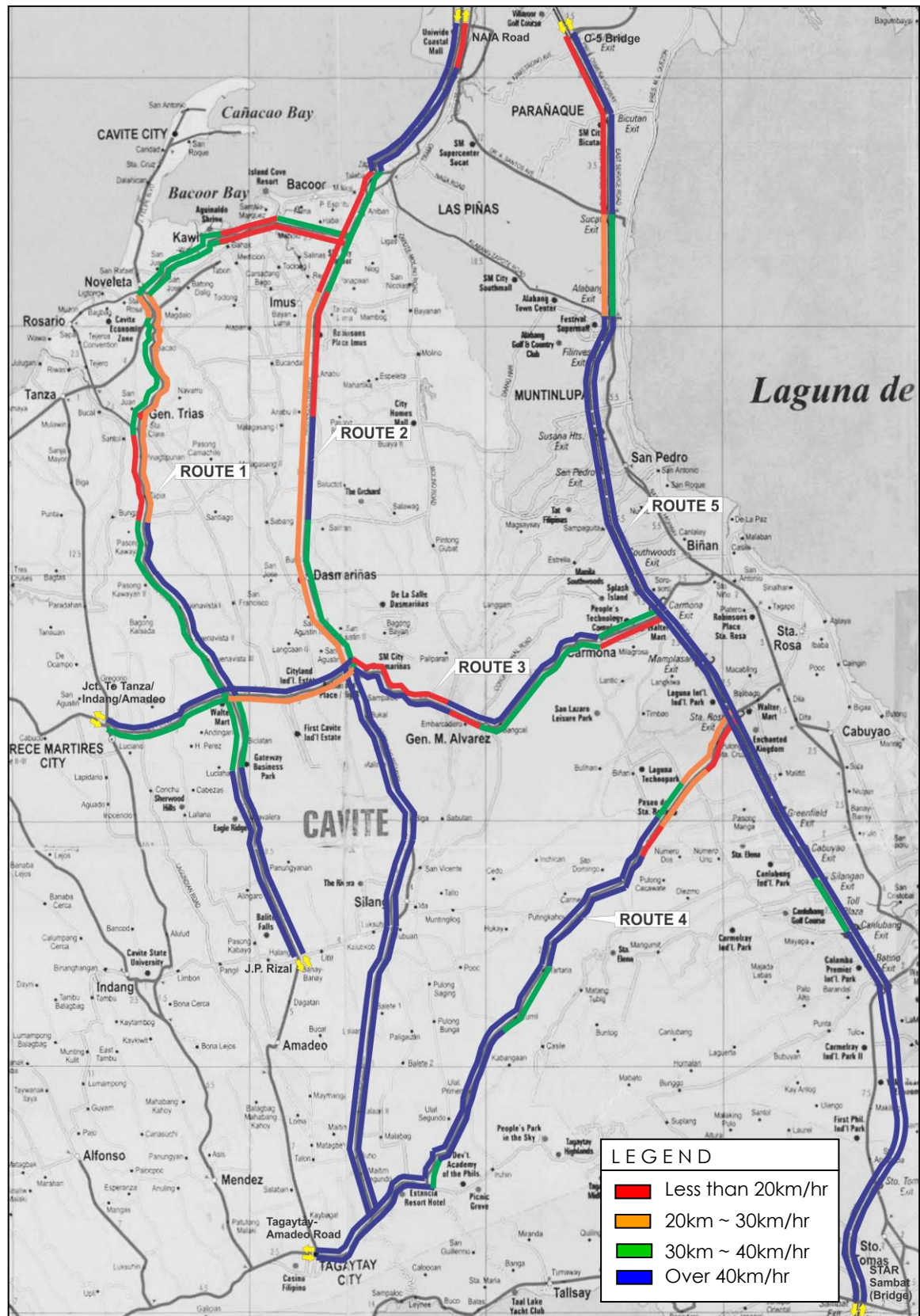
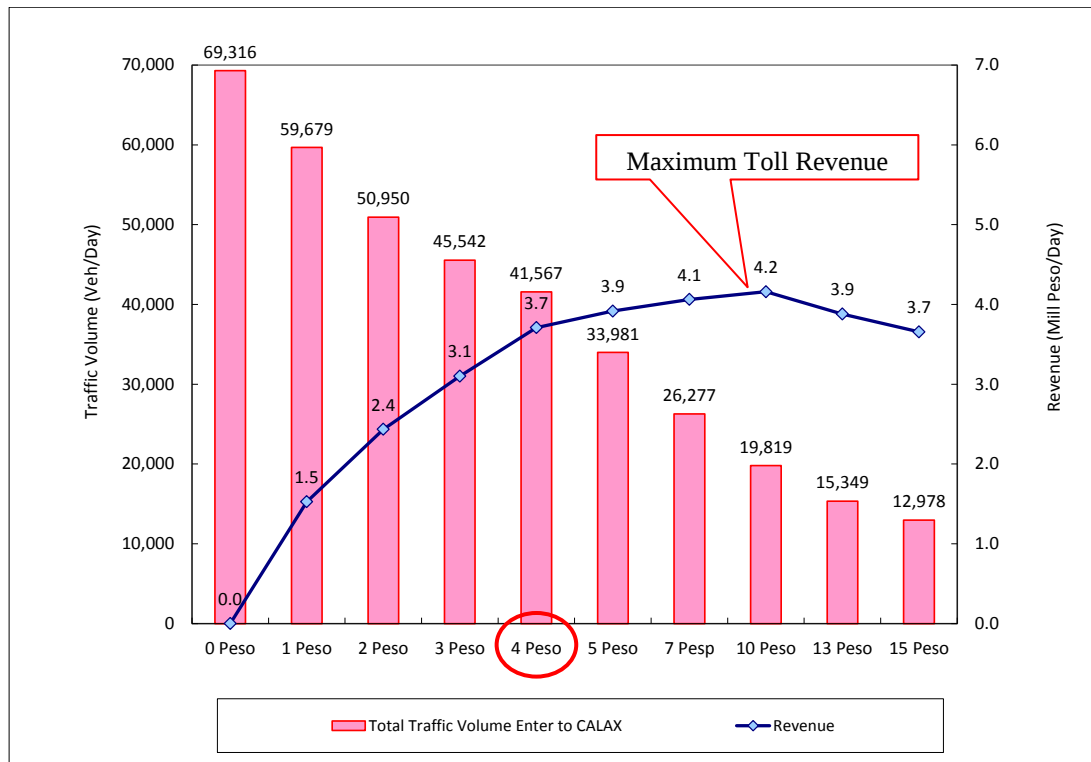


Figure 1.3.4-2 Travel Speed of Major Corridors In The South of Metro Manila (Afternoon Peak Hours)



**Figure 1.3.4-3 Toll Rate Vs Revenue (CALAX, Year 2011)**

#### 1.3.4.4 Estimated Traffic on Expressway

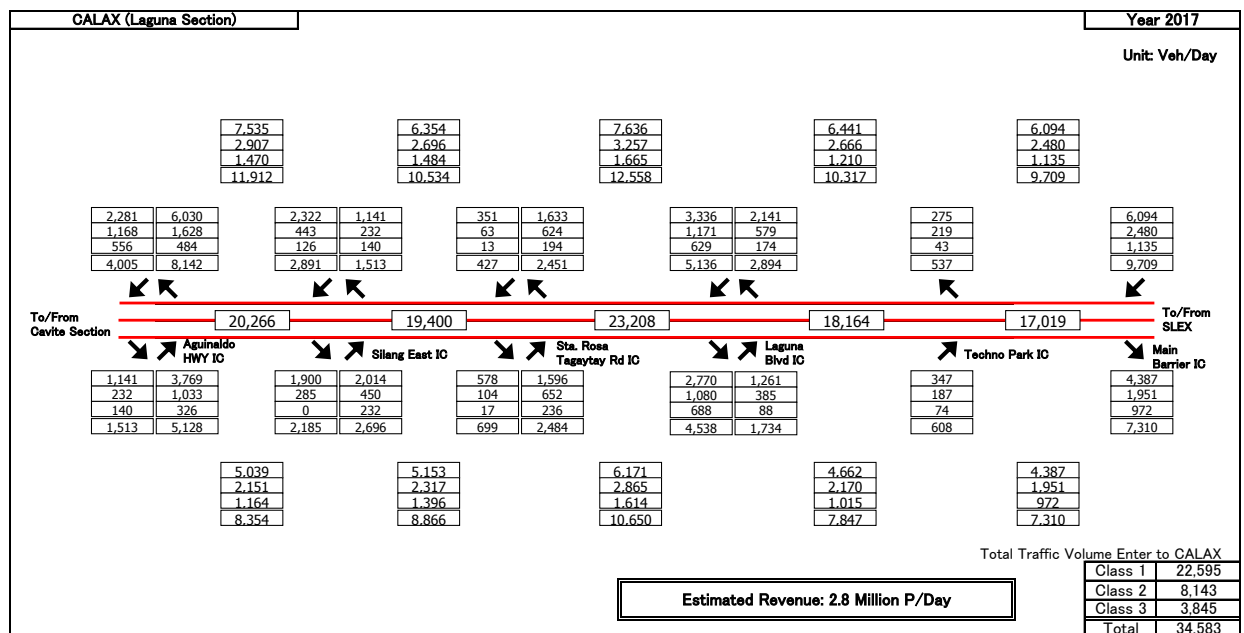
Figures 1.3.4-4 to 1.3.4-6 show the estimated traffic volume of CALAX Laguna section. The highest traffic volume interchange section is between Sta.Rosa-Tagaytay IC and Laguna Blvd. IC, which number of traffic are 23,208 (vehicle/day) in year 2017, 31,122 (vehicle/day) in year 2020 and 48,796 (vehicle/day) in year 2030.

TABLE 1.3.4-1 shows the total traffic volume to enter CALAX Laguna section and total vehicle km of CALAX Laguna Section.

**TABLE 1.3.4-1 Traffic Volume And Vehicle Km (CALAX Laguna Section)**

| Item                         | Vehicle Class | Year 2017 | Year 2020 | Year 2030 |
|------------------------------|---------------|-----------|-----------|-----------|
| Traffic Volume<br>(Veh./day) | Class 1       | 22,595    | 31,108    | 60,091    |
|                              | Class 2       | 8,143     | 9,712     | 14,870    |
|                              | Class 3       | 3,845     | 4,347     | 5,855     |
|                              | Total         | 34,583    | 45,167    | 80,816    |

| Item                                 | Vehicle Class | Year 2017 | Year 2020 | Year 2030 |
|--------------------------------------|---------------|-----------|-----------|-----------|
| Vehicle*km                           | Class 1       | 204,109   | 275,222   | 510,503   |
|                                      | Class 2       | 87,460    | 106,403   | 151,367   |
|                                      | Class 3       | 45,718    | 53,809    | 73,808    |
|                                      | Total         | 337,287   | 435,434   | 735,678   |
| Toll Revenue<br>(Million<br>Php/day) | All classes   | 2.8       | 4.0       | 10.5      |



**Figure 1.3.4-4 Traffic Projection (Year 2017) of CALAX Laguna Section**

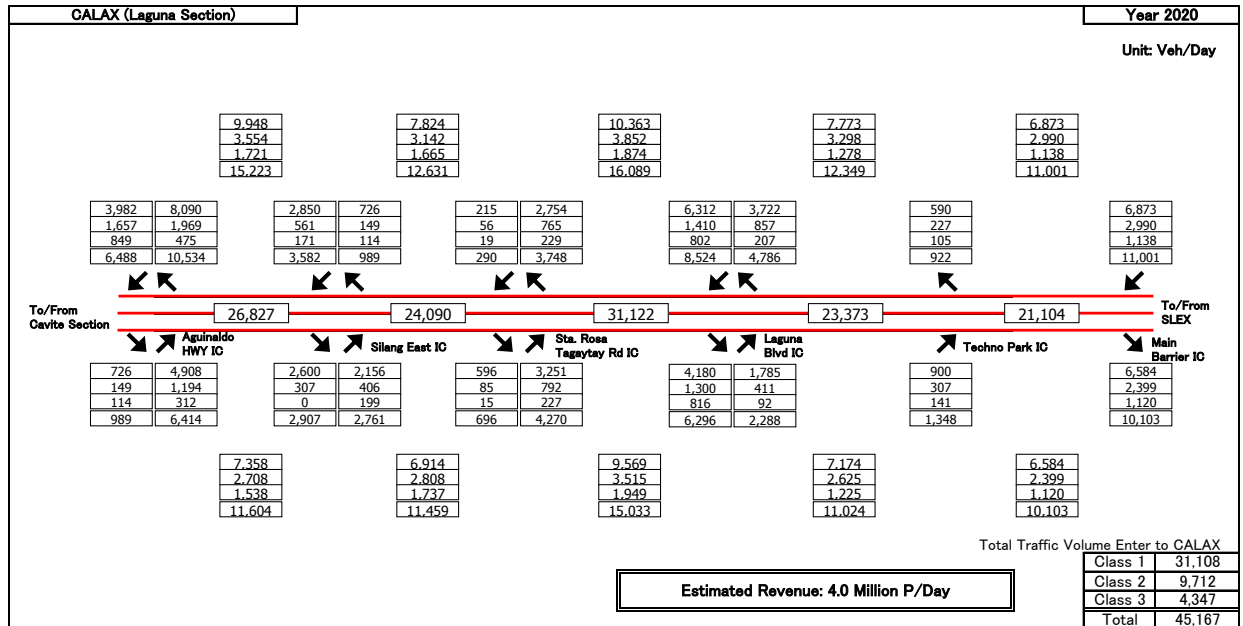


Figure 1.3.4-5 Traffic Projection (Year 2020) of CALAX Laguna Section

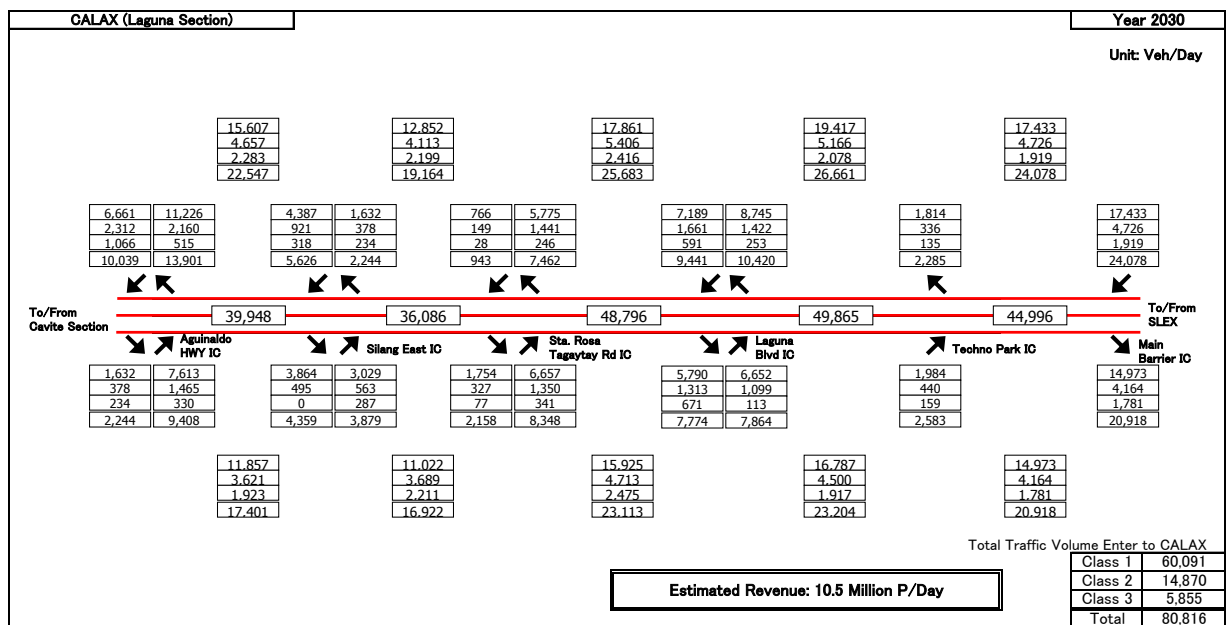


Figure 1.3.4-6 Traffic Projection (Year 2030) of CALAX Laguna Section

## 1.4 PROJECT COMPONENTS

The proposed CALA Expressway Project is consists of the following major components:

- 4-Lane Expressway Length = 18.10 km;
- Interchanges, 4;
- Elevated Section, Length = 5.04 km;
- Road Crossing, 5; and
- Toll Barrier, 1

## 1.5 TECHNOLOGY OPTIONS

The project does not require any special technology and ordinary technologies adopted in the Philippines can be utilized.

The project will be divided into two contract packages as follows;

|                    |   |                         |             |
|--------------------|---|-------------------------|-------------|
| Contract Package 1 | : | Km. 0+690 ~ Km. 10+600  | (L=9.91 km) |
| Contract Package 2 | : | Km. 10+600 ~ Km. 18+810 | (L=8.21 km) |

Major quantities required by each contract package is shown in **Table 1.5-1**. Major material requirement is shown in **Table 1.5-2**. Major equipment to be used is shown in **Table 1.5-3**.

**Table 1.5-1 Major Quantities By Contract Package**

| Items       |                                                | Unit | Quantity      |               | Total         |
|-------------|------------------------------------------------|------|---------------|---------------|---------------|
|             |                                                |      | Package 1     | Package 2     |               |
| <b>1.00</b> | <b>Earthworks</b>                              |      |               |               |               |
| 1.10        | Roadway Excavation                             | cu.m | 925,455.00    | -             | 925,455.00    |
| 1.20        | Embankment from Roadway Excavation             | cu.m | 582,501.00    | 342,954.00    | 925,455.00    |
| <b>2.00</b> | <b>Subbase and Base Course</b>                 |      |               |               |               |
| 2.10        | Aggregate Subbase Course                       | cu.m | 91,898.00     | 108,703.00    | 200,601.00    |
| 2.20        | Crushed Aggregate Base Course                  | cu.m | 64,852.00     | 17,245.00     | 82,097.00     |
| 2.30        | Cement Treated Base Course                     | cu.m | 30,647.00     | 10,119.00     | 40,766.00     |
| <b>3.00</b> | <b>Surface Course</b>                          |      |               |               | -             |
| 3.10        | Bituminous Concrete Binder Course (t=60mm)     | sq.m | 257,008.00    | 67,621.00     | 324,629.00    |
| 3.20        | Bituminous Concrete Surface Course (t=60mm)    | sq.m | 270,997.00    | 187,893.00    | 458,890.00    |
| <b>4.00</b> | <b>Bridge Structure</b>                        |      |               |               |               |
| 4.10        | Concrete Piles Cast in Drilled Holes (Ø1800mm) | l.m  | 2,406.00      | 7,783.00      | 10,189.00     |
| 4.20        | Reinforcing Steel, Grade 60 (Bridge)           | kg   | 15,989,512.00 | 23,895,495.00 | 39,885,007.00 |
| 4.30        | Structural Concrete Class P38MPa for Coping    | cu.m | 8,603.00      | 26,049.00     | 34,652.00     |
| 4.40        | Structural Concrete Class AA for Deck Slab     | cu.m | 18,184.97     | 39,725.03     | 57,910.00     |
| 4.50        | Structural Concrete Class AA for Abutment      | cu.m | 7,038.40      | 1,936.60      | 8,975.00      |
| 4.60        | AASHTO Girder Type V, L=35m                    | each | 567.00        | 1,087.00      | 1,654.00      |
| 4.70        | Structural Steel                               | kg   | 238,256.00    | -             | 238,256.00    |
| <b>5.00</b> | <b>Drainage and Slope Protection Structure</b> |      |               |               |               |
| 5.10        | RCPC (Ø610mm)                                  | l.m  | 7,672.00      | 3,288.00      | 10,960.00     |
| 5.20        | Grouted Riprap Class A (Side Ditch)            | cu.m | 6,138.16      | 2,630.64      | 8,768.80      |
| 5.30        | Single Metal Beam Guardrail                    | l.m  | 1,400.00      | 600.00        | 2,000.00      |
| 5.40        | Double Metal Beam Guardrail                    | l.m  | 9,910.00      | 9,050.00      | 18,960.00     |
| <b>6.00</b> | <b>Miscellaneous Structures</b>                |      |               |               |               |
| 6.10        | Warning Sign                                   | each | 18.00         | 27.00         | 45.00         |
| 6.20        | Regulatory Sign                                | each | 45.00         | 46.00         | 91.00         |
| 6.30        | Reflectorial Thermoplastic Pavement Marking    | sq.m | 11,900.35     | 9,736.65      | 21,637.00     |

**Table 1.5-2 Major Material List For CALAX**

|    | Material                                       | Unit | Quantity      |               |              |               | Remarks |
|----|------------------------------------------------|------|---------------|---------------|--------------|---------------|---------|
|    |                                                |      | Package-1     | Package-2     | Service Road | Total         |         |
| 1  | Crushed Aggregate for Base and Sub base Course | cu.m | 187,397.00    | 52,426.00     | 83,881.00    | 323,704.00    |         |
| 2  | Asphalt                                        | ton  | 64,564.00     | 31,163.00     |              | 95,727.00     |         |
| 3  | Bituminous Tack Coat, Emulsified Asphalt, SS-1 | ton  | 122.00        | 92.00         |              | 214.00        |         |
| 4  | Bituminous Prime Coat, MC-701                  | ton  | 717.00        | 228.00        |              | 945.00        |         |
| 5  | Fine Aggregate for Asphalt Pavement            | cu.m | 3,067.00      | 1,484.00      |              | 4,551.00      |         |
| 6  | Aggregate for Asphalt Pavement                 | cu.m | 7,667.00      | 3,710.00      |              | 11,377.00     |         |
| 7  | Cement                                         | ton  | 26,235.36     | 51,552.36     | 16,124.04    | 93,911.76     |         |
| 8  | Fine Aggregate for Concrete                    | cu.m | 22,446.00     | 44,106.00     | 13,795.00    | 80,347.00     |         |
| 9  | Aggregate for Concrete                         | cu.m | 38,479.00     | 75,610.00     | 23,649.00    | 137,738.00    |         |
| 10 | Reinforcing Steel, Grade 60 (Bridge)           | kg   | 15,989,512.00 | 23,598,954.00 | 296,541.00   | 39,885,007.00 |         |
| 11 | Prestressing Steel                             | kg   | 375,657.00    | 1,293,936.00  |              | 1,669,593.00  |         |
| 12 | Structure Steel,                               | kg   | 238,256.00    |               |              | 238,256.00    |         |
| 13 | DOUBLE METAL BEAM GUARDRAIL (w/Post)           | l.m  | 9,910.00      | 9,050.00      |              | 18,960.00     |         |
| 14 | Single Metal Beam Guardrail (w/Post)           | l.m  | 1,400.00      | 600.00        |              | 2,000.00      |         |
| 15 | Rolled Gutter (Median) 600mm x 200mm           | l.m  | 7,672.00      | 3,288.30      |              | 10,960.30     |         |
| 16 | Fiber Optic                                    | l.m  | 9,910.00      | 8,307.00      |              | 18,217.00     |         |
| 17 | RCPC, 610 mm dia.                              | l.m  | 7,672.00      | 2,192.00      | 1,096.00     | 10,960.00     |         |
| 18 | RCPC, 1200 mm dia.                             | l.m  | 1,400.00      | 400.00        | 200.00       | 2,000.00      |         |

Source: JICA Study Team

**Table 1.5-3 Major Equipment To Be Used**

| Equipment                                           | Capacity                          | Package-1 | Package-2 | Service Road | Total Requirement Number | Remarks |
|-----------------------------------------------------|-----------------------------------|-----------|-----------|--------------|--------------------------|---------|
| Dump Truck                                          | 11 ton                            | 50        | 30        | 5            | 85                       |         |
| Wheel Loder                                         | 1.53 m3                           | 4         | 2         | 1            | 7                        |         |
| Motor Grader 14G                                    | 3m/200HP                          | 2         | 2         | 1            | 5                        |         |
| Vibratory Roller                                    | 11 ton, 125 Hp                    | 2         | 2         |              | 4                        |         |
| Tired Roller                                        | 12.6 ton                          | 2         | 2         |              | 4                        |         |
| Crawler Tractor (w/Bulldozer)                       | Cataerpilar D7G PS                | 4         | 2         | 1            | 7                        |         |
| Hydraulic Excavator                                 | 1.0 m3                            | 10        | 3         | 2            | 15                       |         |
| Backhoe                                             | 0.6 m3                            | 6         | 4         | 1            | 11                       |         |
| Vibratory Plate Compactor                           | 7 Hp                              | 10        | 6         | 1            | 17                       |         |
| Track Crane                                         | 160 ton, 300Hp                    | 3         | 6         | 1            | 10                       |         |
| Crawler Crane                                       | 60T/275Hp                         | 3         | 5         | 1            | 9                        |         |
| Drill Rig for Pile                                  | CWV Model TRM35/31 $\phi$ 1.5~2.5 | 3         | 4         | 1            | 8                        |         |
| Concrete transit Mixer                              | 5 m3                              | 12        | 20        | 5            | 37                       |         |
| Concrete Pump                                       | 60 yd3                            | 2         | 3         | 1            | 6                        |         |
| Concrete Plant                                      | 40m3/hr                           | 1         | 1         |              | 2                        |         |
| Track Mounted Crane                                 | 21-25t, 200Hp                     | 3         | 3         | 1            | 7                        |         |
| Concrete Vibrator                                   | Gasoline type                     | 10        | 20        | 5            | 35                       |         |
| Semi Trailer                                        | 20 ton                            | 5         | 5         | 1            | 11                       |         |
| Asphalt Paver                                       | 4.7 m, 112 Hp                     | 2         | 2         |              | 4                        |         |
| Asphalt Distributor                                 | 5 ton                             | 2         | 2         |              | 4                        |         |
| Asphalt Plant                                       | 60 t/hr                           | 1         | 1         |              | 2                        |         |
| Lane Marker                                         | 8 ton Track                       | 1         | 1         |              | 2                        |         |
| Steel girder and structure prefabrication equipment |                                   | 1         |           |              | 1                        |         |
| Industrial x-ray equipment at site                  |                                   | 1         |           |              | 1                        |         |
| Ultrasonic Examination Equipment at site            |                                   | 1         | 1         |              | 2                        |         |

Source: JICA Study Team

## 1.6 PROJECT SIZE

The proposed CALA Expressway (Laguna Section) Project has a linear length of **18.10 km** and ROW of **50-60 m**. **Table 1.6-1** shows the total area covered by the project alignment.

**TABLE 1.6-1 TOTAL PROJECT SIZE**

| Length (km) | ROW | Total Area Covered (ha) |
|-------------|-----|-------------------------|
| 18.10       | 50  | 90.5                    |
| 18.10       | 60  | 108.6                   |

## 1.7 DEVELOPMENT PLAN, DESCRIPTION OF PROJECT PHASES AND CORRESPONDING TIMEFRAMES

Described in **Figure 1.7-1** is the implementation timeframe of the proposed CALA Expressway Project. Selection of consultant for the Detailed Engineering Design (DED) of the project is expected to start in 2013 until the third quarter of the year. The DED will immediately commence once the consultant is selected. Overlapping with the conduct of the DED is the execution of the Right-Of-Way (ROW) Acquisition which is anticipated to start in 2014. Selection of the Contractor will also start in 2014 around the second quarter. Once ROW acquisition and DED are completed, construction of the Expressway will start in the third quarter of 2015. Operation and maintenance of the newly constructed CALA Expressway begin after **two (2)** years of construction period.

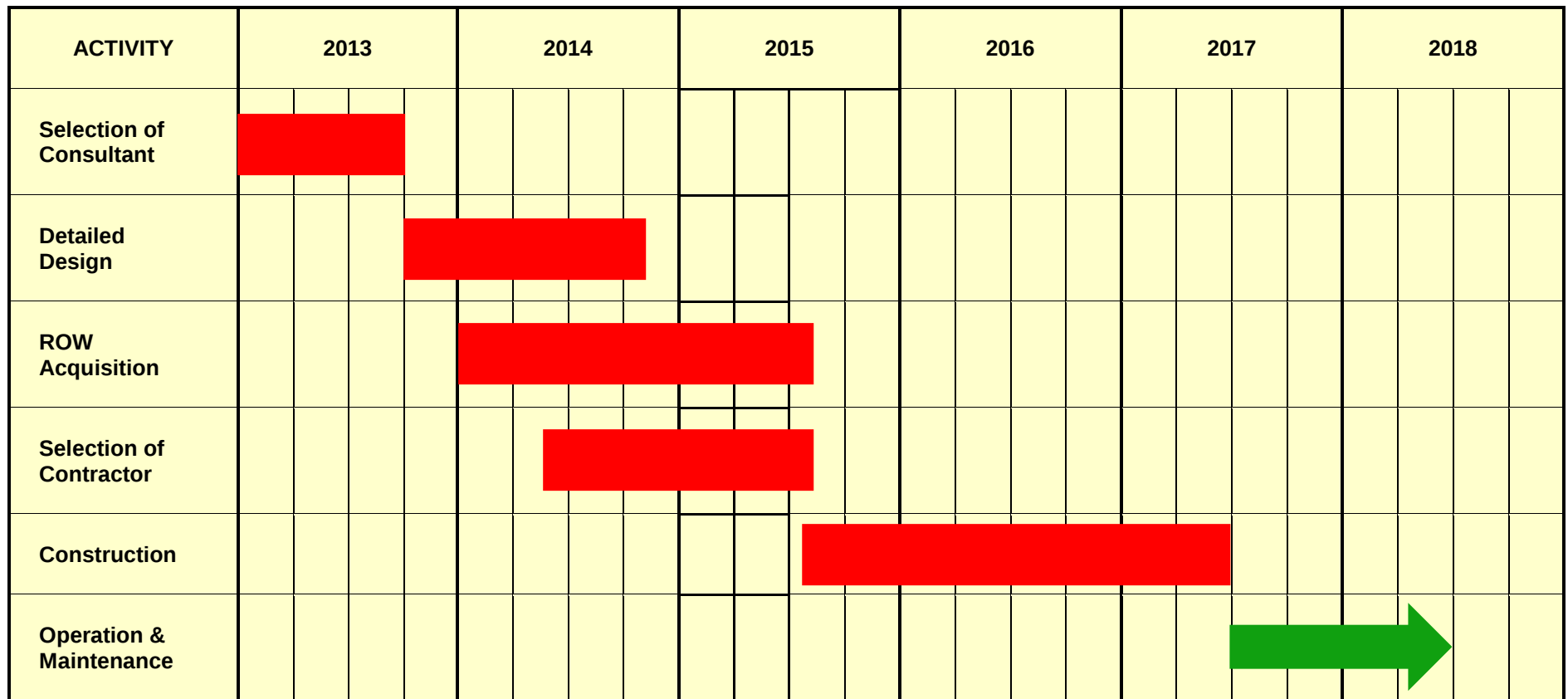


Figure 1.7-1 Implementation Schedule for the Proposed CALA Expressway Project (Tentative)

### **1.7.1 Pre-Construction Phase**

The following activities are Pre-Construction activities In preparation for the construction of the viaduct substructure and superstructure the following activities shall be undertaken:

- Selection of DED Consultant;
- Conduct of Detailed Engineering Design;
- ROW Acquisition; and
- Selection of Contractor;

### **1.7.2 Construction Phase**

The construction phase of the project shall entail the following activities:

- Relocation/replacement of affected basic social service utilities;
- Balling/cutting and relocation of trees;
- Construction/provision of temporary construction facilities/structures;
- Demolition of affected pedestrian overpass and foot bridges (if any);
- Earth moving activities and other related works;
- Erection of foundations;
- Superstructure construction (viaduct, and on and off ramps); and
- Construction of toll plaza;

#### **1.7.2.1 Construction of Temporary Construction Facilities/Structures**

The following facilities will be provided by the Contractor. These will be at the proximity of the construction site.

- Field office where staff meeting are held and overall construction activities are planned;
- Stockyard where other construction materials are kept;
- Equipment yard where idle equipment are parked;
- Construction barracks and workers' quarters where workers rest and spend their idle time;

- Dumping sites where excavated materials and other debris are temporarily dumped before final disposal;
- Space where construction materials such as cutting and bending of reinforcing bars, etc. are done;
- Communication base for proper coordination; and
- Service vehicles for engineers

#### 1.7.2.2 Relocation of Affected Basic Social Service Utilities

Simultaneous to initial construction works, public utility lines identified during the Pre-Construction Stage will be relocated to suitable location. Normally, the concerned local utility (water supply, power and telephone) companies are contracted to do the work. Early and close coordination with the concerned utility companies will be undertaken to ensure that disruption of communication lines, and power and water supplies will be limited to the shortest possible time.

The Contractor will be tasked to do the drainage. Relocation and/or improvements shall be closely coordinated with concerned utility agencies and local government units.

#### 1.7.3 Demobilization/Decommissioning Phase

Demobilization/Decommissioning Phase described herein entails the activities that will be undertaken immediately after completion of the CALA Expressway Project. The Contractor/Sub-Contractors must ensure that the following decommissioning/demobilization activities are complied with:

- All temporary construction facilities/structures such bunkhouses, field offices, and portable sanitary facilities are properly dismantled;
- All solid and domestic wastes generated from the temporary sanitation facilities are completely and properly disposed to designated disposal site/s duly approved by the concerned LGUs;
- All disconnected/disrupted basic social service facilities such as water and power supplies, and communication lines are fully restored to their normal functions;

- Affected public structures are reconstructed/restored; and
- All temporary stockpiles construction spoils/debris are properly disposed to the approved disposal sites

#### **1.7.4 Operational Phase**

The proposed CALA Expressway shall be opened to traffic after **2 years** of construction period. Operation and maintenance is expected to commence on the second half of Year **2017**. During this period, the Operator shall perform various maintenance works along the expressway to ensure optimal service to motorists using the highway which include the following activities:

- Periodic inspection and maintenance of the expressway's structural integrity;
- Periodic inspection and maintenance of drainage facilities installed;
- Periodic inspection of pavement and pavement markings;
- Periodic inspection and maintenance of traffic signs and related facilities;
- Periodic inspection and maintenance of tubular steel railings; and
- Periodic inspection and maintenance of the toll plaza and all ancillary facilities

### **1.8 MANPOWER REQUIREMENT**

Listed on **Table 1.8-1** is the manpower requirement for the proposed CALA Expressway (Laguna Section) Project. Also presented in the **Table** is the estimated number of personnel by gender needed for each item

**Table 1.8-1 ESTIMATED MANPOWER REQUIREMENTS FOR THE PROPOSED CALA EXPRESSWAY (LAGUNA SECTION) PROJECT**

| Manpower Requirement                           | Expertise/Skills Needed                                  | Estimated No. of Personnel Required |       | Preferred Scheme for Sourcing                                                                                                                     |
|------------------------------------------------|----------------------------------------------------------|-------------------------------------|-------|---------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                |                                                          | Men                                 | Women |                                                                                                                                                   |
| Construction Supervision Consultants' Staff    |                                                          |                                     |       |                                                                                                                                                   |
| 60                                             | Technical Staff                                          | 36                                  | 24    | From outside; from the host LGUs (qualified and duly endorsed by the Mayors); from the DIA (qualified and duly endorsed by the Brgy. Captain)     |
| 10                                             | Administrative Staff                                     | 2                                   | 8     | From outside; from the host LGUs (qualified and duly endorsed by the Mayors); from the DIA (qualified and duly endorsed by the Brgy. Captain)     |
| Contractors' Engineering and Supervision Staff |                                                          |                                     |       |                                                                                                                                                   |
| 70                                             | Technical Staff                                          | 42                                  | 28    | From outside; from the host LGUs (qualified and duly endorsed by the City Mayor); from the DIA (qualified and duly endorsed by the Brgy. Captain) |
| 20                                             | Administrative Staff                                     | 4                                   | 16    | From outside; from the host LGUs (qualified and duly endorsed by the Mayors); from the DIA (qualified and duly endorsed by the Brgy. Captain)     |
| Construction Personnel                         |                                                          |                                     |       |                                                                                                                                                   |
| 160                                            | Heavy equipment operators                                | 160                                 | N.A.  | From outside; from the host LGUs (qualified and duly endorsed by the Mayors); from the DIA (qualified and duly endorsed by the Brgy. Captain)     |
| 30                                             | Construction foremen                                     | 30                                  | N.A.  | From outside; from the host LGUs (qualified and duly endorsed by the Mayors); from the DIA (qualified and duly endorsed by the Brgy. Captain)     |
| 50                                             | Carpenters                                               | 50                                  | N.A.  | From outside; from the host LGUs (qualified and duly endorsed by the Mayors); from the DIA (qualified and duly endorsed by the Brgy. Captain)     |
| 1,000–1,500                                    | Unskilled workers (bar benders, steel men, masons, etc.) | 1,000–1,500                         | N.A.  | From outside; from the host LGUs (qualified and duly endorsed by the Mayors); from the DIA (qualified and duly endorsed by the Brgy. Captain)     |

## 1.9 INDICATIVE PROJECT INVESTMENT COST

Summarized in **Table 1.9-1** is the estimated project cost for the proposed CALA Expressway Project.

**Table 1.9-1 Estimated Project Cost for the CALA Expressway**

| Item         | Cost<br>(Million Pesos) |
|--------------|-------------------------|
| ROW          | 3,200                   |
| Civil Works  | 13,400                  |
| <b>TOTAL</b> | <b>16,600</b>           |

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## Chapter 2

# Analysis of Key Environmental Impacts

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## 2 ANALYSIS OF KEY ENVIRONMENTAL ASPECTS

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### 2.1 THE LAND

#### 2.1.1 Land Use and Classification

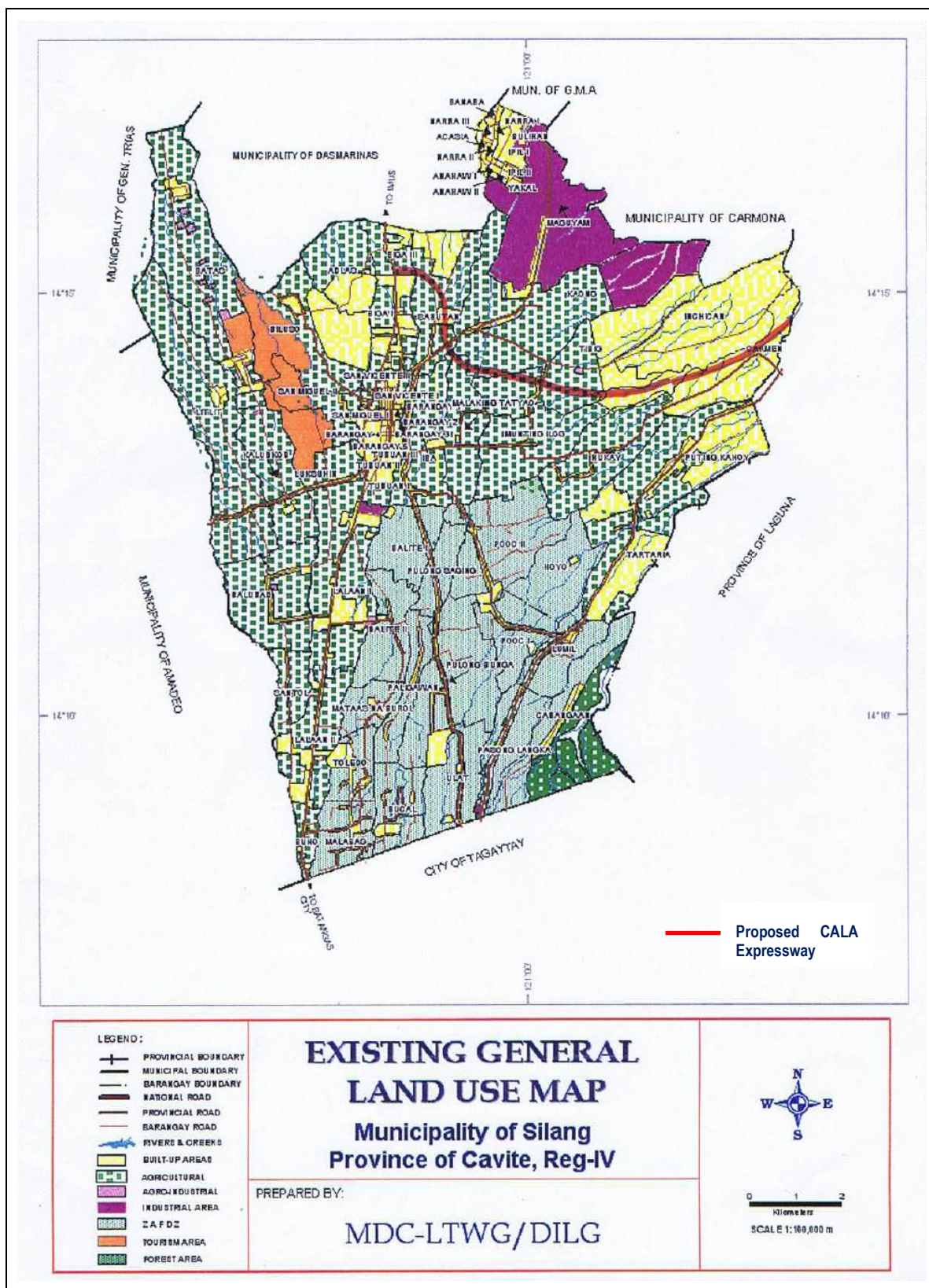
##### 2.1.1.1 Silang, Cavite

The Land Use Classification Map of Silang, Cavite presented in **Figure 2.1.1-1**, shows that there are **11** land use classifications identified in the Municipality of Silang, Cavite. Most recent data (Year 2009) from the Provincial Agriculturist Office (PAO) indicated that about **60.3%** or **9,431.83 ha** of Silang's total land area of **15,641 ha** are primarily intended for agricultural purposes. Being the major crops of the town, pineapple and coffee are predominantly planted to approximately **7,014.66 ha** or **74.37%** of the municipality's agricultural lands.

The remaining **6,209.17 ha (25.63%)** in Silang's land area is almost evenly distributed to other purposes such as residential, industrial, built-up, institutional, agro-industrial, commercial, tourism area, cemetery, open grassland with scattered trees, and dump site.

In Silang, the proposed CALA Expressway alignment will generally traverse **agricultural areas**. However, actual survey conducted revealed that most of these areas are unproductive agricultural lands which appear to have transformed into **open grassland land** (see **Plate No. 1**) due to unavailability of irrigation system. Patches of marginal pineapple plantations and corn fields are observed in Brgy. Sabutan and Tibig (see **Plate Nos. 3 and 4**). Farther down southeast, the alignment will traverse through some coffee, banana, and coconut plantations in Brgy. Tibig.

The alignment will also cut across some residential properties of **Stateland** in Brgy. Sabutan, and **Extra Ordinary** in Brgy. Carmen. On the southeast, it will also pass along prime residential areas such as the **Ayala West Grove Heights** and **South Forbes** in Brgy. Inchican.



Source: Municipality of Silang, Planning Division

**Figure 2.1.1-1 Land Use Classification Map of Silang, Cavite**



**Plate No. 1** Vast unproductive and non-irrigated agricultural land to be traversed by the CALA Expressway alignment (red line) between **Km 3+900–4+300** in Brgy. Tibig, which has evidently transformed into open grassland.



**Plate No. 2** Patches of corn fields (encircled) in the middle of grassland areas observed in Brgy. Sabutan, Silang, Cavite between **Km 1+000–2+000**.



**Plate No. 3** Marginal pineapple plantation on the southeast side of Sabutan Road, in Brgy. Sabutan, Silang, Cavite (Km 1+000–2+000).



**Plate No. 4** Photo of the orchard planted to coffee, banana, and coconut owned by the **Mercados** between **Km 4+200–4+800** in Brgy. Tibig, Silang, Cavite. The proposed CALA Expressway alignment will pass through the middle of the plantation, effectively splitting the property into **two (2)**.

#### 2.1.1.2 Santa Rosa, Laguna

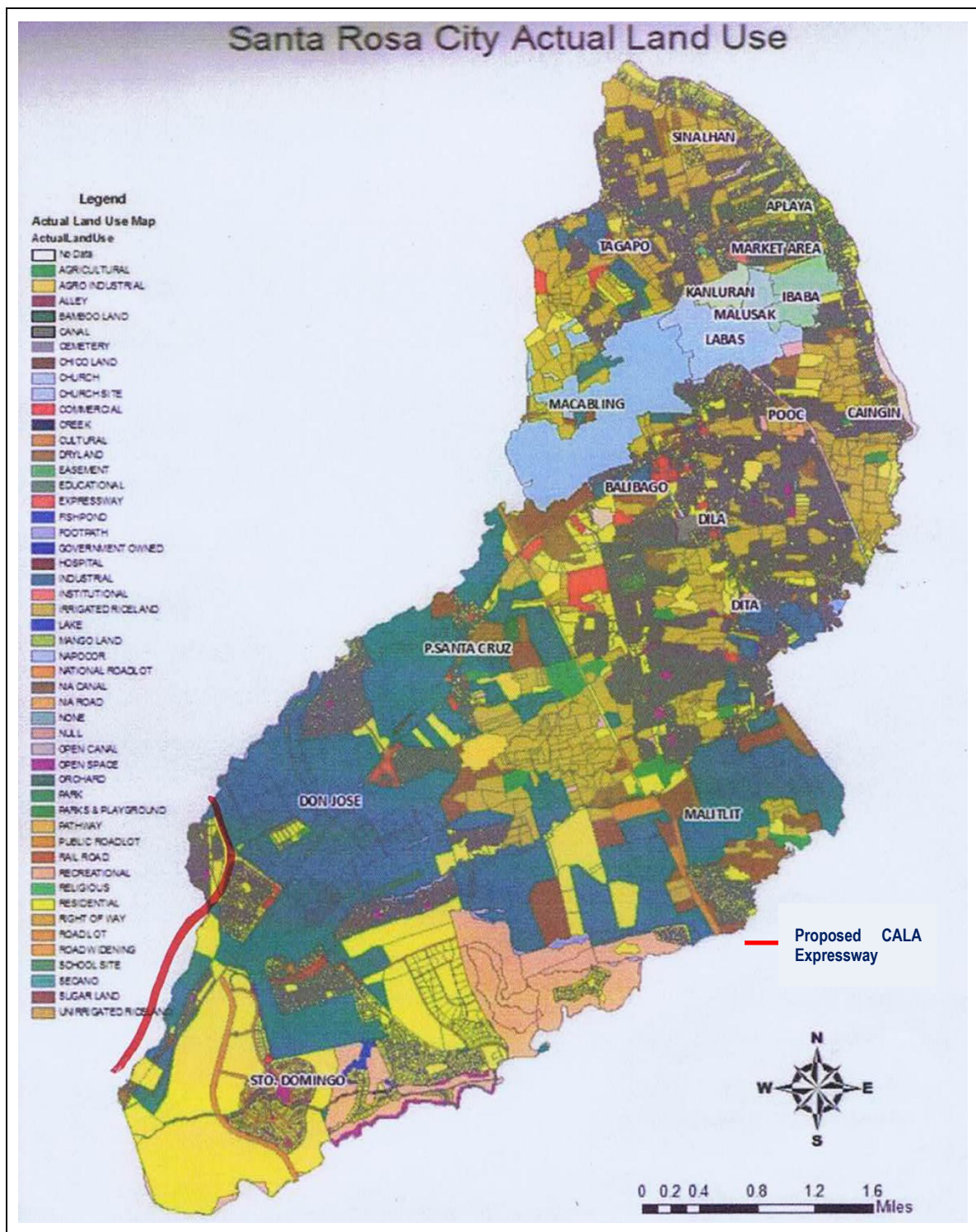
Santa Rosa City's total land area of approximately **54.13 km<sup>2</sup> (5,413 ha)** is divided into **11** land use classifications that includes residential, agricultural, industrial, built-up, agro-industrial, commercial, tourism area, institutional, cemetery, mud/sand, and open grasslands. Among these classifications, large portions of the City's land area are almost equally subdivided to residential, industrial, and agricultural purposes.

The extensive industrial estates of the Santa Rosa City as shown in the Land Use Classification and Vegetation Map presented in **Figure 2.1.1-2** are virtually concentrated on the western sector of the City. It accommodates the Laguna Techno Park, the largest bottling plant of Coca Cola Company in the Philippines, the assembly plant of Isuzu Philippines Corporation, Toyota Motors Corporation Philippines manufacturing plant, Nissan Motors Philippines, and other recognized industries such as Common Image Generator Interface (CIGI) and Filsyn. Food giant Monde Nissin Corporation's **14-hectare** manufacturing plant (Lucky Me noodles and Monde biscuits) is also located in the City's industrial zone. The western sector of Santa Rosa is likewise characterized by the presence of prime residential subdivisions, Paseo Mall, hotel establishments, as well as the eco zone areas of Nuvali.

Open grasslands with scattered trees likewise occupy a significant fraction of the City's land area. In the future, these areas are expected to be developed into first-class residential zones and prime commercial centers, particularly those along the Sta. Rosa-Tagaytay Road.

The tourism area on the southernmost part of Sta. Rosa City hosts the Sta. Elena Golf & Country Estate that includes one of the premier golf courses in the country, the Sta. Elena Golf and Country Club. The City is also home to Enchanted Kingdom, a world-class theme park located at RSBS Blvd., in San Lorenzo South, Balibago that opened on July 28, 1995.

From Brgy. Carmen, Silang Cavite, the alignment will enter Sta. Rosa City through Brgy. Don Jose. The alignment will connect to the existing Nuvali Spine Road and will pass by the residential developments of **Sta. Rosa Village** on the northeast and the Sta. Rosa Estates on the southeast. To the east of the proposed alignment is the Laguna Techno Park, Sta. Rosa City side.



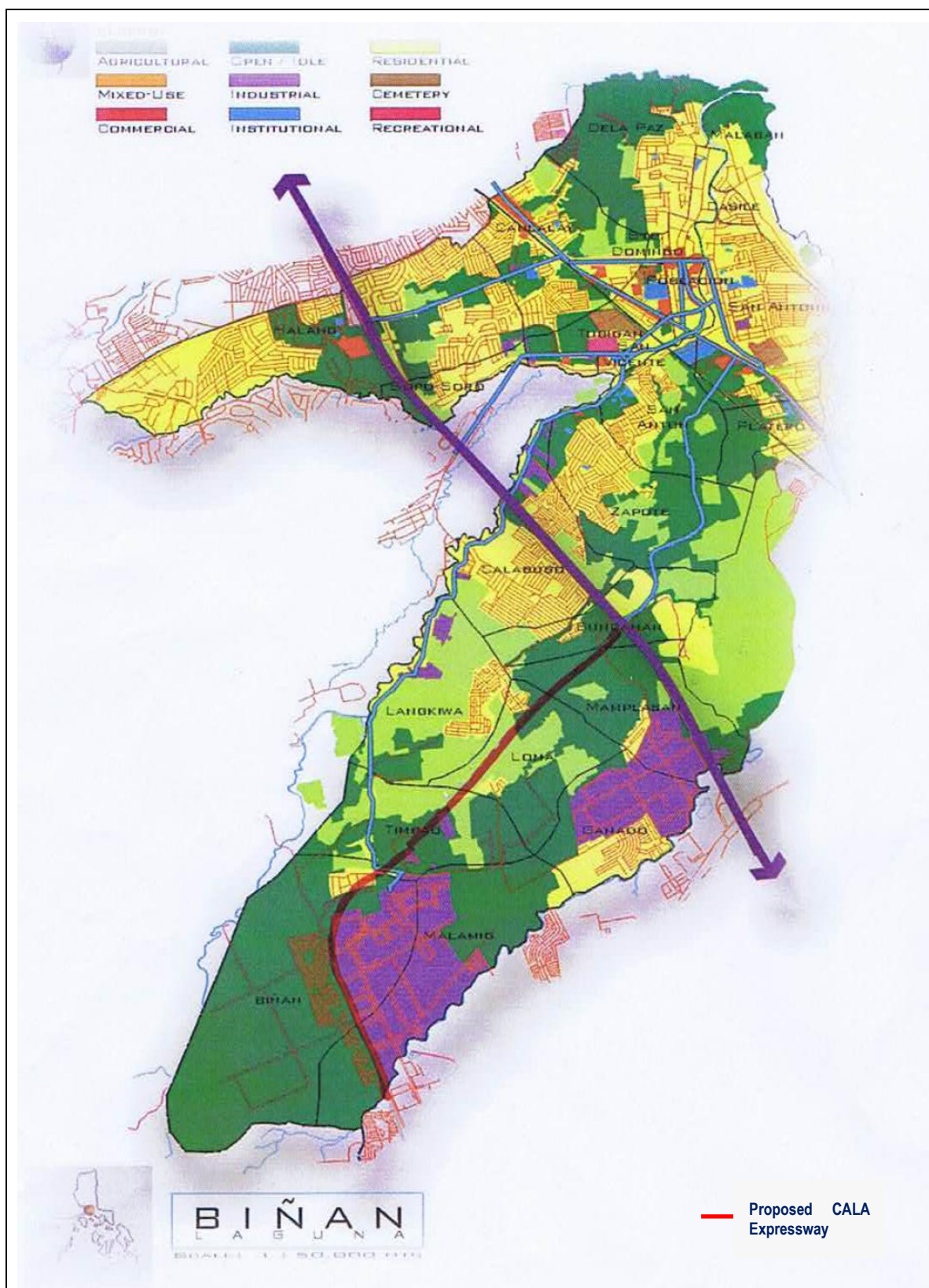
Source: Sta. Rosa City, Planning Division

**Figure 2.1.1-2 Land Use Classification and Vegetation Map of Sta. Rosa City, Laguna**

### 2.1.1.3 Biñan City, Laguna

Biñan City has a total land area of **4,350 ha**, which represents **2.5%** of the entire Laguna area. Of the 11 land use classifications illustrated in **Figure 2.1.1-3**, a large portion of the City's land area is dedicated for residential purposes. Open grasslands with scattered trees also represent a substantial space in the City. The built-up, agricultural, and industrial uses nearly secure equal shares of Biñan's land areas. The remaining portions of the City are subdivided to other utilizations such as agro-industrial, commercial, institutional, cemetery, mud/sand, and tourism area.

The alignment from the Nuvali Spine Road in Brgy. Don Jose, Santa Rosa City, will then follow the existing Laguna Boulevard in Brgy. Biñan, Biñan City, passing by the Laguna Techno Park on the east, and **Sta. Rosa Village** and **San Jose Village** on the west. As the alignment continues to follow the existing road towards northeast, it will pass by **Southville** in Brgy. Malamig before cutting across the **Tamayo Property** in Brgy. Timbao. It will then follow the existing Nuvali passing by the **Verdana Homes** on the northwest and **Celina Homes** on the east. Towards its terminus, the alignment immediately after Celina Homes will pass along the **Greenfields Property** at **Km 16+150**. The proposed CALA Expressway will eventually cut across the **Greenfields Property** approximately at **Km 16+950** and will continue to traverse the said property until it reaches its end section at **Km 18+010** in Brgy. Mamplasan.



Source: Biñan City, Planning Division

**Figure 2.1.1-3 Land Use Classification and Vegetation Map of Biñan City, Laguna**



**Plate No. 5** Photo taken along the Greenfield Parkway-Mamplasan Overpass Road inside the Greenfields property between **Km 17+000–18+000**. Both sides of the road are open grassland areas with patches of trees.



**Plate No. 6** Photo taken along the Nuvali Road. The properties on both sides of the road are owned by the Greenfields.



**Plate No. 7** Photo taken along the existing Nuvali Road, Brgy. Malamig, Biñan City, Laguna section. On the southeast side of the road is the Laguna Techno Park.

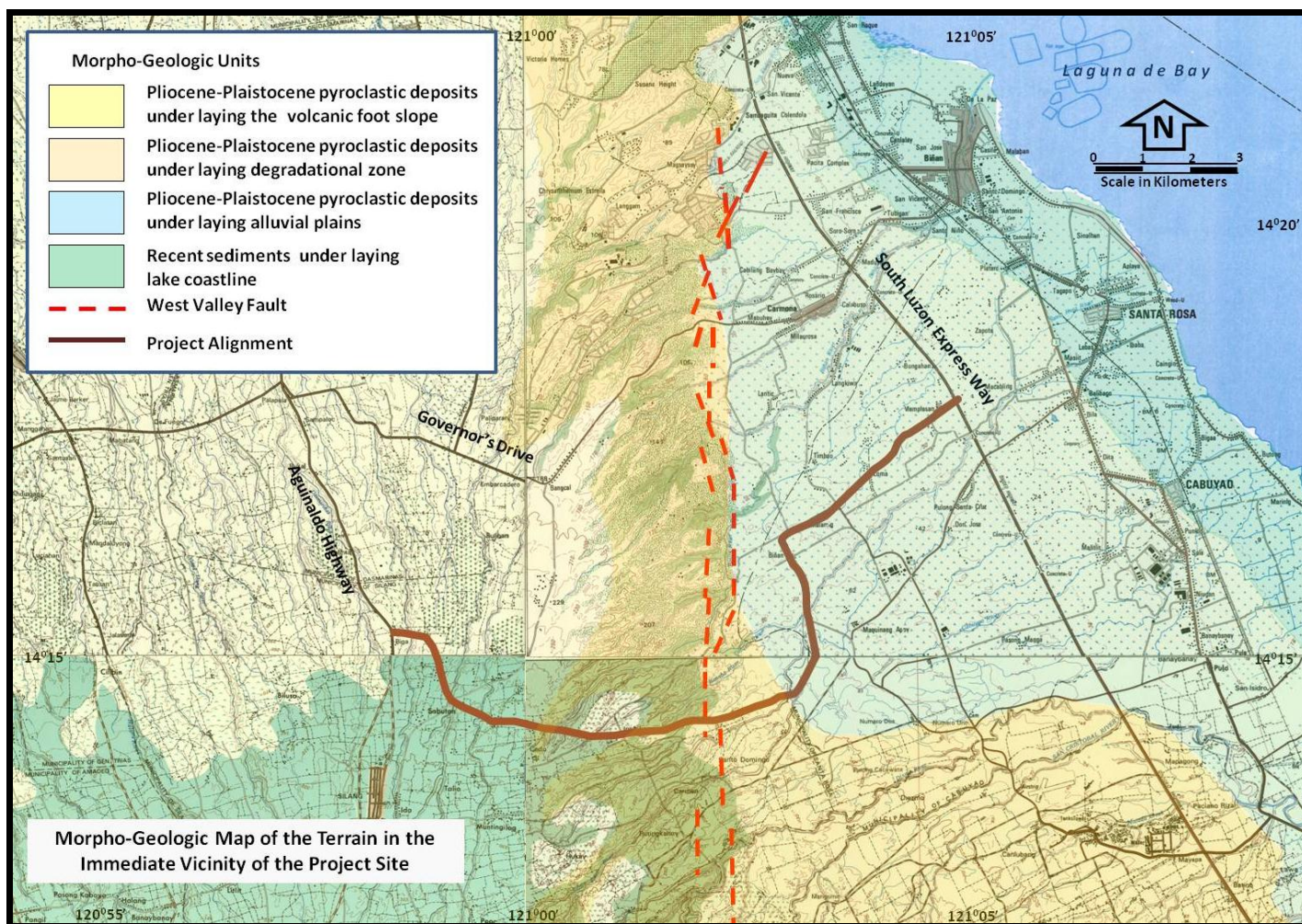


**Plate No. 8** Photo taken at the northwest side of the roundabout in Brgy. Mamplasan, Biñan City.

## 2.1.2 General Geomorphology and Geology

The general morphology of the project area can be described as generally flat on the eastern portions (Cities of Sta. Rosa and Biñan), gradually shifts to rolling terrain as it approaches the western side, until it attains an average slope of **18%** as it reaches Silang, Cavite on the west side of the alignment. As briefly explained in **Table 2.1.2-1**, there are **four (4)** distinct geomorphic units, namely from the east: (i) *Lake Coastline*, (ii) *Alluvial Plain*, (iii) *Degradation Zone*, and (iv) *Volcanic Foot Slope*. The corresponding morpho-geologic units are described and graphically shown in **Figure 2.1.2-1**.

| <b>Table 2.1.2-1 Summary of Morpho-Geologic Units Along the proposed Cavite-Laguna Expressway (Laguna Section) Project Alignment</b> |                                                                                                                          |                                                                                                                                                                                                     |                                                                                             |
|--------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| <b>Geomorphic Units</b>                                                                                                              | <b>Geologic Age/Lithology</b>                                                                                            | <b>Terrain Feature</b>                                                                                                                                                                              | <b>Slope</b>                                                                                |
| Volcanic Foot Slope                                                                                                                  | Plio-Pleistocene volcanic ash/tuff deposited as pyroclastic flow at the flank of Taal Volcano prior to caldera formation | Generally circular in shape and gently sloping from the crest at the area of Tagaytay towards the low land along the coastline of Manila Bay and Laguna de Bay                                      | 3-8% near the toe (Silang to the low lands;<br>8-18% in Tagaytay to Silang, Cavite          |
| Degradation Zone                                                                                                                     |                                                                                                                          | Marks the transition between the volcanic foot slope and the alluvial plains. Characterize by deeply incised near parallel gullies with near vertical walls and escarpment of the West Valley Fault | 30-50% at gully walls and escarpment;<br>3-8% on slope sections in between parallel gullies |
| Alluvial Plain                                                                                                                       | Plio-Pleistocene volcanic ash/tuff deposit inter-tonguing with the alluvial sediments form by erosion of gullies         | Generally flat terrain that extends from the volcanic foot slope and gently slopes eastward towards Laguna de Bay.                                                                                  | 3-8%                                                                                        |
| Lake Coastline                                                                                                                       | Recent unconsolidated sediments                                                                                          | Generally flat terrain that runs parallel to the coastline of Laguna de Bay.                                                                                                                        | 0-3%                                                                                        |



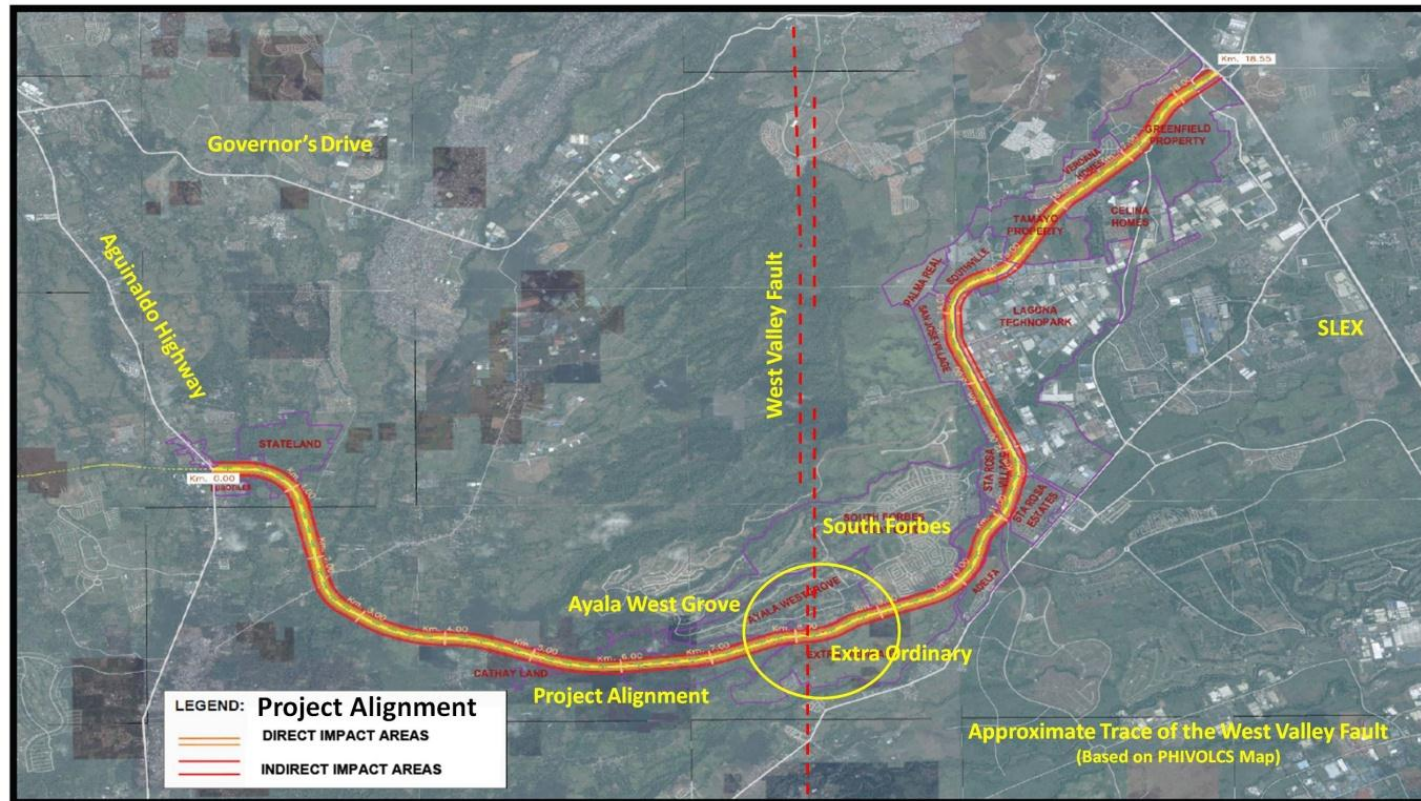
(Modified from PHIVOLCS Map)

**Figure 2.1.2-1 Summary of the Morpho-Geologic Units along the Project Route Corridor**

### The West Valley Fault System

Based on the Impact Area Map (**Figure 2.1.2-2**) showing the plot of the West Valley Fault (WVF), the proposed Cavite-Laguna Expressway alignment intersects the WVF in the vicinity of Ayala West Grove/South Forbes, approximately between **Km 8+000–8+500** in Brgy. Carmen, Silang, Cavite. This road section cuts on a very gentle slope along the west flank of the Tagaytay Volcanic Slope.

Deeply incised gullies with near vertical walls runs easterly on the northern margin of the Ayala West Grove and South Forbes and at the southern margin of the Extra Ordinary.



**Figure 2.1.2-2 Approximate Trace of the West Valle Fault along the Proposed CALAX Alignment**

**Note:** This is an approximate trace on the West Valley Fault relative to the Project Alignment based on available map from PHIVOLCS. Said maps were based on aerial photo interpretation with limited ground checking such as trenching. Since the trace on the fault is not a single line but actually a zone with varying width on the ground, the actual point of intersection of the fault trace and the road alignment can only be determine if actual ground trenching is conducted preceded by aerial photo interpretation and ground resistivity survey.

At the point of intersection, the road runs along the **4-lane** well paved, Tagaytay-Sta. Rosa Road, constructed in the late 1990's with a very gentle gradient and design speed of approximately **80 kph**. No slope cut exists in the road section thus, no rock fall, land slide and other adverse effect due to slope instability can be expected.

In the event of fault movement, fault rupture is possible resulting to displacement. For Marikina Fault, displacement varies, depending on the site. In the area of Tunasan, Muntinlupa City, displacement of about **1 meter** lateral and **0.5 meters** vertical as shown in the attached photos.



**Plate No. 9** Vertical displacement reflected on road pavement in Tunasan, Muntinlupa City.



**Plate No. 10** Dislocated wall section due to lateral movement of fault in Tunasan, Muntinlupa City.

Based on the study by MMDA-JICA-PHIVOLCS the West Valley Fault can possibly generate a magnitude **7.2 earthquake**. By deterministic approach using the Fukushima Tanaka Equation, the estimated Peak Ground Acceleration (PGA) ratio to be experienced by the structures of the project road such as but not limited to the bridges and interchanges, at a given distance are summarized in the following Tables.

| Table 2.1.2-2 Estimates of Peak Ground Acceleration (g) in Average Ground Condition at the Site Due to Earthquakes from West Valley Fault |                       |      |       |      |
|-------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|------|-------|------|
| Distance Between Epicenter and Project Site (Km)                                                                                          | Earthquake Magnitudes |      |       |      |
|                                                                                                                                           | 6.8                   | 7.2  | 7.4   | 7.7  |
| 0.0                                                                                                                                       | 0.64                  | 0.65 | 0.65  | 0.66 |
| 5.0                                                                                                                                       | 0.51                  | 0.55 | 0.56  | 0.58 |
| 10                                                                                                                                        | 0.40                  | 0.46 | 0.48  | 0.51 |
| 15                                                                                                                                        | 0.33                  | 0.39 | 0.41  | 0.45 |
| 20                                                                                                                                        | 0.27                  | 0.33 | 0.369 | 0.40 |

| Table 2.1.2-3 Estimates of Peak Ground Acceleration (g) in Average Rock Condition at the Site Due to Earthquakes from West Valley Fault |                       |       |       |       |
|-----------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-------|-------|-------|
| Distance Between Epicenter and Project Site (Km)                                                                                        | Earthquake Magnitudes |       |       |       |
|                                                                                                                                         | 6.8                   | 7.2   | 7.4   | 7.7   |
| 0.0                                                                                                                                     | 0.38g                 | 0.39g | 0.39g | 0.39g |
| 5.0                                                                                                                                     | 0.31g                 | 0.33g | 0.34g | 0.35g |
| 10                                                                                                                                      | 0.24g                 | 0.27g | 0.29g | 0.31g |
| 15                                                                                                                                      | 0.20g                 | 0.23g | 0.25g | 0.27g |
| 20                                                                                                                                      | 0.16g                 | 0.20g | 0.21g | 0.24g |

The PGA estimate used the possible earthquake magnitude of **6.8**, **7.2**, and **7.4** for a given fault length of **30 km**, **67 km**, and **96 km**, respectively, as estimated by *Bautista et al (2000)*. In addition, the possible maximum earthquake magnitude of M7.7 based on horizontal and vertical displacement measurements along the fault line done by *R.E. Rimando and P.L.K. Knuepfer* (Feb. 2004) were also used. The estimated magnitudes and fault length of *Bautista* and *Rimando* is summarized as follows:

| Assumed Fault Length            | Possible Magnitude |
|---------------------------------|--------------------|
| Length = 30 km                  | 6.8                |
| Length = 67 km                  | 7.2                |
| Length = 96 km                  | 7.4                |
| (Based on Rimando et al (2004)) | 7.7                |

The computation shows that the ground acceleration level decreases as the distance of the project site from the possible hypocenter increases.

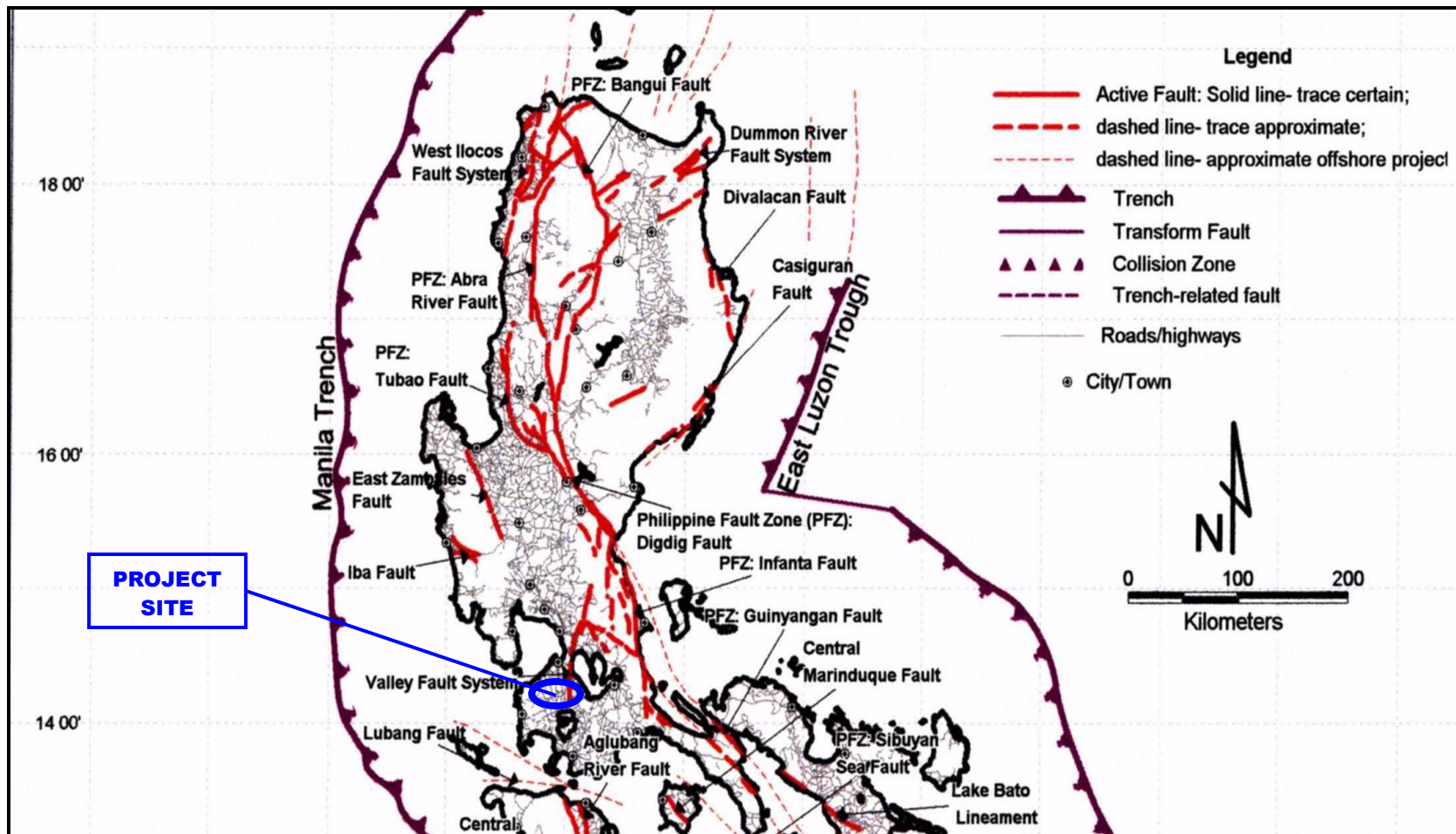
#### 2.1.2.1 Geological Hazard Assessment

##### Earthquakes

Earthquakes in the region around the project site are influenced by the tectonic features described in **Figure 2.1.2-3**. Most of the earthquakes plotted in the map belong to **four(4)** clusters, one along the eastern shores of Luzon, around Polilio

Island, one on the eastern coast of Samar; another cluster exists on the western coast of Luzon around Mount Pinatubo and the south of Taal Volcano, along the northern shore of Mindoro. Seismicity in these four clusters is influenced mostly by the subduction processes in these sites, as modified by the local volcanic and tectonic structures. The other earthquakes plotted in the map that are not related to the four clusters are generated by the major faults that cut the Philippine archipelago.

Seismicity along the East Luzon Trench is characterized by a sequence of high magnitude earthquakes (larger than 5.5) and their time sequence and spatial distribution link them to the apparent stress partitioning from the Philippine Trench to the faults in northern Luzon. The earthquakes in this area are interpreted to be caused mainly by the convergence between the Benham Plateau and Luzon.



**Figure 2.1.2-3 Distributions of Active Fault and Trenches in Luzon**

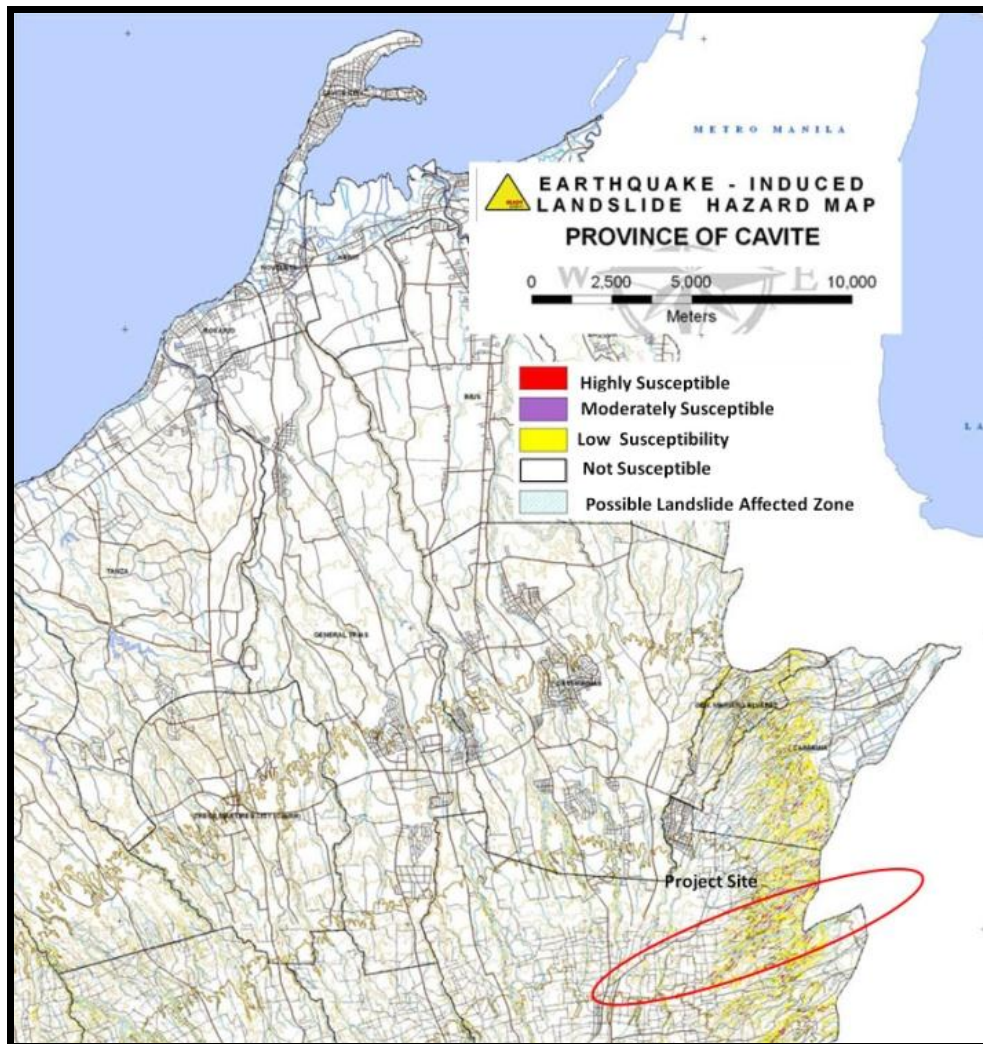
(Modified from EPRMP for the Proposed LRT Line 2 East & West Extension Project 2011, ECOSYSCORP, Inc.)

### Liquefaction Vulnerability

**Liquefaction is not considered as hazard along the project alignment** since the under laying bedrock are compacted and well consolidated volcanic ejectas. Loose, water saturated sediments susceptible to liquefaction are confined along the coastline of Laguna de Bay and Manila Bay, a far distance from the alignment.

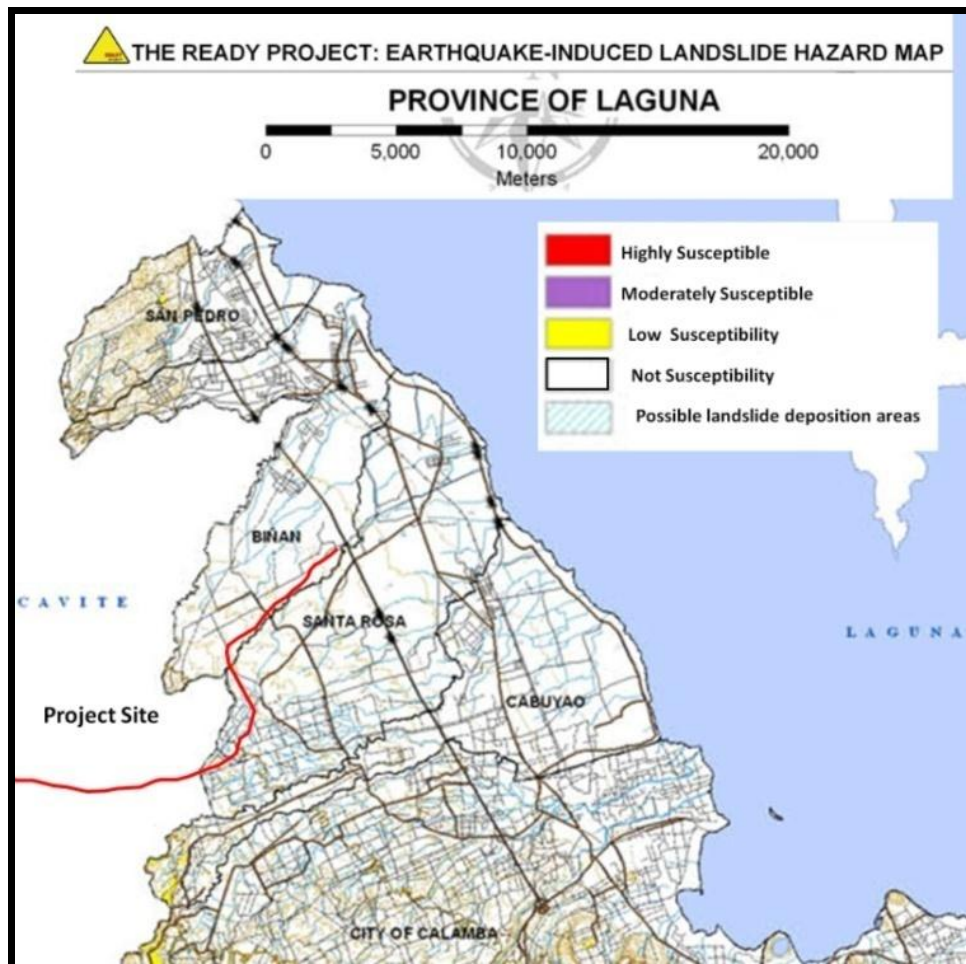
### Earthquake-Induced Landslides

As can be discerned from the earthquake-induced landslides hazard maps of Cavite and Laguna Provinces provided as **Figures 2.1.2-4** and **2.1.2-5**, respectively, the proposed CALA Expressway alignment is not susceptible to such hazard. Landslides due to earthquake if ever it will occur will be confined on gully walls and possibly at the escarpment at the eastern margin of the volcanic slope. The alignment will not pass along escarpments. Gullies if crossed will be through bridges with engineered abutments founded into the gully floor or imbedded into the gully walls.



(Map modified from the Ready Project of the MGB, PHIVOLCS, NAMRIA, and others 2009)

**Figure 2.1.2-4 Earthquake-Induced Landslide Hazard Map of Cavite Province**



(Map modified from the Ready Project of the MGB, PHIVOLCS, NAMRIA, and others 2009)

**Figure 2.1.2-5 Earthquake-Induced Landslide Hazard Map of Laguna Province**

### Rain-Induced Landslides

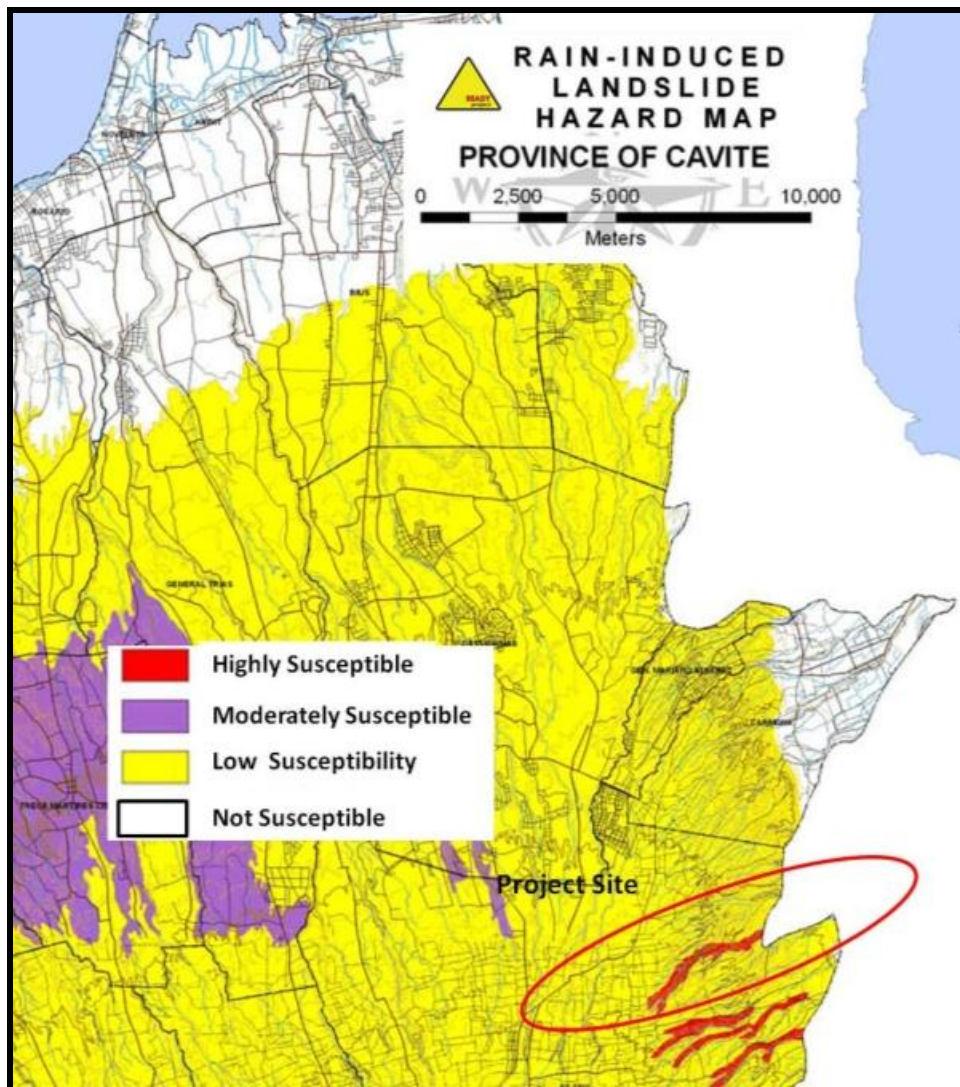
Map prepared under the *Ready Project* shows the road section in Cavite will be on an area with low susceptibility to rain induced landslide while the section in Laguna runs on a terrain not susceptible to rain induced landslide.

The project will have a low risk to rain induced land slide due to the following:

- The alignment will run through a gently sloping terrain;
- Suitable angle of repose will maintained along cut sections;
- Rain-induced landslide if ever it will occur will be confined on unstable section of walls of gullies; and

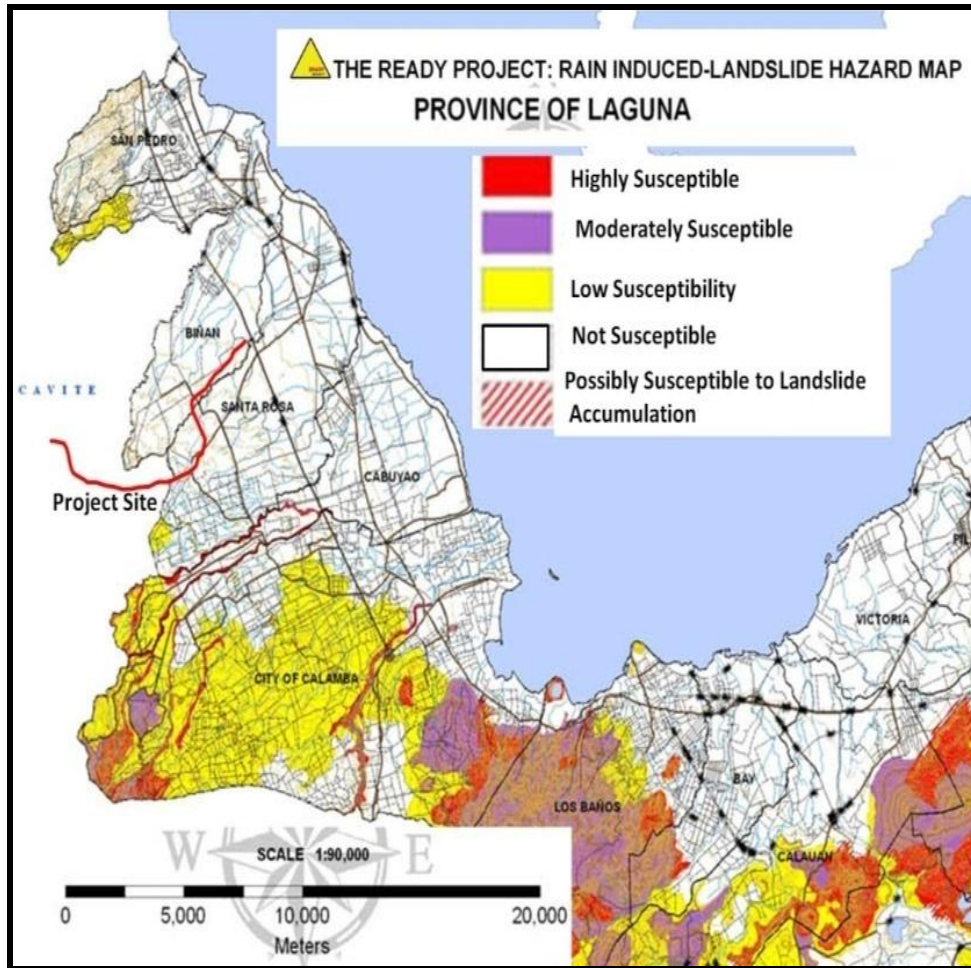
- Bridge crossing will have properly designed abutments founded into the gully floor or imbedded into the gully walls

Figures 2.1.2-6 and 2.1.2-7 present the rain-induced hazard maps for the Provinces of Cavite and Laguna, respectively.



(Map modified from the Ready Project of the MGB, PHIVOLCS, NAMRIA and others 2009)

**Figure 2.1.2-6 Rain-Induced Landslide Hazard Map of Cavite Province**



(Map modified from the Ready Project of the MGB, PHIVOLCS, NAMRIA and others 2009)

**Figure 2.1.2-7 Rain-Induced Landslide Hazard Map of Laguna Province**

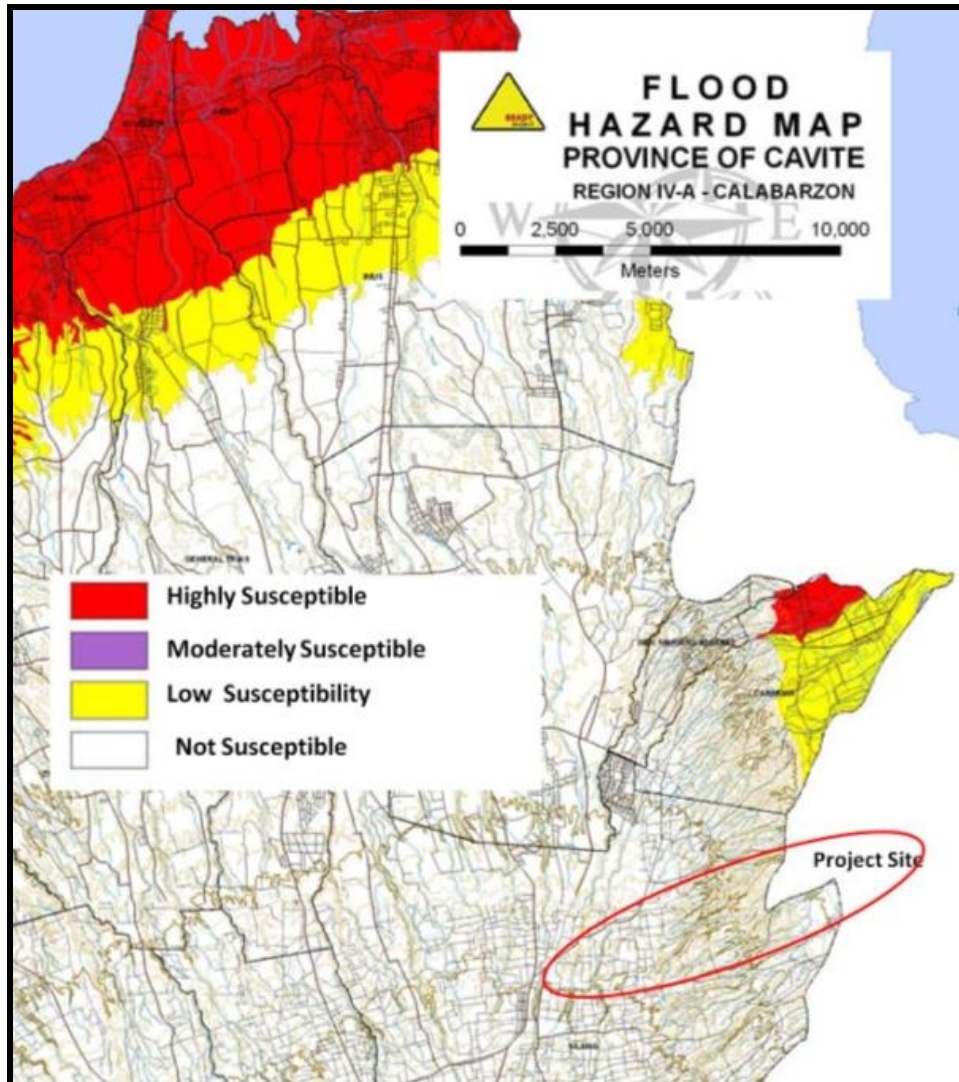
## Flooding

The road alignment has a low susceptibility to flooding due to the following terrain considerations:

1. Elevation is relatively high about **140 meters** at the Aguinaldo Highway to about **20 meters** above sea level in SLEX. This elevation allows storm water to immediately flow towards Laguna de Bay in Laguna and Manila Bay in Cavite;
2. The alignment crosses a number of deep gullies which acts as a discharge points for engineered drainage lines. These gullies are relatively deep and flow towards the receiving bodies of water (e.g. Laguna de Bay etc.);

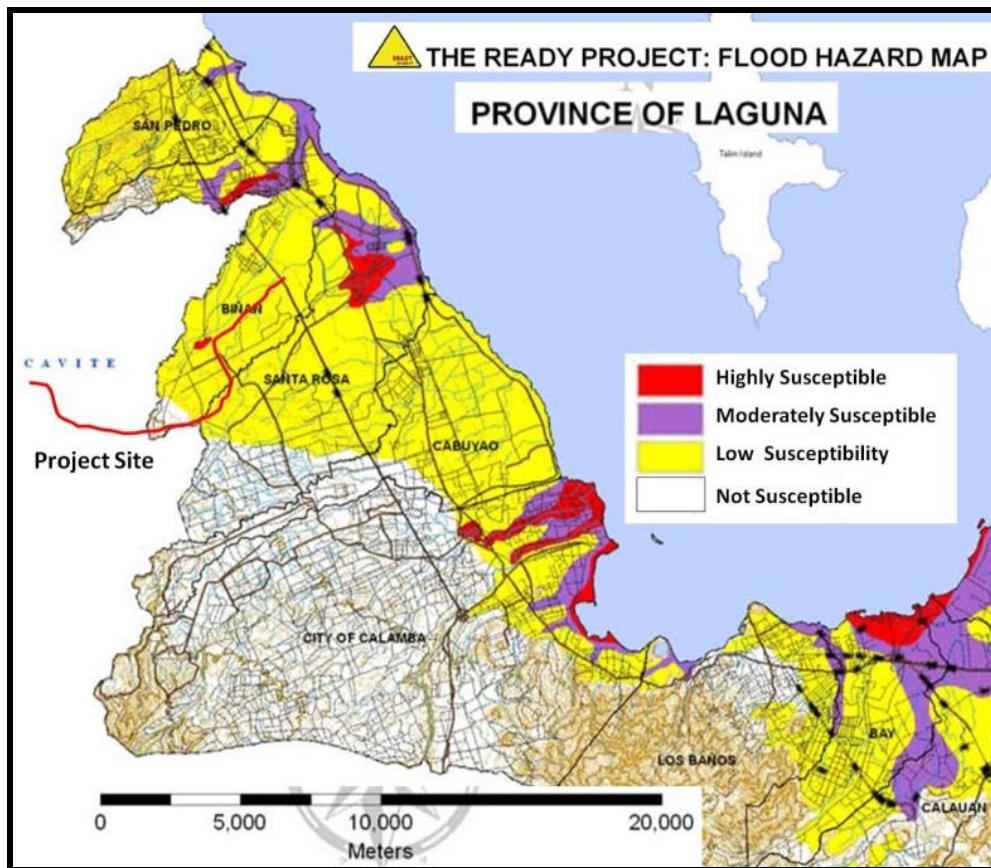
3. Both sides of the proposed road alignment are developed subdivisions with engineered drainage systems;
4. The developed sections of the alignment already have engineered drainage lines. Flooding at the site can be avoided through:
  - Biñan, Carmona, Sta. Rosa, and the adjacent cities and municipalities need to have an integrated drainage system
  - Dumping of garbage on natural water ways must be avoided
  - Natural water ways must be kept free of informal settlers
  - Engineered drainage lines both on private and public properties/development have to be regularly cleaned and properly maintained
  - Flood alleviation is a community effort and solutions cannot be through recommendations best by application
5. Topographic map and cross section of the road project to indicate the areas of localized flooding cannot be used since these maps are confined within the road alignment. Further, the adjacent areas of the proposed road alignment had already been developed into subdivisions and industrial parks which are private properties with their own drainage system; and
6. Flash flood cannot be mitigated since the flood water will be coming from the surrounding catchment area where the project has no control or influence. What can be mitigated is the duration of inundation due to flash flood by providing sufficient and adequate drainage system both (e.g. cross drain and storm drain) to hasten for flood water to subside.

The flood hazard maps for the Provinces of Cavite and Laguna are given as **Figures 2.1.2-8** and **2.1.2-8**, respectively.



(Map modified from the Ready Project of the MGB, PHIVOLCS, NAMRIA and others 2009)

**Figure 2.1.2-8 Flood Hazard Map of Cavite Province**



(Map modified from the Ready Project of the MGB, PHIVOLCS, NAMRIA and others 2009)

**Figure 2.1.2-9 Flood Hazard Map of Laguna Province**

### Volcanic Activity (Taal Volcano)

Given the approximate distance of the project site from Taal Volcano as indicated in **Figure 2.1.2-10**, ash fall is the most likely volcano related hazard that might affect the project site. The level on impact however may be low and dictated by the following:

- Type of eruption;
- The volume of extruded volcanic materials (a function of the type of eruption);
- Height of eruption/ash cloud; and
- Direction of the prevailing wind during the eruption period (more likely if the prevailing wind is the southwest monsoon)

Volcanic ash is pulverized rock to silt and sand size particles by the volcanic activity. This are ejected material which initially form an eruption column that rise several miles above a volcano. Height of eruption column depends on the type of eruption. The column eventually spread to form a cloud high into the atmosphere. It eventually spread with the plume direction influenced by the prevailing wind direction.

Hazards related to volcanic activity and the possible effects to the project site are summarized in **Table 2.1.2-4**.

**Table 2.1.2-4 Hazards Related to Volcanic Activity and Possible Effect to the Project Site**

| HAZARD                            | DEGREE                                                                       | IMPACT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | MITIGATION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-----------------------------------|------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ash Fall                          | Influenced by the nature of eruption and prevailing meteorological condition | <ul style="list-style-type: none"> <li>• Ash can clog drainage;</li> <li>• Fine ash is extremely slippery, hampering driving and walking;</li> <li>• Volcanic ash is gritty, abrasive and corrosive and can trouble infants, the elderly and those with respiratory ailments. Ash particles can abrade the front of the eye under windy conditions. For these reasons, minimal exposure of ash sensitive individuals is advised;</li> <li>• Ash can abrade and damage machinery and sensitive electronic/electrical equipment; and</li> <li>• Long-term exposure to wet ash can corrode metal</li> </ul> | <ul style="list-style-type: none"> <li>• Volcanic ash accumulation along the project roadway should be cleared immediately;</li> <li>• Vulnerable people must wear face mask or cover their nose &amp; mouth with damp handkerchief or cloth;</li> <li>• Public buildings and critical infrastructures are most vulnerable. Identify and organize ash clearing teams to monitor and clear ash accumulation;</li> <li>• Closely monitor the bulletin of PHIVOLCS and heed their advice; and</li> <li>• Issue warning bulletin to road users</li> </ul> |
| Volcanic Smog                     |                                                                              | <ul style="list-style-type: none"> <li>• Generally associated with eruption clouds/ash fall;</li> <li>• Can aggravate respiratory problems; and</li> <li>• Can form acid rain that can corrode metals and contaminate drinking water if collected or sourced from rainwater catchment systems</li> </ul>                                                                                                                                                                                                                                                                                                 | <ul style="list-style-type: none"> <li>• Closely monitor the bulletin of PHIVOLCS and heed their advice; and</li> <li>• Issue warning bulletin to road users</li> </ul>                                                                                                                                                                                                                                                                                                                                                                               |
| Ground Subsidence due to Eruption | Low                                                                          | Confined within the Volcano Island                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <ul style="list-style-type: none"> <li>• No effect to the project area</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Pyroclastic Flow                  |                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Volcanic Bombs/ Projectiles       |                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Lava Flow                         |                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Fissure                           |                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Volcanic Slides                   |                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Seiche                            |                                                                              | Confined within the Coastline of Taal Lake                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |



Source: Google Earth

Figure 2.1.2-10 Approximate Distance of Taal Volcano from the Proposed Cavite-Laguna (Laguna Section) Expressway Alignment

### 2.1.3 Pedology

Summarized in **Table 2.1.3-1** are the soil characteristics in the study area.

| Table 2.1.3-1 Soil Characteristics in the Study Area                     |      |                            |                            |                               |                     |
|--------------------------------------------------------------------------|------|----------------------------|----------------------------|-------------------------------|---------------------|
| Feature                                                                  |      | Coastal Landscapes         | Alluvial Lowlands          | Piedmont Plains and Foothills | Hills and Mountains |
| Effective Depth                                                          | Soil | Shallow to moderately deep | Shallow to moderately deep | Shallow to Deep               | Hills and Mountains |
| Composition                                                              |      | Organic                    | Organic                    | Non-organic                   | Non-organic         |
| Soil plasticity                                                          |      | Very high                  | Very high                  | Low                           | Low                 |
| Soil drainage                                                            |      | moderate                   | moderate                   | good                          | good                |
| Note: Color-shaded columns are the type of soils found in the study area |      |                            |                            |                               |                     |

Source: Bureau of Soils and Water Management, Department of Agriculture, 2012

#### 2.1.3.1 Alluvial Lowlands

In Cavite, parent soil material is largely fine clay that is poorly drained in flat to nearly flat areas and moderately drained in gently sloping areas. Fine loam is found in the levee areas. As such, soil varies from sandy to silty clay loam to clay and is somewhat poorly drained. The area possesses potentials for high yielding wells.

#### 2.1.3.2 Hills and Mountains

Parent soil material is sandy loam or loam that is drained well. Effective soil depth varies from very shallow to deep.

#### 2.1.3.3 Borehole Data

**Figure 2.1.3-1** presents the location of bore hole tested along the recommended CALA Expressway alignment. As can be discerned from the soil profile illustrated in **Figure 2.1.3-2a**, **Figure 2.1.3-2b**, and **Figure 2.1.3-2c**, **Layer A** corresponds to soil materials that are characteristic of coastal landscapes and **alluvial plains**, being slightly to highly plastic, due to considerable amount of clay materials.

**Layer B**, which is described as grayish brown/gray silty sand with little amount of tuff materials, and **Layer C**, which are non-plastic sandy silts are characteristic of soils found in **hilly and mountainous landscapes**, as presented in the previous section.

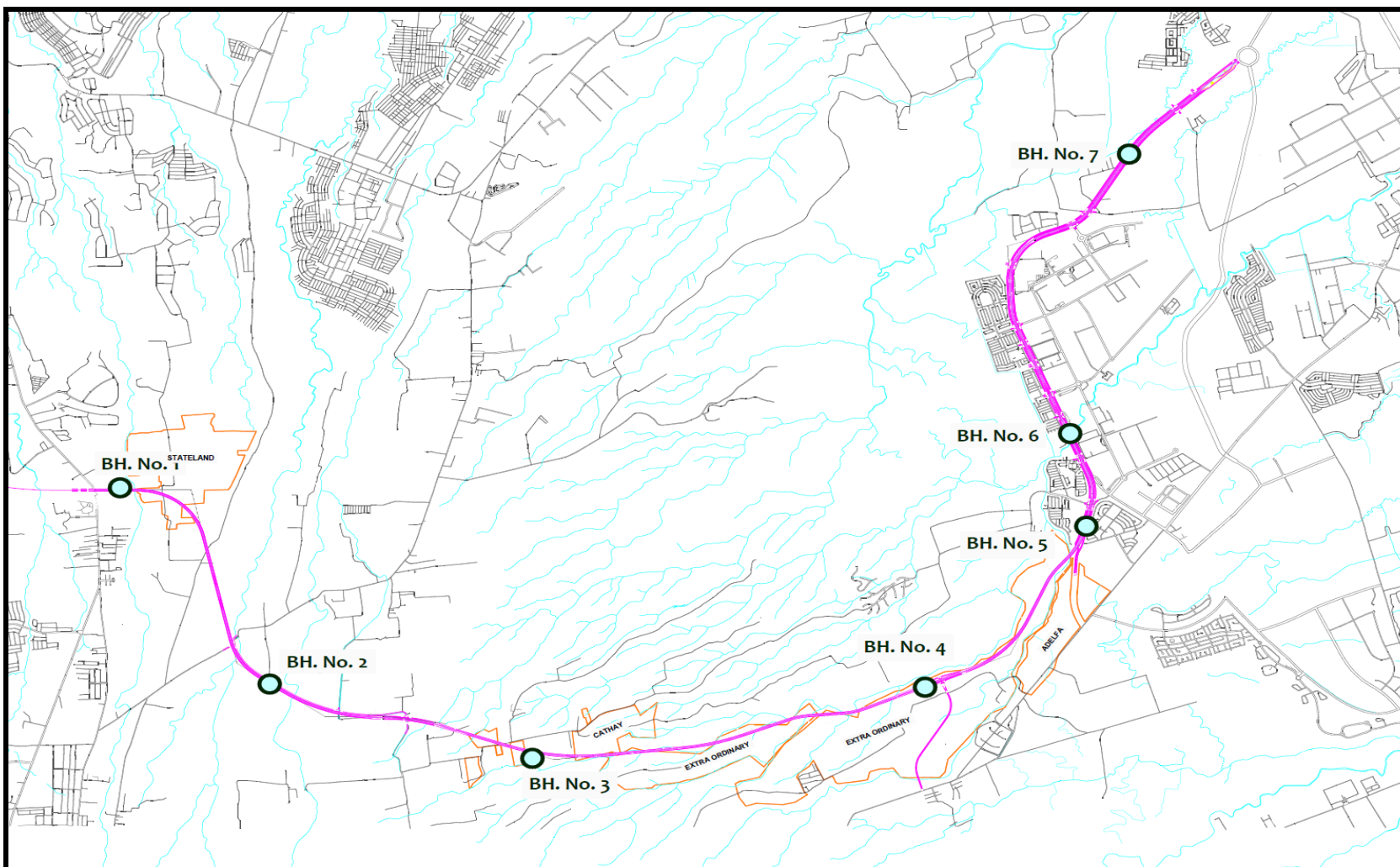


Figure 2.1.3-1 Location of Boreholes along the CALA Expressway Alignment

## 2.1.4 Terrestrial Biology

### 2.1.4.1 Terrestrial Flora

The vegetation cover along the areas traversed by the proposed CALA Expressway alignment can be classified into **two (2)** major types, the **Cultivated Vegetation**, and the **Natural Vegetation**. The **Natural Type** primarily consists of Secondary Growth and Lowland Grassland, while the **Cultivated Type** on the other hand is subdivided into Agricultural and Built-Up. To fully visualized the vegetation cover of the area refer to **Fig. 1.1.3-1**, Site Condition (page 1-8)

### Cultivated Vegetation Type

#### Agricultural Type



Photo 1



Photo 2

Photo 1 and 2 taken at Km. 1+000 – 2+000 at Barangay Sabutan, Cavite, vast unproductive and non-irrigated agricultural land to be traversed by the CALA Expressway.

Based on the Land-use Map of Silang, Km. 1+000-Km. 2+000, located in Bgy. Sabutan, Silang is an Agricultural Area.

Among the affected areas, Silang, Cavite represents the biggest agricultural expanse. The town is famous for producing the very sweet medium-sized **pineapple** (*Ananas comosus*) and the best tasting **robusta coffee** (*Coffea canephora*) in the whole Province of Cavite. Yellow and green corn (*Zea mays*) varieties are extensively cultivated in Silang, while palay (*Oryza sativa*) is planted merely in upland areas due to unavailability of irrigated farmlands. Yellow corn

variety is the main raw material for animal feeds. Limited number of *Cocos nucifera* is also sighted in the area.

Root crops such as kamote/sweet potato (*Ipomea batatas*), kamoteng kahoy (*Manihot esculenta*), patatas (*Solanum tuberosum*), and peanut (*Atachis hypogaea*) are also cultivated in Silang. According to local accounts, *A. hypogaea* is planted in between cropping seasons to recover soil fertility. Vegetables grown include okra (*Abelmoschus esculentus*), lettuce (*Lactuca sativa*), eggplant (*Solanum melongena*), tomato (*Lycopersicon esculentum*), and black pepper (*Piper nigrum*).

### **Natural Vegetation Type**

#### Secondary Growth

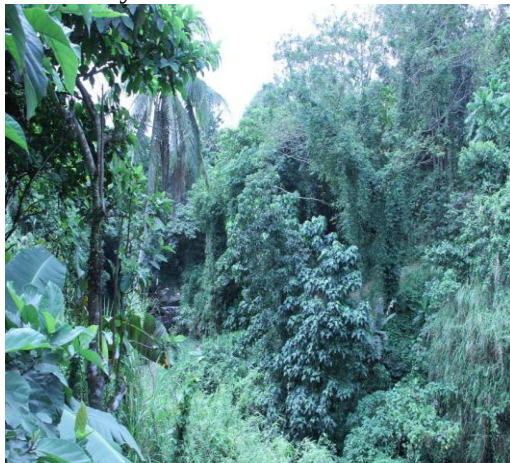


Photo 3



Photo 4



Photo 5



Photo 6

Photos 3-6 are taken at Km. 2+900 Barangay Sabutan, Silang, Cavite at the gullies bordering Malaking Ilog River. Mixed stands of secondary forest tree species such as *F. nota*, *T. orientalis*, *A. cadamba*, *M. Philipinensis*, *M. tanarius*, *A. bunius*, *Bambusa* sp., mahogany, *Gliricida sepium*, etc.

**In the study area, there is no primary forest growth observed.** The sparsely vegetated landscape serves as a reminder of the past human activities that have dictated the formation of a distinct flora community. Regenerations of tree species typical of a *secondary forest* are very evident along gullies and edges of rivers and creeks. Mixed growths of mature and juvenile *Ficus nota* (tibig), *Macaranga tanarius* (binunga), *Anthocephalus cadamba* (kaatoang bangkal), *Trema orientalis* (anabiong), *Antidesma buniis* (bignai) is common. It is balanced well by the growths of associated species like *Mallotus multiglandosus* (alim), *Vitex negundo* (lagundi), *Ficus odorata* (pakiling), *Macaranga grandifolia* (takip-asin), and *Artocarpus communis* (rimas/kamansi). Proliferations of *Leucaena leucocephala* (ipil-ipil) strongly indicate previous slash and burn farming activities in the study area.

**It is important to note that endangered and/or rare flora species were not encountered in the study area.** Given in **Table 2.1.4-1** is the list of tree species identified in the study area.

**Table 2.1.4-1 List of Secondary Forest Plant Species Found in the Study Area (1/2)**

| Common Name | Scientific Name                | Family Name      |
|-------------|--------------------------------|------------------|
| Achuete     | <i>Bixa Orellana</i>           | Bixaceae         |
| Alibangbang | <i>Bauhinia monandra</i>       | Leguminosae      |
| Alim        | <i>Mallotus multiglandosus</i> | Euphorbiaceae    |
| Anabiong    | <i>Trema orientalis</i>        | Ulmaceae         |
| Anahaw      | <i>Livistona rotundifolia</i>  | Palmae/Arecaceae |
| Antipolo    | <i>Artocarpus blancoi</i>      | Moraceae         |
| Balanti     | <i>Homallanthus sp</i>         | Euphoibiaceae    |
| Banaba      | <i>Lagerstroemia speciosa</i>  | Lythraceae       |
| Banato      | <i>Mallotus philipensis</i>    | Euphorbiaceae    |
| Bangkal     | <i>Nauclea sp.</i>             | Rubiaceae        |
| Bignai      | <i>Antidesma buniis</i>        | Euphorbiaceae    |
| Binayuyu    | <i>Antidesma ghaesembilla</i>  | Euphorbiaceae    |
| Binunga     | <i>Macaranga tenarius</i>      | Euphorbiaceae    |
| Bunga       | <i>Areca Catechu</i>           | Palmae           |
| Buri        | <i>Corypha elata</i>           | Palmae           |
| Dao         | <i>Dracontomelon dao</i>       | Anacardiaceae    |
| Hemindang   | <i>Macanranga tanarius</i>     | Euphorbiaceae    |
| Hauili      | <i>Ficus septica</i>           | Moraceae         |
| Hinlaumo    | <i>Mallotus ricinoides</i>     | Euphorbiaceae    |

**Table 2.1.4-1 List of Secondary Forest Plant Species Found in the Study Area (1/2)**

|                                                                      |                        |               |
|----------------------------------------------------------------------|------------------------|---------------|
| Igot                                                                 | Ficus septica          | Moraceae      |
| Ilang Ilang                                                          | Cananga odorata        | Annonaceae    |
| Ipil-Ipil                                                            | Leucaena leucocephala  | Rubiaceae     |
| Kaatoang-bangkal                                                     | Anthocephalus cadamba  | Rubiaceae     |
| Kalios                                                               | Streblus asper         | Moraceae      |
| Kamagong/mabolo                                                      | Diospyros philipensis  | Ebenaceae     |
| Kapok                                                                | Ceiba pentandra        | Bombacaceae   |
| Kauayan                                                              | Bambusa sp.            | Gramineae     |
| Lagundi                                                              | Vitex negundo          | Verbenaceae   |
| Libas                                                                | Spondias pinnata       | Anacardiaceae |
| Lumbang                                                              | Aleurites moluccana    | Euphorbiaceae |
| Madre cacao                                                          | Gliricida sepium       | Leguminosae   |
| Malapapaya                                                           | Polyscias nodosa       | Araliaceae    |
| Molave                                                               | Vitex parviflora       | Verbenaceae   |
| Makiling                                                             | Ficus odorata          | Moraceae      |
| Rimas                                                                | Artocarpus communis    | Moraceae      |
| Takipan                                                              | Caryota rumphiana      | Palmaceae     |
| Talisay                                                              | Terminalia catappa     | Combretaceae  |
| Tanglin                                                              | Adenanthera intermedia | Leguminosae   |
| Tibig                                                                | Ficus nota             | Moraceae      |
| Tubing-bakod                                                         | Jatropha curcas        | Euphorbiaceae |
| <i>Source: As Observed by the EIA Study Team during Field Survey</i> |                        |               |



Photo 7: Taken at Km. 3+900- 4+300 in Barangay Tibig, Silang, Cavite

## **Natural Vegetation Type**

### Secondary Growth

#### Lowland Grassland

“Kaingin” or slash and burn farming is the oldest method of agricultural practice known to man since the early years of the 20th century. Undeniably, it has greatly influenced the formation of vegetative cover not only in the study area, but in the entire country as well. Due to the enormity of the converted forest areas, farmers are unable to till every corner of the expanse, which leads to the evolution of another vegetation community, called the *Lowland Grassland*.

Similar to other grassland, vegetation growth in the study area is dictated mainly by **two (2)** grass species – *Saccharum spontaneum* (talahib) and *Imperata cylindrica* (cogon). Although *I. cylindrica* is the more aggressive species of the two, grassland areas traversed by the alignment are dominated by the much taller and coarser *S. spontaneum*. Mixed growths of various grass, shrub, and herb species such as *Axonopus compressus* (carabao grass), *Lantana camara* (coronitas), *Amaranthus spinosus* (colitis), *Chromolaena odorata* (hagonoy), *Clitorea ternatea* (pukinggan), *Peperomia pellucida* (pansit-pansitan/olasiman ihalas), *Eclipta alba* (tinta-tintahan), *Paspalum conjugatum* (laau-laau/T-grass) are also common.

Densely covering the grassland/uncultivated land are *Murdannia nudiflora* (alibangon-lalaki), *Mimosa pudica* (makahiya), *Urena lobata* (kulut-kulutan), *Aneilema malabaricus* (bangal), *Alocasia macrorhiza* (biga/elephant’s ear), *Chloris barbata* (koroskorosan), and *Hyptis capital* (botonesan).

Enumerated in **Table 2.1.4-2** are the various grass, weeds, shrubs, and herbs species encountered in the study area.

**Table 2.1.4-2 List of Shrub, Herb, Grass, and Sedge Species Identified in the Study Area (2/2)**

| Common Name               | Scientific Name                | Family Name   | Habit |
|---------------------------|--------------------------------|---------------|-------|
| Alikbangon-lalaki         | <i>Murdannia nudiflora</i>     | Commelinaceae | Herb  |
| Alinang                   | <i>Cyperus iria</i>            | Cyperaceae    | Sedge |
| Apuy-apuyan               | <i>Cleome gynandra</i>         | Capparidaceae | Herb  |
| Baki-Baki                 | <i>Cyperus difflormis</i>      | Cyperaceae    | Sedge |
| Bakwit                    | <i>Eriochloa procera</i>       | Gramineae     | Grass |
| Bangal                    | <i>Aneilema malabaricum</i>    | Commelinaceae | Herb  |
| Botonesan                 | <i>Hyptis capitata</i>         | Labiatae      | Herb  |
| Botonsilyo or Borobotones | <i>Cyperus kyllingia</i>       | Cyperaceae    | Sedge |
| Botonsilyong Gapang       | <i>Gomphrena celosioides</i>   | Amaranthaceae | Herb  |
| Bulang                    | <i>Echinochloa colonum</i>     | Gramineae     | Grass |
| Buntot pusa               | <i>Pennisetum polystachyon</i> | Gramineae     | Grass |
| Coronitas                 | <i>Lantana camara</i>          | Verbenaceae   | Shrub |
| Dampalit                  | <i>Sesuvium portulacastrum</i> | Aizoaceae     | Herb  |
| Dawa-Dawa                 | <i>Dawa-Dawa</i>               | Gramineae     | Grass |
| Golasiman                 | <i>Portulaca oleracea</i>      | Portulacaceae | Herb  |
| Hagonoy                   | <i>Chromolaena odorata</i>     | Asteraceae    | Shrub |
| Hangod                    | <i>Achyranthes aspera</i>      | Amaranthaceae | Herb  |
| Kalog-Kalog               | <i>Crotalaria retusa</i>       | Leguminosae   | Shrub |
| Kastuli                   | <i>Abelmoschus moschatus</i>   | Malvaceae     | Herb  |
| Kogon                     | <i>Imperata cylindrica</i>     | Gramineae     | Grass |
| Korokorosan               | <i>Chloris barbata</i>         | Gramineae     | Grass |
| Kulut-kulitan             | <i>Triumfetta bartramia</i>    | Tiliaceae     | Herb  |
| Laa-Laa                   | <i>Paspalum conjugatum</i>     | Gramineae     | Grass |
| Lapnis                    | <i>Malachra capitata</i>       | Malvaceae     | Shrub |
| Makahiya                  | <i>Mimosa pudica</i>           | Leguminosae   | Herb  |
| Makahiyang lalake         | <i>Aeschynomene americana</i>  | Leguminosae   | Herb  |
| Malbas                    | <i>Abutilon indicum</i>        | Malvaceae     | Shrub |
| Maraotong                 | <i>Acalypha indica</i>         | Euphorbiaceae | Herb  |
| Mutha                     | <i>Cyperus rotunda</i>         | Cyperaceae    | Sedge |
| Olasiman-lhalas           | <i>Peperomia pellucida</i>     | Piperaceae    | Herb  |
| Nguad                     | <i>Bidens pilosa</i>           | Compositae    | Herb  |
| Olasiman-lhalas           | <i>Peperomia pellucida</i>     | Piperaceae    | Herb  |
| Polytrias                 | <i>Polytrias praemorsa</i>     | Gramineae     | Grass |

| Table 2.1.4-2 List of Shrub, Herb, Grass, and Sedge Species Identified in the Study Area (2/2) |                                |               |       |
|------------------------------------------------------------------------------------------------|--------------------------------|---------------|-------|
| Pukinggan                                                                                      | <i>Clitorea ternatea</i>       | FABACEAE      | Vine  |
| Putokan                                                                                        | <i>Crotalaria quinquefolia</i> | Leguminosae   | Herb  |
| Sabilaw                                                                                        | <i>Cyanotis axillaris</i>      | Commelinaceae | Herb  |
| Sambong                                                                                        | <i>Blumea balsamifera</i>      | Compositae    | Shrub |
| Sampa-sampalukan                                                                               | <i>Phyllanthus niruri</i>      | Euphorbiaceae | Herb  |
| Seru walai                                                                                     | <i>Cleome rutidisperma</i>     | Capparidaceae | Herb  |
| Talahib                                                                                        | <i>Saccharum spontaneum</i>    | Gramineae     | Grass |
| Tayum                                                                                          | <i>Indigofera suffruticosa</i> | Leguminosae   | Herb  |
| Tayuman                                                                                        | <i>Indigofera hirsuta</i>      | Leguminosae   | Herb  |
| Tikog                                                                                          | <i>Fimbristylis globulosa</i>  | Cyperaceae    | Sedge |
| Tintatintahan                                                                                  | <i>Eclipta alba</i>            | Compositae    | Herb  |
| Titonia or Tithonia                                                                            | <i>Tithonia diversifolia</i>   | Compositae    | Shrub |
| Uray                                                                                           | <i>Amaranthus spinosus</i>     | Amaranthaceae | Herb  |
| Walis-walisan                                                                                  | <i>Sida acuta</i>              | Malvaceae     | Shrub |
| Source: As Observed by the EIA Study Team during Field Survey                                  |                                |               |       |



Photo 8: Km. 4+200-4+800, Bgy. Tibig, Silang, Cavite, various fruit bearing trees

Commercial fruit trees such as papaya (*Carica papaya*), mango (*Mangifera indica*), banana (*Musa sapientum*/*Musa paradisiaca*), lanzones (*Lansium domesticum*), jackfruit (*Artocarpus heterophylla*), rambutan (*Nephelium lappaceum*), and coconut (*Cocos nucifera*) are widely grown in the study area. C.

papaya is widely grown in backyards and broader farmlands as it is considered as a profitable enterprise used in cosmetics and food preparation.

Anthurium (*Anthurium andraeanum*) and orchids (*Dendrobium sp.*) are the main cutflowers propagated. Cutflowers and ornamentals are generally grown throughout the Silang aside from agricultural produce.

|                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <p>Photo 9</p>                                                                      | <p>Photo 10</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|  | <p>Photo taken at Bgy. Carmen, Silang, Cavite, km. 8+900 - Km.9+100, noted are the following tree species: Bambusa sp (Kawayan), Jethropa curcas ( Tubangbakod) , Tamarindus indica (Sampalok), Arthocarpus heterophylla (Jackfruit), Musa coccinea (saging), and Gliricida sepium (Madre de Cacao),etc. Varieties of shrubs and grass species are also noted: Saccharum spontaneum (Talahib), Imperata cylindrical (Kogon), Photos were re-taken due to some technical defects of the camera on the previous site inspection</p> |
| <p>Photo 11</p>                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

Photo taken at Bgy. Carmen, Silang, Cavite also has a mixed grown of commercial fruit trees such as mango (*Mangifera indica*), banana (*Musa sapientum/Musa paradisiaca*), lanzones (*Lansium domesticum*), jackfruit (*Arthocarpus heterophylla*), rambutan (*Nephelium lappaceum*), tamrindus indica (Sampalok) and coconut (*Cocos nucifera*) are widely grown in the study area. The area has also wild varieties of shrubs, herb, and grass which includes the Bambusa Specie (Kauayan), Saccharum spontaneum (Talahib), Imperata cylindrical (Kogon)C. papaya is widely grown in backyards and broader farmlands as it is considered as a profitable enterprise used in cosmetics and food preparation.

| <b>Table 2.1.4-3 List of Fruit Bearing Trees Identified in the Study Area</b> |                                |                    |
|-------------------------------------------------------------------------------|--------------------------------|--------------------|
| <b>Common Name</b>                                                            | <b>Scientific Name</b>         | <b>Family Name</b> |
| Anonang                                                                       | <i>Cordia dichotoma</i>        | Ehretiaceae        |
| Aratiles                                                                      | <i>Muntingia calabura</i>      | Tiliaceae          |
| Atis                                                                          | <i>Annona squamosa</i>         | Annonaceae         |
| Avocado                                                                       | <i>Persea americana</i>        | Lauraceae          |
| Balimbing                                                                     | <i>Averrhoa caranbola</i>      | Oxalidaceae        |
| Bayabas                                                                       | <i>Psidium Guajaba</i>         | Myrtaceae          |
| Cacao                                                                         | <i>Theobroma cacao</i>         | Sterculiaceae      |
| Calamansi                                                                     | <i>Citrus microcarpa</i>       | Rutaceae           |
| Camachile                                                                     | <i>Pithecellobium dulce</i>    | Leguminosae        |
| Chestnut                                                                      | <i>Castanea sp.</i>            | Fagaceae           |
| Chico                                                                         | <i>Manilkara sapota</i>        | Sapotaceae         |
| Coconut/niyog                                                                 | <i>Cocos nucifera</i>          | Palmae             |
| Dalandan                                                                      | <i>Citrus aurantium</i>        | Rutaceae           |
| Duhat                                                                         | <i>Sizigium Cumini</i>         | Myrtaceae          |
| Durian                                                                        | <i>Durio zibethinus</i>        | Malvaceae          |
| Granda                                                                        | <i>Punica granatum</i>         | Punicaceae         |
| Guyabano                                                                      | <i>Annona muricata</i>         | Annonaceae         |
| Jackfruit                                                                     | <i>Artocarpus heterophylla</i> | Moraceae           |
| Kaimito                                                                       | <i>Chrysophyllum cainito</i>   | Sapotaceae         |
| Kamias                                                                        | <i>Averrhoa bilimbi</i>        | Oxalidaceae        |
| Kasoi                                                                         | <i>Anacardium occidentale</i>  | Anacardiaceae      |
| Lansones                                                                      | <i>Lansium domesticum</i>      | Meliaceae          |
| Makopa                                                                        | <i>Sizigium Samarangense</i>   | Myrtaceae          |
| Mandarin                                                                      | <i>Citrus reticulata</i>       | Rutaceae           |
| Manga                                                                         | <i>Mangifera indica</i>        | Anacardiaceae      |
| Papaya                                                                        | <i>Carica papaya</i>           | Caricaceae         |
| Pomelo                                                                        | <i>Citrus aurantium</i>        | Rutaceae           |
| Rambutan                                                                      | <i>Nephelium lappaceum</i>     | Rutaceae           |
| Saging                                                                        | <i>Musa coccinea</i>           | Musaceae           |
| Sampalok                                                                      | <i>Tamarindus indica</i>       | Leguminosae        |
| Santol                                                                        | <i>Sandoricum koetjape</i>     | Meliaceae          |
| Sineuelas                                                                     | <i>Spondias purpurea</i>       | Anacardiaceae      |
| Tiesa                                                                         | <i>Pouteria campechiana</i>    | Sapotaceae         |
| Source: As Observed by the EIA Study Team during Field Survey                 |                                |                    |



**Photo No. 12** Grasslands predominated by *S. spontaneum* (talahib) observed on both sides of Nuvali Road, at km. 10-Km. 11+500 Brgy. Timbao, Biñan City.

### Built-Up Type

Essentially, built-up vegetation as the term suggests is comprised mainly of ornamental plant species propagated in urban and settlement areas. Ornamental plants largely correspond to “garden plants” which are usually cultivated in gardens, front yards and backyards, and landscaping areas. Most commonly, ornamental garden plants are grown for the display of aesthetic features enjoyed by visitors and the public.

Characteristic of the built up vegetation in the study area is described by a wide variety of ornamental plants species. The landscaped frontages and periphery of the exclusive residential subdivisions along the proposed alignment augments the myriad of plants species present.

*Vitex parviflora* (molave) is fast becoming a popular ornamental tree. It is abundantly cultivated at the landscaped area of Verdana Homes alongside *Plumeria rubra* (white calachuchi) and *Jatropha pandurifolia* (Shanghai beauty). Accentuating the frontage area are *Sansevieria cylindrica* (spear plant), *Sansevieria trifasciata* (bow string hemp),

*Cracaena reflex* (Song of India), and *Dracaena reflex* (Song Thailand). Well-trimmed *Cynodon dactylon* (bermuda grass) covers the ground like a carpet.

Mature stands of *Samanea saman* (acacia) lining the Nuvali Road in Brgy. Malamig, provide shade and relief from the scorching heat of the sun to the walking public in front of the Laguna Techno Park. Mixed stands of *Swietenia macrophylla* (large-leaved mahogany), *Swietenia mahogani* (common mahogany), and *Pterocarpus indicus subsp. indicus* (narra) were also observed.



**Photo No. 13 at Km. 12+000 – Km. 14+000**



**Photo No. 14 at Km. 15+200**



**Photo No. 15 at Km. 16+150**



**Photo No. 16 at Km. 15+800**

Photo of the existing Nuvali Road and Laguna Blvd., Brgy. Malamig,, Biñan, Laguna. On the southeast side of the road is the Laguna Techno Park, Biñan side. Built-up areas are planted with varieties of tree species and Ornamental Trees

**Table 2.1.4-4 List of Ornamental Plants Species Identified in the Study Area (1/2)**

| <b>Common Name</b>      | <b>Scientific Name</b>             | <b>Family Name</b> | <b>Habit</b> |
|-------------------------|------------------------------------|--------------------|--------------|
| Adelfa                  | <i>Nerium oleander</i>             | Apocynaceae        | Shrub        |
| Agave                   | <i>Agave franzosinii</i>           | Agavaceae          | Herb         |
| Alocasia                | <i>Alocasia sp.</i>                | Araceae            | Herb         |
| Asparagus plant         | <i>Asparagus densiflorus</i>       | Liliaceae          | Herb         |
| Bandera Española        | <i>Cannax generalis</i>            | Cannaceae          | Herb         |
| Baston de San Jose      | <i>Cordyline fruticosa</i>         | Agavaceae          | Shrub        |
| Begonia                 | <i>Begonia coccinea</i>            | Begoniaceae        | Herb         |
| Bignonia                | <i>Tecoma stans</i>                | Bignoniaceae       | Shrub        |
| Blood leaf              | <i>Iresine herbstii</i>            | Amaranthaceae      | Herb         |
| Blood lily              | <i>Haemanthus multiflorus</i>      | Amaryllidaceae     | Herb         |
| Bougainvillea           | <i>Bougainvillea spectabilis</i>   | Nyctaginaceae      | Vine         |
| Buntot tigre            | <i>Sansevieria trifasciata</i>     | Agavaceae          | Herb         |
| Calico plant            | <i>Althernanthera ficoidea</i>     | Amaranthaceae      | Herb         |
| Common dischidia        | <i>Dischidia oiantha</i>           | Asclepiadaceae     | Shrub        |
| Common spear plant      | <i>Sansevieria cylindrica</i>      | Agavaceae          | Shrub        |
| Corazon de Maria        | <i>Caladium bicolor</i>            | Araceae            | Herb         |
| Cucharita               | <i>Althernanthera ficoidea</i>     | Amaranthaceae      | Herb         |
| Dama de noche           | <i>Cestrum nocturnum</i>           | Solanaceae         | Shrub        |
| Dama de noche           | <i>Cestrum nocturnum</i>           | Solanaceae         | Shrub        |
| Dieffenbachia           | <i>Dieffenbachia maculata</i>      | Araceae            | Herb         |
| Doña Aurora             | <i>Mussaenda Doña Aurora</i>       | Rubiaceae          | Shrub        |
| Episcia                 | <i>Episcia cupreata</i>            | Gesneriaceae       | Shrub        |
| False birds of paradise | <i>Heliconia bihai</i>             | Heliconiaceae      | Herb         |
| False sisal             | <i>Agave decipiens</i>             | Agavaceae          | Herb         |
| Five fingers            | <i>Schefflera odorata</i>          | Araliaceae         | Vine         |
| Fortune plant           | <i>Dracaena fragrans</i>           | Agavaceae          | Shrub        |
| Gumamela                | <i>Hibiscus rosa-sinensis</i>      | Malvaceae          | Shrub        |
| Lobster claw            | <i>Vriessea carinata</i>           | Bromeliaceae       | Herb         |
| Lollipop plant          | <i>Pachystachys lutea</i>          | Acanthaceae        | Shrub        |
| Mauritius hemp          | <i>Furcrarea foetida</i>           | Agavaceae          | Shrub        |
| Mayana                  | <i>Coleus Blumei</i>               | Labiatae/Lamiaceae | Herb         |
| Monstera                | <i>Monstera deliciosa</i>          | Araceae            | Vine         |
| Moradong dilaw          | <i>Pseuderanthemum reticulatom</i> | Acanthaceae        | Shrub        |
| Orchids                 | <i>Dendrobium sp.</i>              | Orchidaceae        | Herb         |

| Table 2.1.4-4 List of Ornamental Plants Species Identified in the Study Area (1/2) |                                      |                |       |
|------------------------------------------------------------------------------------|--------------------------------------|----------------|-------|
| Painted drop-tongue                                                                | <i>Aglaonema crispum</i>             | Araceae        | Herb  |
| Palawan                                                                            | <i>Cyrtosperma merkusii</i>          | Araceae        | Herb  |
| Panama hat plant                                                                   | <i>Carludovica palmata</i>           | Cyclanthaceae  | Shrub |
| Pigeon berry/golden bush                                                           | <i>Duranta repens</i>                | Verbenaceae    | Shrub |
| Purple false eranthemum                                                            | <i>Pseuderanthemum atropurpureum</i> | Acanthaceae    | Shrub |
| Rose                                                                               | <i>Rosa</i>                          | Rosaceae       | Herb  |
| Sampaguita                                                                         | <i>Jasminum bifarium</i>             | Oleaceae       | Vine  |
| San Francisco sp.                                                                  | <i>Codiaeum variegatum</i>           | Euphorbiaceae  | Herb  |
| Sanchezia                                                                          | <i>Sanchezia speciosa</i>            | Acanthaceae    | Shrub |
| Santan                                                                             | <i>Ixora chinensis</i>               | Rubiaceae      | Shrub |
| Sedang dahon                                                                       | <i>Aglaonema commutatum</i>          | Araceae        | Shrub |
| Shrimp plant                                                                       | <i>Justicia brandegeana</i>          | Acanthaceae    | Shrub |
| Song of India                                                                      | <i>Cracaena reflex</i>               | Agavaceae      | Herb  |
| Song of Jamaica                                                                    | <i>Dracaena reflexa</i>              | Agavaceae      | Herb  |
| Song of Thailand                                                                   | <i>Dracaena reflexa</i>              | Agavaceae      | Herb  |
| Spanish bayonet                                                                    | <i>Yucca aloifolia</i>               | Agavaceae      | Shrub |
| Spider lily                                                                        | <i>Crinum amabile</i>                | Amaryllidaceae | Herb  |
| Toothed philodendron                                                               | <i>Philodendron lacerum</i>          | Araceae        | Vine  |
| Umbrella plant                                                                     | <i>Cyperus alternifolius</i>         | Cyperaceae     | Shrub |
| Yellow-margined century plant                                                      | <i>Agave americana</i>               | Agavaceae      | Herb  |

| Table 2.1.4-5 List of Ornamental Trees Observed in the Study Area (1/2) |                                |               |
|-------------------------------------------------------------------------|--------------------------------|---------------|
| Common Name                                                             | Scientific Name                | Family Name   |
| Acacia                                                                  | <i>Samanea saman</i>           | Leguminosae   |
| Adelfa                                                                  | <i>Nerium oleander</i>         | Apocynaceae   |
| African tulip                                                           | <i>Spathodea campanulata</i>   | Bignoniaceae  |
| Agoho                                                                   | <i>Casuarina equisetifolia</i> | Casuarinaceae |
| Banyan tree                                                             | <i>Ficus retusa</i>            | Moraceae      |
| Baobab                                                                  | <i>Adansonia digitata</i>      | Bombacaceae   |
| Beach pandan                                                            | <i>Pandanus tectorius</i>      | Pandanaceae   |
| Begonia                                                                 | <i>Begonia coccinea</i>        | Begoniaceae   |
| Benjamin's fig                                                          | <i>Ficus benjamin</i>          | Moraceae      |
| Bignonia                                                                | <i>Tecoma stans</i>            | Bignoniaceae  |

| Table 2.1.4-5 List of Ornamental Trees Observed in the Study Area (1/2) |                                                     |                  |
|-------------------------------------------------------------------------|-----------------------------------------------------|------------------|
| Bo tree                                                                 | <i>Ficus religiosa</i>                              | Moraceae         |
| Bunga de China sp.                                                      | <i>Veitchia merrillii</i>                           | Palmae/Arecaceae |
| Caballero                                                               | <i>Caesalpinia pulcherrima</i>                      | Leguminosae      |
| Campanilla                                                              | <i>Allamandra cathartica</i>                        | Apocynaceae      |
| Caña fistula                                                            | <i>Cassia fistula</i>                               | Leguminosae      |
| Common mahogany                                                         | <i>Swietenia mahogani</i>                           | Meliaceae        |
| Dapdap                                                                  | <i>Erythrina variegata</i>                          | Leguminosae      |
| Dracaena                                                                | <i>Dracaena multiflora</i>                          | Agavaceae        |
| Eucalyptus/blue gum tree                                                | <i>Eucalyptus Blobulus</i>                          | Myrtaceae        |
| Fire tree                                                               | <i>Delonix regia</i>                                | Leguminosae      |
| Giant dracaena                                                          | <i>Cordyline australis</i>                          | Agavaceae        |
| Indian tree                                                             | <i>Polyalthia longifolia</i>                        | Annonaceae       |
| Japanese acacia                                                         | <i>Acacia auriculiformis</i>                        | Leguminosae      |
| Juniper                                                                 | <i>Junniperus communis</i>                          | Cuppressaceae    |
| Kalatsutsing-puti                                                       | <i>Plumeria obtusa</i>                              | Apocynaceae      |
| Karmay                                                                  | <i>Phyllanthus acidus</i>                           | Euphorbiaceae    |
| Large-leaved mahogany                                                   | <i>Swietenia macrophylla</i>                        | Meliaceae        |
| Licuala                                                                 | <i>Licuala spinosa</i>                              | Palmae           |
| Lipstick palm                                                           | <i>Cyrtostachys renda</i>                           | Palmae/Arecaceae |
| Mac Arthurs' palm                                                       | <i>Ptychosperma macarthur</i>                       | Palmae/Arecaceae |
| Maluko                                                                  | <i>Pisonia alba</i>                                 | Nyctaginaceae    |
| Mangium                                                                 | <i>Acacia mangium</i>                               | Leguminosae      |
| Narra                                                                   | <i>Pterocarpus indicus</i><br>subsp. <i>indicus</i> | Leguminosae      |
| Neem tree                                                               | <i>Azidarachta indica</i>                           | Meliaceae        |
| Octopus tree                                                            | <i>Brassaia actinophylla</i>                        | Araliaceae       |
| Oliva                                                                   | <i>Cycas revoluta</i>                               | Cycacaceae       |
| Panama rubber tree                                                      | <i>Castilla elastica</i>                            | Moraceae         |
| Pitogo                                                                  | <i>Cycas circinalis</i>                             | Cycadaceae       |
| Rainbow tree                                                            | <i>Dracaena margarita</i>                           | Agavaceae        |
| Shanghai beauty                                                         | <i>Jatropha pandurifolia</i>                        | Euphorbiaceae    |
| Thailand shower/Siamese acacia                                          | <i>Cassia siamea</i>                                | Leguminoseae     |
| Traveler's tree                                                         | <i>Ravenala madagascariensis</i>                    | Sterculiaceae    |
| Yellow bell                                                             | <i>Allamanda cathartica</i>                         | Apocynaceae      |
| Source: As Observed by the EIA Study Team during Field Survey           |                                                     |                  |



Photo No. 17



Photo No. 18



Photo No. 19



Photo No. 20

Photo taken along the Greenfield Parkway- Mamplasan Overpass Road inside the Greenfields property between **Km 17+000–18+000**. Both sides of the road are open grassland areas with patches of tree species: *Ficus nota* (Tibig), *Vitex parviflora* (molave), etc..

#### 2.1.4.2 Terrestrial Wildlife Fauna (Animals)

The existing terrestrial fauna in the area is classified into **two (2)** major groups, **Avifauna** (birds) and **domesticated animals**. Further discussion on the fauna groups is presented in the succeeding section.

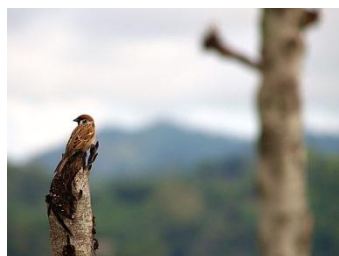
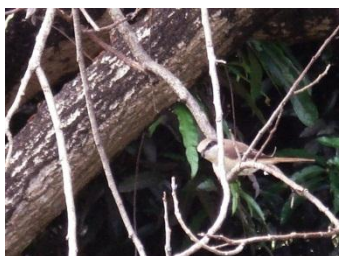
##### Avifauna (Birds)

The study area is typical of a disturbed wildlife habitat. Forest areas that will provide habitat to fauna species no longer exist. As discussed previously, species

diversity of the remaining vegetation covers which are commonly converged on ravines and edges of rivers and creeks or in scattered patches is poor.

This being the case, comprehensive study on the existing terrestrial fauna was not undertaken. Instead, documentation of the wildlife fauna was based primarily on actual sightings, focusing mainly on avifauna (birds), since this is the only group most likely to be affected by the project. Species encountered were identified and validated using descriptive and photographic handbook guide on Philippine birds.

Majority of the birds encountered are species commonly found in urban, agricultural, and grassland areas, the most common of which is the Eurasian tree sparrow (*Passer montanus*). This species is believed to have been introduced to the country from China during the 1930s. Species associated with *P. montanus* that were identified in the area include yellow-vented bulbul (*Pycnonotus goiavier*), long-tailed shrike (*Lanius schach*), glossy swiftlet (*Collocalia esculenta*), and pied fantail (*Rhipidura javanica*).

|                                                                                                                                                                   |                                                                                                                                                                     |                                                                                                                                                                       |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <p>Mayang Bato(Eurasian tree Sparrow) found at Bgy. Biga, Silang, Cavite</p>  |  <p>Maya Kapra (Rhipidura Nigritorquis) found at Bgy. Tibig, Silang, Cavite</p> |  <p>Maya (Eurasian tree Sparrow) found at Bgy. Kaong, Silang, Cavite</p>         |
|  <p>Mayang Bato (Eurasian tree Sparrow) found at Bgy. Biñan, Biñan, Laguna</p> |  <p>Mayang Bato (Eurasian tree Sparrow) found at Bgy. Tibig, Silang, Cavite</p> |  <p>Mayang Kosta (Rice Bird or Sparrow) found at Bgy. Carmen, Silang, Cavite</p> |

|                                                                                                                                                                   |                                                                                                                                                                 |                                                                                                                                                      |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <p>Mayang Bato (Eurasian tree Sparrow) found at Bgy. Malamig, Biñan, Laguna</p> |  <p>Uwak (crow on top of a carabao) found at Bgy. Sabutan, Silang, Cavite</p> |  <p>Tagak (white heron) found at Bgy. Sabutan, Silang, Cavite</p> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|

**Source:** PMO-BOT and ESSO, DPWH

Other birds species observed are zebra dove (*Geopelia striata*), barred-button quail (*Turnix suscitator*), barred rail (*Gallirallus torquatus*), lesser coucal (*Centropus bengalensis*), brown shrike (*Lanius cristatus*), chestnut munia (*Lonchura malacca*), white-breasted wood swallow (*Artamus leucorhynchus*), cattle egret (*Bubulcus ibis*), and striated grassbird (*Megalurus palustris*).

Sighting of olive-backed sunbird (*Cinnyris jugularis*), crested myna (*Acridotheres cristatellus*), white-collared kingfisher (*Halcyon chloris*), black-naped oriole (*Oriolus chinensis*), large-billed crow (*Corvus macrorhynchos*) were likewise documented.

Interview with the locals revealed that **two (2)** species of owls are present in the study area. These are the Philippine endemic scops owl (*Otus megalotis*) and grass owl (*Tyto longimembris*).

**It was not established if significant bird activities such as mating, roosting, and nesting are performed in the study area. Evidently, the existing flora species do not offer sufficient food value to the birds keeping the diversity range at the minimum. Thus, bird species from nearby protected forest areas like the Mt. Makiling Forest Reserve is not expected to migrate in the study area.**

**During the field survey, there are no threatened, endangered, and/or vulnerable species encountered.**

| <b>Table 2.1.4-6 List of Bird Species Encountered in the Study Area</b> |                                 |                            |
|-------------------------------------------------------------------------|---------------------------------|----------------------------|
| <b>Common Name</b>                                                      | <b>Scientific name</b>          | <b>Conservation Status</b> |
| Barrel Rail                                                             | <i>Gallirallu storquatus</i>    | Conservation Status        |
| Barrel-button quail                                                     | <i>Turnix suscitator</i>        | Least Concerned            |
| Black-naped oriole                                                      | <i>Oriolus chinensis</i>        | Least Concerned            |
| Brown Shrike                                                            | <i>Laniu scristatus</i>         | Least Concerned            |
| Cattle Egret                                                            | <i>Bubulcus ibis</i>            | Least Concerned            |
| Chesnut Munia                                                           | <i>Lonchura Malacca</i>         | Least Concerned            |
| Crested Myna                                                            | <i>Acrida therescritatellus</i> | Least Concerned            |
| Eurasian tree sparrow                                                   | <i>Passer Montanus</i>          | Least Concerned            |
| Glossy Swiftlet                                                         | <i>Collocalia esculenta</i>     | Least Concerned            |
| Grass Owl                                                               | <i>Tyto longtimembris</i>       | Least Concerned            |
| Large-billed crow                                                       | <i>Corvus macrorhychos</i>      | Least Concerned            |
| Lesser coucal                                                           | <i>Centropus bengalensis</i>    | Least Concerned            |
| Long-tailed shrike                                                      | <i>Lanius schach</i>            | Least Concerned            |
| Olive-backed sunbird                                                    | <i>Cinnyris jugularis</i>       | Least Concerned            |
| Pied Fantail                                                            | <i>Rhipidura javanica</i>       | Least Concerned            |
| Scops owl                                                               | <i>Out smeggalotis</i>          | Least Concerned            |
| Straited grass bird                                                     | <i>Megaluruspalust</i>          | Least Concerned            |
| White-breast wood swallow                                               | <i>Artamus leucorynchus</i>     | Least Concerned            |
| White-collared kingfisher                                               | <i>Halcyn chloris</i>           | Least Concerned            |
| Yellow-vented bulbul                                                    | <i>Pycnonotus goiavier</i>      | Least Concerned            |
| Zebra dove                                                              | <i>Geopelia striata</i>         | Least Concerned            |
| Source: As Observed by the EIA Study Team during Field Survey           |                                 |                            |

## Domesticated Animals

Perhaps, dog (*Canis lupus familiaris*) is the first animal to be domesticated and has been the most widely kept working, hunting, and companion animal in human history. It is also considered to be the most popular pet in the world. Like the dog, domestic cats or house cats (*Felis silvestris catus*) are highly valued by humans for companionship. Its ability to hunt vermin such as rats, mice, and cockroaches make these small furry felines a more beneficial household pet.

Cattles or more popularly known as cows (*Bos primigenus*) are merely left to graze in open wastelands and are not bred for its commercial livestock value and

dairy products but to assist farmers in agricultural works. Carabao (*Bubalus bubalis carabanesis*) which is one of the popular members of the farm animals is a great help to farmers in pulling both a plow and the cart used to haul produce.

Chicken (*Gallus gallus domesticus*) is one of the common and widespread domestic animals raised in the area aside from pig/hog (*Sus domesticus*). Small scale poultry farming is seen in Brgy. Sabutan and Tibig in Silang, Cavite. Chickens are raised not only as a source of meat but also of eggs. Backyard gamecocks or fighting cocks breeding is also observed.

Roosters and hens (*Gallus gallus*) are often seen wandering around scrabbling for food even after the owners have just fed them. As a member of farm animals, native hens (female) in the area are bred for sustenance, whose meat has been known to be tastier than the commercial breed.

Domestic goat (*Capra aegagrus hircus*) is a subspecies of goat domesticated from the wild goat of southwest Asia and Eastern Europe. It is a member of the family Bovidae and is closely related to the sheep as both are in the goat-antelope subfamily Caprinae. In the project area, goats are usually kept for sustenance or up to some extent for commercial purposes.

Pigeon fanciers in the area keep domestic pigeons simply for recreation. Though pigeon flying is not a popular sport, breeding of pigeons (*Columba livia f. domestica*) merely provide the breeders with some form of enjoyment. Trained domestic pigeons which are common in the study area are able to return to their home loft if released at a location that they have never visited before and that may be up to 1,000 km away.

## 2.2 THE WATER

### 2.2.1 River Systems

There are **three (3)** main river systems draining the area traversed by the alignment. These are the: (i) *Malaking Ilog River*, (ii) *Lumbia River*, and (iii) *Malindig River*. Malaking Ilog is an almost N-S trending, steeply incised river with upstream portions draining the Tagaytay highlands, into the downstream catchment areas in GMA, Cavite. Lumbia and Malindig are being fed by numerous tributaries, and drain the hilly areas of Silang from the southwest, into the lowland areas of Sta. Rosa and Biñan, on the northeast.

### 2.2.2 Water Quality

Baseline water quality sampling was undertaken at **three (3)** selected rivers crossed by the proposed CALA Expressway alignment to establish the physico- chemical properties of the waterways that may be affected by the project. Water sampling Sta. 1, Malaking Ilog River is located in Brgy. Sabutan, Silang, Cavite. Sampling Sta. 2, Lumbia River is located in Santo Domingo, Santa Rosa City, Laguna, and the third sampling station, Sta. 3 Malindig River is sited in under the bridge along Laguna Blvd. separating the Cities of Santa Rosa and Biñan. **Figure 2.2.2-1** shows the location of the water sampling sites.

Laboratory results showed that the detected Total Coliform content from **all water samples exceeded** the DENR Standard of **5,000 MPN/100 ml**. Among the samples, the one obtained from the Malindig River exhibits the highest coliform content of **160,000 MPN/100 ml**. This followed by the sample from Lumbia River with **24, 000 MPN/100 ml**. The least amount was measured from the sample collected from Malaking Ilog River (**17, 000 MPN/100 ml**). Some of the known sources of coliform bacteria include agricultural run-off, effluent from septic systems sewage discharge, and infiltration of domestic animal fecal matter.

All water samples contain the same amount of lead. The value detected is **less than 0.01 mg/L**, and is well within standard limit of **not more than 0.05 mg/L**. Dissolved oxygen (DO) levels measured ranged from **6.2-7.7 mg/L**. These values are within the required DENR Standard of not less than **5.0 mg/L**. The observed total suspended solids (TSS)

levels of the samples is between **4.5-10.2 mg/L**, while the 5-day day BOD range is **1.1-2.2 mg/L**. Conductivity at **25°C** varies between **314 µ/cm** to **370 µ/cm**.

Physically, the rivers are clear and water is freely flowing. The pH level range is between **6.9-8.0**, which is within the desirable limit to provide protection for the life of freshwater fish and bottom dwelling invertebrates. Water temperature of Lumbia River (**28°C**) is relatively warmer compared to the Malaking Ilog and Lumbia Rivers (**23°C** and **24°C**, respectively). The disparity is probably due to the difference in the time of sampling.

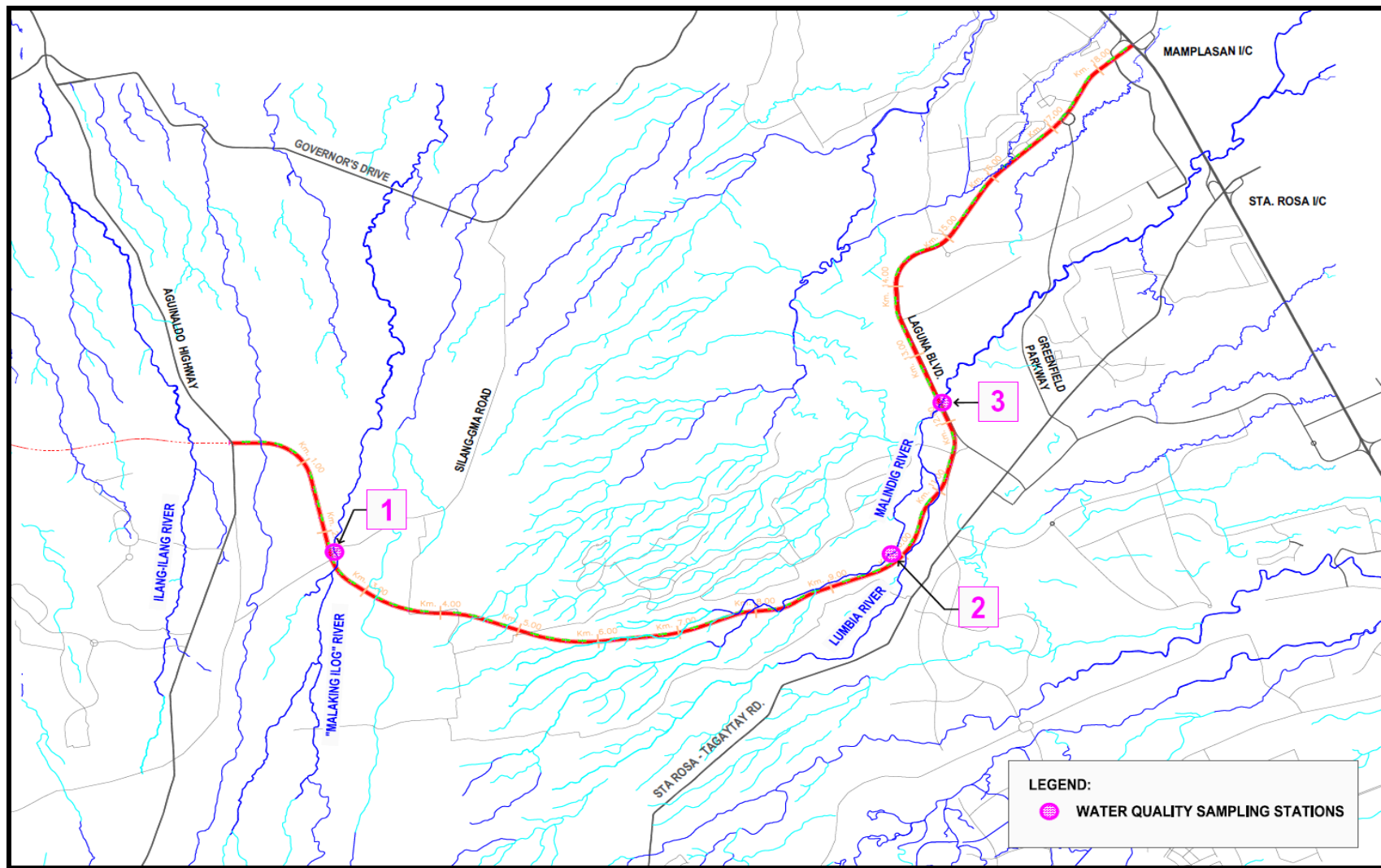


Figure 2.2.2-1 Water Quality Sampling Sites along the Proposed CALA Expressway Alignment

| Table 2.2.2-1 Physico-Chemical Properties of Selected Waterways Along the Proposed CALA Expressway        |                         |                                |                  |                          |           |                                       |             |                                     |                               |                                       |                     |
|-----------------------------------------------------------------------------------------------------------|-------------------------|--------------------------------|------------------|--------------------------|-----------|---------------------------------------|-------------|-------------------------------------|-------------------------------|---------------------------------------|---------------------|
| Sampling Station & Location                                                                               | Date & Time of Sampling | Geographic Coordinates         | Parameters       |                          |           |                                       |             |                                     |                               |                                       |                     |
|                                                                                                           |                         |                                | pH               | Temp (°C)                | Turbidity | TSS (mg/L)                            | Lead (mg/L) | Total Coliform                      | Dissolved Oxygen              | 5-Day 20°C BOD                        | Conductivity @ 25°C |
| <b>Sta.1</b><br><b>Malaking Ilog River,</b><br>(Brgy. Kaong, Silang, Cavite)                              | 19 Jan. 2012<br>11:58   | N 14°14'35"<br>E120°59'09.5"   | 8.0              | 23                       | Clear     | 4.5                                   | < 0.01      | <b>17,000</b><br><b>MPN/100 mL</b>  | 7.7 mg/L                      | 1.1 mg/L                              | 314 µ/cm            |
| <b>Sta. 2</b><br><b>Lumbia River</b><br>(Brgy. Sto. Domingo, Sta. Rosa City, Laguna)                      | 19 Jan. 2012<br>13:49   | N 14°14'20.3"<br>E120°02'59.9" | 7.6              | 28                       | Clear     | 10.2                                  | < 0.01      | <b>24,000</b><br><b>MPN/100 mL</b>  | 7.3 mg/L                      | 1.3 mg/L                              | 356 µ/cm            |
| <b>Sta.3</b><br><b>Malindig River</b><br>(Bridge along Laguna Blvd. Boundary of Biñan & Sta. Rosa Cities) | 27 Jan. 2012<br>10:40   | N 14°15'45.6"<br>E121°03'17.2" | 6.9              | 24                       | Clear     | 9.8                                   | < 0.01      | <b>160,000</b><br><b>MPN/100 mL</b> | 6.2 mg/L                      | 2.2 mg/L                              | 370 µ/cm            |
| <b>DENR Standards for Class "C" Waters</b>                                                                |                         |                                | <b>6.5 - 8.5</b> | <b>Max. 3°C increase</b> |           | <b>Not more than 30 mg/L increase</b> | <b>0.05</b> | <b>5,000 MPN/100 mL</b>             | <b>Not less than 5.0 mg/L</b> | <b>Not more than 20 mg/L increase</b> | <b>—</b>            |



**Plate No. 15** On-site pH measurement of the water sample collected from Malaking Ilog River (**Sta. 1**).



**Plate No. 16** Water sample collection at water sampling **Sta. 2**, Lumbia River on 19 January 2012.



**Plate No. 17** Temperature measurement of sample collected from Malindig River, **Sta. 3** using a laboratory thermometer.

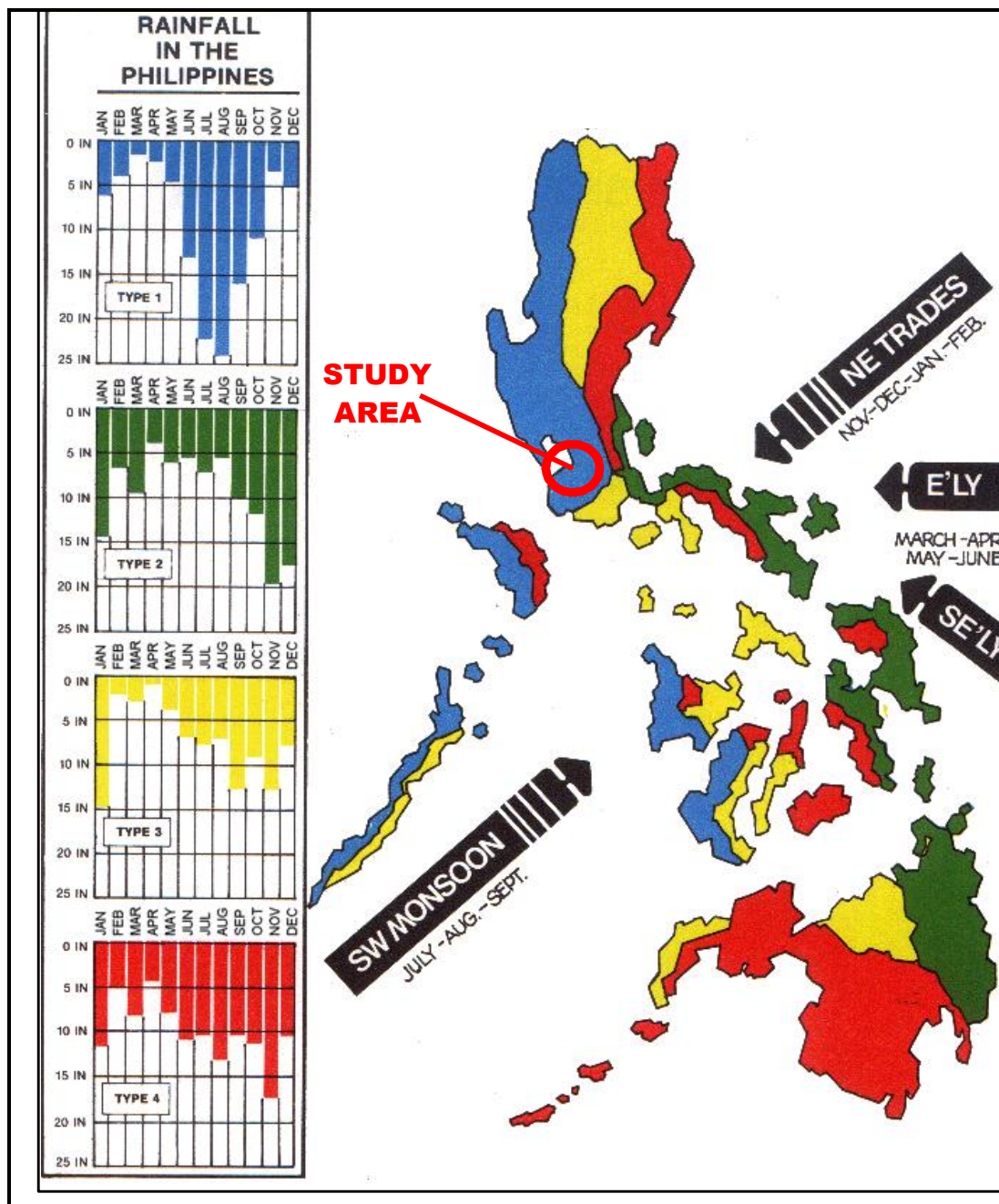
## **2.3 THE AIR**

### **2.3.1 Meteorology**

The nearest synoptic meteorological stations in the study area are **NAS UPLB Los Baños, Laguna**, on the north and **Sangley Point, Cavite City** on the south.

The Philippines has **four (4)** recognized climate types which are based on rainfall distribution. According to the Modified Corona Classification, climate pattern in the study area belongs to **Type 1**. This climate type is characterized by **two (2)** distinct seasons: dry from November to April, and wet during the rest of the year. Maximum rain period is expected from June to September.

**Figure 2.3.1-1** presents the climate map of the Philippines.



**Figure 2.3.1-1 Climate Map of the Philippines**

- Type I:** There are two pronounced seasons: The dry season (from November to April) and wet season (rest of the year).
- Type II:** There is no dry season under this classification, with a very pronounced rainfall from November to January.
- Type III:** Seasons are not very pronounced. It is relatively dry from November to April, and wet during the rest of the year.
- Type IV:** Rainfall is more or less evenly distributed throughout the year under this classification.

### 2.3.1.1 Rainfall

The summer monsoon brings heavy rains in the study area from May to October. Monsoon rains, although hard and drenching, are not normally associated with high winds and waves. The annual rainfall can be highly attributed to tropical cyclones that enter the Philippine Area of Responsibility (PAR) – the designated area assigned to the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) to monitor during weather disturbances.

The climatological normal values presented in **Table 2.3.1-1a** show that the Municipality of Silang and the entire Province of Cavite receive an annual rainfall of **2078.4 mm**. During the rainy months of June to October, the average rainfall recorded is **342.1 mm**. The month of August recorded the highest amount of rainfall of **457.2 mm** and the most number of rainy days of **21**. Occasional shower is also experienced during the summer month of March. The amount of rainfall recorded is during this time is **9.4 mm**.

As can be deciphered from **Table 2.3.1-1b**, the recorded average rainfall from June to November in the Cities of Santa Rosa and Biñan, Laguna is **257.6 mm**. The month of October yields the highest amount of rainfall of **321.4 mm**, while the most number of rainy days was recorded in July, with **21 days**. During the month of March, the western part of Laguna experiences very few rainy days of **6**. Minimal amount of rainfall of **26.3 mm** is recorded during the heart month of February.

### 3.3.1.2 Temperature

Moderately warm temperature is felt in in Santa Rosa and Biñan Cities from March to November. The weather station located at NAS UPLB, Los Baños, Laguna measured that the maximum temperature felt in both cities ranged from **30.8°C** to **34.5°C**, while the minimum temperature recorded ranged between **22.0°C** to **24.1°C**. During the summer months of March to May in Silang, from a cool **24.6°C** the temperature can heat up to a scorching **34.4°C**. From March to November the maximum temperature range is between **31.1°C** to **34.4°C**.

The study area will take a break from the warm weather and experience cooler temperature when the easterly winds begin to blow starting from December and lasting up to February. The recorded average mean temperature between these months in Silang is **26.9°C**, while the Cities of Santa Rosa and Biñan is **25.7°C**. Comparatively, cooler weather is felt in Santa Rosa and Biñan than in Silang during From March to November.

#### 2.3.1.3 Relative Humidity

Moisture content of the atmosphere in the whole study area is at its highest in the months of August and December, with **83%** and **84%**, respectively. On the contrary, Silang experiences a low humidity of **71%** in April. Similarly, Santa Rosa and Biñan Cities have a low humidity of **76%** in April and May. The annual relative humidity in the Cavite area is **78%**, while Santa Rosa and Biñan have an annual relative humidity of **81%**.

#### 2.3.1.4 Tropical Cyclones (Typhoons)

The Philippines sit astride the typhoon belt, and the country suffers an annual onslaught of dangerous storms from July through October. These are especially hazardous for northern and eastern Luzon and the Bicol and Eastern Visayas regions, but Manila gets devastated periodically as well.

Typhoon is locally termed as “*Bagyo*”. Statistics from PAGASA showed that from 1948 to 2004, around an average of **20** storms and/or typhoons per year enter the PAR. In 1993, a record 19 typhoons made landfall in the country making it the most in one year. Historically, the deadliest tropical cyclone to impact the Philippines was “Uring” (Tropical Storm Thelma) which caused floods that killed thousands of people in 1991.

Typhoons are categorized into **four (4)** types according to its wind speed by the PAGASA. All tropical cyclones, regardless of strength, are named by PAGASA.

- Tropical Depressions have maximum sustained winds of between 55 kilometres per hour (30 kn) and 64 kilometres per hour (35 kn) near its center;
- Tropical Storms have maximum sustained winds of 65 kilometres per hour (35 kn) and 119 kilometres per hour (64 kn);
- Typhoons achieve maximum sustained winds of 120 kilometres per hour (65 kn) to 185 kilometres per hour (100 kn); and
- Super typhoons having maximum winds exceeding 185 kilometres per hour (100 kn)

#### 2.3.1.5 Wind

East Southeasterly (ESE) winds prevail in the Province of Cavite during the months of October through June. It has a recorded wind speed of **3 m/s**. Westerly winds on the other hand prevail from July to September.

In Laguna, the northeasterly winds prevail from November through May with a measured wind speed of **2 m/s**. The easterly winds meanwhile prevail during the months of June through October.

**Table 2.3.1-1a Climatological Normal Values**

**Station Name:** Sangley Point, Cavite City  
**Period:** 1981-2010  
**Latitude:** 14.5 N  
**Longitude:** 120.9 E  
**Elevation:** 3.0 m

| MONTH         | RAINFALL      |            | TEMPERATURE  |              |             |               |               |                | Vapor Pressure (MBS) | Relative Humidity (%) | Mean Sea Level Pres (mbs) | WIND              |             | Cloud Amount (okta) | Number of Days with |            |
|---------------|---------------|------------|--------------|--------------|-------------|---------------|---------------|----------------|----------------------|-----------------------|---------------------------|-------------------|-------------|---------------------|---------------------|------------|
|               | Amount (mm)   | No. Of RD  | Maximum (°C) | Minimum (°C) | Mean (°C)   | Dry Bulb (°C) | Wet Bulb (°C) | Dew Point (°C) |                      |                       |                           | Direction (16 pt) | Speed (mps) |                     | Thunder storm       | Lightning  |
| JAN           | 16.9          | 4          | 30.0         | 23.3         | 26.6        | 26.8          | 23.9          | 22.8           | 27.7                 | 79                    | 1012.5                    | ESE               | 3           | 5                   | 0                   | 0          |
| FEB           | 11.1          | 2          | 30.8         | 23.6         | 27.2        | 27.4          | 24.1          | 22.9           | 27.7                 | 76                    | 1012.7                    | ESE               | 3           | 5                   | 0                   | 0          |
| MAR           | 9.4           | 2          | 32.7         | 24.6         | 28.6        | 28.7          | 25.0          | 23.7           | 29.1                 | 74                    | 1012.1                    | ESE               | 3           | 4                   | 1                   | 1          |
| APR           | 18.5          | 2          | 34.4         | 25.9         | 30.1        | 30.3          | 26.0          | 24.6           | 30.6                 | 71                    | 1010.5                    | ESE               | 3           | 4                   | 2                   | 5          |
| MAY           | 139.1         | 9          | 34.1         | 26.1         | 30.1        | 30.3          | 26.5          | 25.3           | 32.0                 | 74                    | 1008.8                    | ESE               | 3           | 5                   | 11                  | 16         |
| JUNE          | 264.5         | 15         | 32.8         | 25.8         | 29.3        | 29.5          | 26.4          | 25.4           | 32.3                 | 78                    | 1008.4                    | ESE               | 3           | 6                   | 14                  | 18         |
| JULY          | 422.4         | 20         | 31.7         | 25.3         | 28.5        | 28.6          | 26.0          | 25.1           | 31.8                 | 81                    | 1008.0                    | W                 | 3           | 6                   | 16                  | 17         |
| AUG           | 457.2         | 21         | 31.3         | 25.2         | 28.3        | 28.2          | 25.8          | 25.0           | 31.5                 | 83                    | 1007.6                    | SW                | 3           | 7                   | 13                  | 14         |
| SEP           | 341.8         | 19         | 31.4         | 25.2         | 28.3        | 28.4          | 25.9          | 25.1           | 31.7                 | 82                    | 1008.4                    | W                 | 3           | 6                   | 15                  | 16         |
| OCT           | 224.3         | 15         | 31.4         | 25.3         | 28.4        | 28.4          | 25.8          | 24.9           | 31.4                 | 81                    | 1009.3                    | ESE               | 3           | 6                   | 9                   | 14         |
| NOV           | 110.5         | 11         | 31.1         | 25.0         | 28.1        | 28.1          | 25.3          | 24.3           | 30.3                 | 80                    | 1010.4                    | ESE               | 3           | 6                   | 4                   | 5          |
| DEC           | 62.7          | 7          | 30.0         | 23.9         | 27.0        | 27.1          | 24.3          | 23.3           | 28.4                 | 79                    | 1011.9                    | ESE               | 3           | 5                   | 1                   | 1          |
| <b>ANNUAL</b> | <b>2078.4</b> | <b>127</b> | <b>31.8</b>  | <b>24.9</b>  | <b>28.4</b> | <b>28.5</b>   | <b>25.4</b>   | <b>24.4</b>    | <b>30.4</b>          | <b>78</b>             | <b>1010.1</b>             | <b>ESE</b>        | <b>3</b>    | <b>5</b>            | <b>86</b>           | <b>107</b> |

Source: PAGASA, 2012

**Table 2.3.1-1b Normal Values**

**Station Name:** NAS, UPLB, LOS BANOS, LAGUNA  
**Period:** 1977-2003  
**Latitude:** 14°17' N  
**Longitude:** 121°25' E  
**Elevation:** m

| MONTH         | RAINFALL      |            | TEMPERATURE  |              |             |               |               |                | Vapor Pressure (MBS) | Relative Humidity (%) | Mean Sea Level Pres (mbs) | WIND              |             | Cloud Amount (okta) | Number of Days with |           |
|---------------|---------------|------------|--------------|--------------|-------------|---------------|---------------|----------------|----------------------|-----------------------|---------------------------|-------------------|-------------|---------------------|---------------------|-----------|
|               | Amount (mm)   | No. Of RD  | Maximum (°C) | Minimum (°C) | Mean (°C)   | Dry Bulb (°C) | Wet Bulb (°C) | Dew Point (°C) |                      |                       |                           | Direction (16 pt) | Speed (mps) |                     | Thunder storm       | Lightning |
| JAN           | 39.0          | 11         | 29.6         | 21.3         | 25.5        | 24.9          | 22.7          | 21.8           | 26.3                 | 83                    | N.A.                      | E                 | 2           | 5                   | N.A.                | N.A.      |
| FEB           | 26.3          | 7          | 30.6         | 21.2         | 25.9        | 25.3          | 22.9          | 21.9           | 26.4                 | 81                    | N.A.                      | NE                | 2           | 5                   | N.A.                | N.A.      |
| MAR           | 38.8          | 6          | 32.3         | 22.0         | 27.1        | 26.8          | 23.8          | 22.7           | 27.6                 | 78                    | N.A.                      | NE                | 2           | 4                   | N.A.                | N.A.      |
| APR           | 41.8          | 7          | 34.2         | 23.3         | 28.8        | 26.8          | 25.1          | 24.0           | 29.8                 | 76                    | N.A.                      | NE                | 2           | 4                   | N.A.                | N.A.      |
| MAY           | 125.8         | 12         | 34.5         | 24.1         | 29.3        | 29.4          | 26            | 24.9           | 31.5                 | 76                    | N.A.                      | NE                | 2           | 4                   | N.A.                | N.A.      |
| JUNE          | 212.4         | 18         | 33.4         | 24.0         | 28.7        | 28.6          | 25.9          | 25.0           | 31.8                 | 81                    | N.A.                      | E                 | 2           | 5                   | N.A.                | N.A.      |
| JULY          | 308.0         | 21         | 32.4         | 23.6         | 28.0        | 27.8          | 25.5          | 24.7           | 31.2                 | 83                    | N.A.                      | E                 | 2           | 6                   | N.A.                | N.A.      |
| AUG           | 250.7         | 19         | 32.3         | 23.7         | 28.0        | 27.8          | 25.4          | 24.5           | 30.8                 | 82                    | N.A.                      | SW                | 3           | 6                   | N.A.                | N.A.      |
| SEP           | 228.3         | 19         | 32.2         | 23.5         | 27.8        | 27.7          | 25.4          | 24.6           | 30.9                 | 83                    | N.A.                      | E                 | 2           | 6                   | N.A.                | N.A.      |
| OCT           | 321.4         | 20         | 31.6         | 23.4         | 27.5        | 27.2          | 25.0          | 24.2           | 30.3                 | 83                    | N.A.                      | E                 | 2           | 6                   | N.A.                | N.A.      |
| NOV           | 224.7         | 20         | 30.8         | 23.1         | 26.9        | 26.7          | 24.5          | 23.7           | 29.4                 | 83                    | N.A.                      | NE                | 2           | 6                   | N.A.                | N.A.      |
| DEC           | 153.0         | 16         | 29.4         | 22.1         | 25.8        | 25.4          | 23.2          | 22.4           | 27.2                 | 84                    | N.A.                      | NE                | 2           | 6                   | N.A.                | N.A.      |
| <b>ANNUAL</b> | <b>1970.0</b> | <b>176</b> | <b>32.0</b>  | <b>23.0</b>  | <b>27.5</b> | <b>27.2</b>   | <b>24.7</b>   | <b>23.8</b>    | <b>29.5</b>          | <b>81</b>             | N.A.                      | <b>NE</b>         | <b>2</b>    | <b>5</b>            | N.A.                | N.A.      |

Source: PAGASA, 2012

### 2.3.2 Air Quality

Ambient air quality sampling in the study area was conducted at **six (6)** selected sites to establish the existing level of air pollutants that may be influenced by the proposed CALA Expressway project. The sites chosen are those adjacent to air pollution sensitive receptor areas. Sampling was undertaken twice in a day to determine the pollutant levels during the morning and afternoon period. The sampling was done in conformity with the National Ambient Air Quality Standards (NAAQS) of the Department of Environment and Natural Resources (DENR). Locations of the air quality sampling stations are presented in **Figure 2.3.2-1**.

| <b>Table 2.3.2-1 Baseline Air Quality Sampling for the CALA Expressway</b>                                                       |                           |                                                 |                                         |                                         |
|----------------------------------------------------------------------------------------------------------------------------------|---------------------------|-------------------------------------------------|-----------------------------------------|-----------------------------------------|
| <b>Station</b>                                                                                                                   | <b>Time and Date</b>      | <b>Parameters<br/>(Concentration in µg/Ncm)</b> |                                         |                                         |
|                                                                                                                                  |                           | <b>TSP</b>                                      | <b>SO<sub>2</sub></b>                   | <b>NO<sub>2</sub></b>                   |
| <b>AQL1</b><br>Aguinaldo Highway<br>Brgy. Biga II, Silang Cavite                                                                 | 0830-0930H<br>23 Dec 2011 | 64                                              | 29                                      | 9                                       |
|                                                                                                                                  | 1335-1435H<br>22 Dec 2011 | 72                                              | 27                                      | 11                                      |
| <b>AQL2</b><br>Along Silang-GMA Road<br>Brgy Sabutan, Silang, Cavite                                                             | 0655-0755H<br>23 Dec 2011 | 118                                             | 31                                      | 10                                      |
|                                                                                                                                  | 1402-1502H<br>22 Dec 2011 | 95                                              | 30                                      | 11                                      |
| <b>AQL3</b><br>Along Sabutan-Tibig<br>Barangay Road<br>Brgy. Tibig, Silang, Cavite                                               | 0948-1048H<br>23 Dec 2011 | 20                                              | 19                                      | 4                                       |
|                                                                                                                                  | 1647-1747H<br>22 Dec 2011 | 51                                              | 19                                      | 3                                       |
| <b>AQL4</b><br>Nuvali-Laguna Blvd<br>Near Entrance Gate of West<br>Groove Subdivision, Santo<br>Domingo, Santa Rosa City, Laguna | 1007-1107H<br>06 Feb 2012 | 119                                             | 27                                      | 7                                       |
|                                                                                                                                  | 1550-1650H<br>06 Feb 2012 | 102                                             | 25                                      | 8                                       |
| <b>AQL5</b><br>Laguna Blvd<br>Near Laguna Techno Park Gate<br>Brgy. Malamig, Biñan City, Laguna                                  | 0645-0745H<br>07 Feb 2012 | 147                                             | 29                                      | 9                                       |
|                                                                                                                                  | 1320-1420H<br>06 Feb 2012 | 102                                             | 24                                      | 6                                       |
| <b>AQL6</b><br>Mamplasan Interchange<br>Fronting Greenfields Subdivision<br>Gate, Mamplasan, Biñan, Laguna                       | 0840-0940H<br>13 Jan 2012 | 98                                              | 24                                      | 9                                       |
|                                                                                                                                  | 1300-1400H<br>13 Jan 2012 | 89                                              | 20                                      | 8                                       |
| <b>DENR Standards (1-hour Sampling Average)</b>                                                                                  |                           | <b>Not more<br/>than<br/>300 µg/Ncm</b>         | <b>Not more<br/>than<br/>340 µg/Ncm</b> | <b>Not more<br/>than<br/>260 µg/Ncm</b> |

### 2.3.2.1 Total Suspended Particulates (TSP)

Result of the monitoring undertaken at all sampling stations showed that the existing TSP levels both in the morning and in the afternoon are **well within the DENR Standard** for a 1 hour sampling period (**300 µg/Ncm**). As can be discerned from **Table 2.3.2-1**, the average TSP level observed at the sampling sites ranged from **20 µg/Ncm** to **147 µg/Ncm**, the highest of which was recorded during the morning sampling at Sta. 6 (Nuvali-Laguna Blvd). The lowest TSP level of **20 µg/Ncm** was obtained in Brgy. Tibig (Sta. 3) also during the morning sampling.

### 2.3.2.2 Gaseous Air Pollutants (SO<sub>2</sub> & NO<sub>2</sub>)

The SO<sub>2</sub> levels observed in all the sampling sites **do not exceed the required standard of the DENR (340 µg/Ncm)** for a 1 hour sampling period. In fact, the recorded concentration levels presented in **Table 2.3.2-1**, which ranged between **19 µg/Ncm** to **31 µg/Ncm** are way below the permissible limit. It can also be discerned from the **Table** that a relative higher SO<sub>2</sub> concentration levels of **31 µg/Ncm** and **30 µg/Ncm** were recorded at Sta. 2 (Brgy. Sabutan) during the morning and afternoon sampling periods, respectively.

Similarly, the measured NO<sub>2</sub> concentration levels at the **six (6)** sampling stations within the 1 hour period are **well within the DENR standard (260 µg/Ncm)**. The concentration level range is between **3 µg/Ncm** to **11 µg/Ncm**. The highest NO<sub>2</sub> concentration of **11 µg/Ncm** was recorded at Sta.1 during the afternoon monitoring period and at Sta. 2 during the morning sampling. The lowest concentration level of **3 µg/Ncm** was measured at Sta. 3 during the afternoon sampling time.

**Figure 2.3.2-2** illustrates the graphical output of the measured air quality for the all the sampling stations.

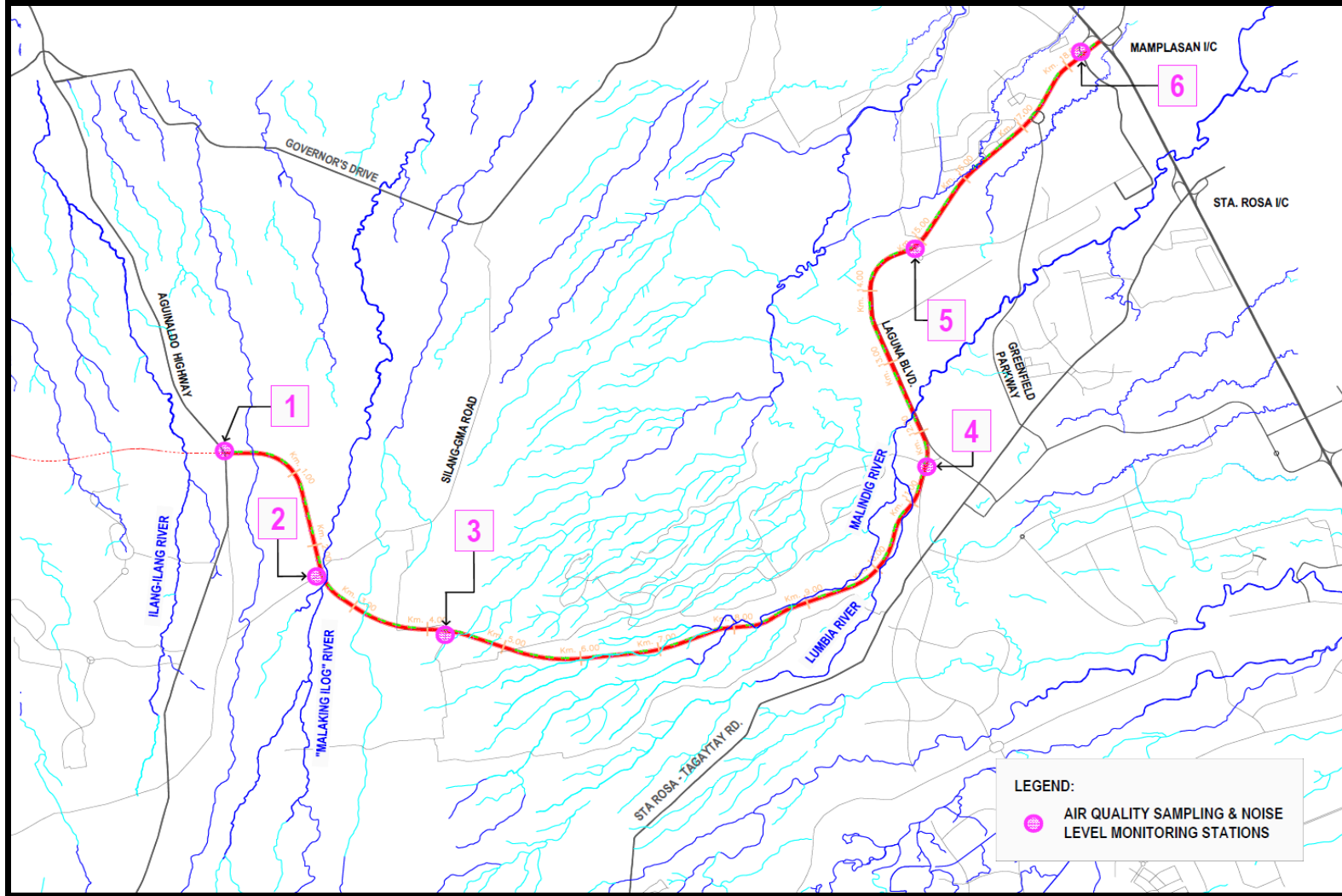


Figure 2.3.2-1 Air Quality and Noise Level Sampling Map

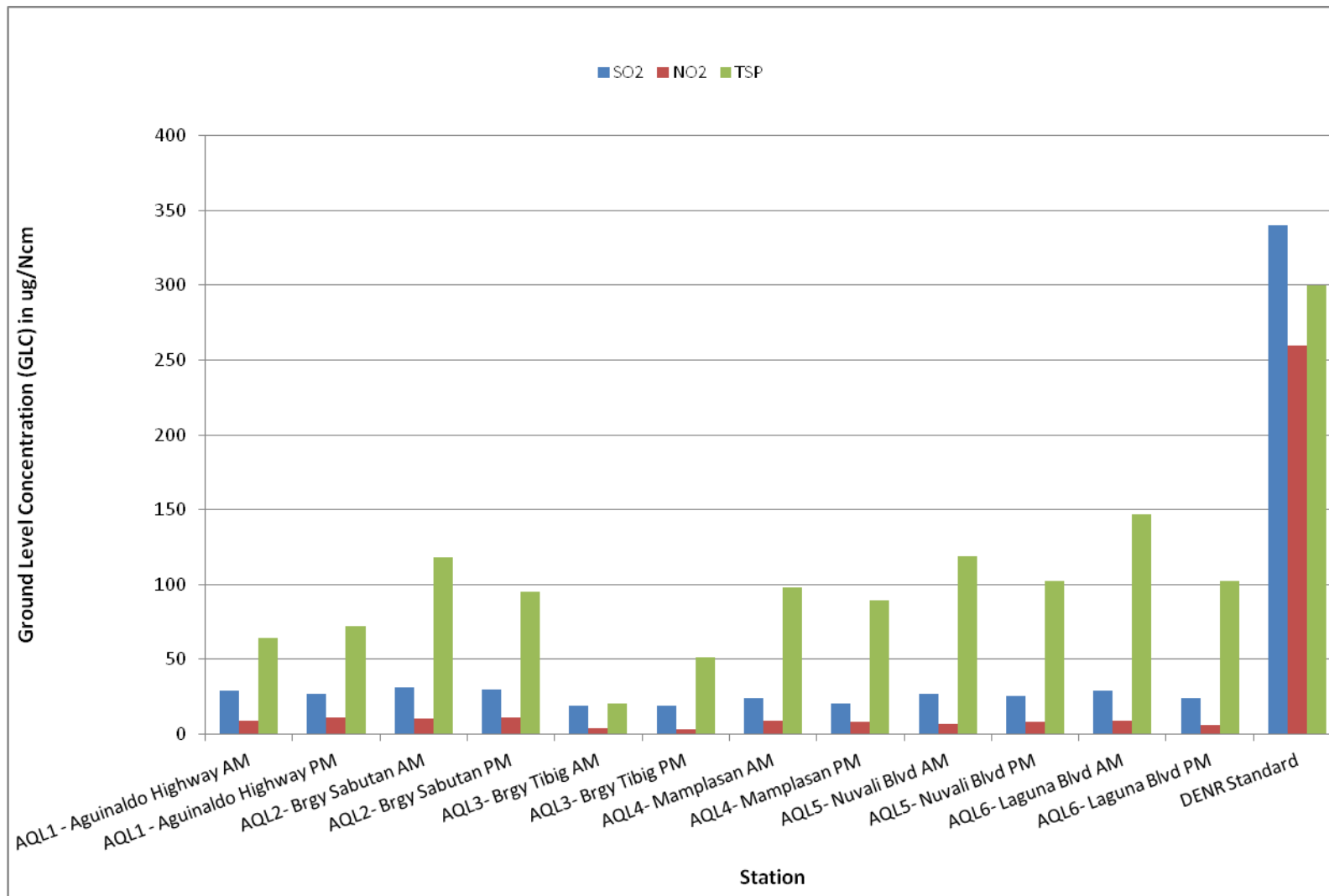


Figure 2.3.3-2 Graph of Measured Pollutants Ground Level Concentrations (GLCs) for the CALA Expressway Project

### 2.3.2.3 Air Quality Modeling

Result of the ambient air quality modeling is attached as **Appendix A**.



**Plate No. 18** Ambient TSP level sampling along E. Aguinaldo Highway, Brgy. Biga II, Silang, Cavite (**Sta. 1**) using a Staplex High-Volume Sampler (indicated by the red marking).



**Plate No. 19** Sulfur Dioxide (SO<sub>2</sub>) and Nitrogen Dioxide (NO<sub>2</sub>) level measurement at the residential area along Silang-GMA Road in Brgy. Sabutan, Silang Cavite (**Sta. 2**) on 22 December 2011.



**Plate No. 20** TSP level monitoring along the Sabutan-Tibig Road (**Sta. 3**) in Brgy. Tibig, Silang, Cavite on 22 & 23 December 2011.



**Plate No. 21** Afternoon TSP level monitoring along the Nuvali-Laguna Boulevard, Brgy. Santo Domingo, Sta. Rosa City, Laguna, **Sta. 4**.



**Plate No. 22** Morning and afternoon SO<sub>2</sub> and NO<sub>2</sub> level measurement at **Sta. 5**, Laguna Boulevard.



**Plate No. 23** Morning SO<sub>2</sub> and NO<sub>2</sub> level measurement at **Sta. 6**, Brgy. Mamplasan, Biñan City, Laguna on 13 January 2012.

### 2.3.3 Noise Level

Monitoring of the ambient noise level along the noise sensitive receptor areas traversed by the proposed CALA Expressway alignment was concurrently undertaken with the air quality sampling. Both monitoring activities were conducted at the same sampling sites (please refer back to **Figure 2.3.2-1**).

Noise levels within a 30-second average period using a Center 322 Datalogging sound level meter on A-weighting scale. Noise averaging was performed during morning time (5:00-9:00 AM), daytime (9:00 AM-6:00 PM), evening time (6:00-10:00 PM), and nighttime (10:00 PM-5:00 AM). The noise standards utilized are categories Class B and Class C. **Class B** is “A section which is primarily use for commercial purposes”, while **Class C** “A section which is primarily reserved as a light industrial area”.

#### 2.3.3.1 Ambient Noise Level

Generally, the recorded average noise levels at the sampling sites established along the proposed alignment are **typical for an urban area** due to the relatively significant traffic volume.

Unsurprisingly, the highest noise levels for all monitoring time periods were recorded at Sta. 2, exceeding the DENR standards for both categories. This can be attributed primarily to the significant traffic volume plying the E. Aguinaldo Highway. As shown in **Table 3.3.1-1**, the observed noise levels at Sta. 1 are **80.8 dBA** (daytime), **74.0 dBA** (morning), **70.1 dBA** (evening), and **66.2 dBA** (nighttime)

On the contrary, noise levels recorded at **Sta. 3** during the morning time, daytime, evening time, and nighttime periods are within the DENR standards for both Class B and C categories. At the said station, the average noise level measured are **52.4 dBA** (morning), **52.6 dBA** (daytime), **54.9 dBA** (evening), and **47.6 dBA** (nighttime).

A closer look at the **Table** will show that the nighttime noise level measured at Sta. 2, 4, 5 are still within the permissible limits for both categories. The nighttime noise level recorded ranges between **49.6-60.0 dBA**. It can in also be discerned that the daytime noise levels measured at Sta. 2 (**59.6 dBA**) and Sta. 4 (**63.6 dBA**) are within the permissible limits. The average evening time noise level observed at Sta. 2 (**59.4 dBA**), Sta. 3 (**54.9 dBA**), and Sta. 6 (**55.6 dBA**), are within the DENR standards of **60 dBA** and **65 dBA** for Class B and Class C categories, respectively.

| Table 2.3.3-1 Observed Ambient Noise Level at the Selected Sampling Sites Along the Proposed CALA Expressway Alignment (1/2) |                   |                                                |                              |                |           |
|------------------------------------------------------------------------------------------------------------------------------|-------------------|------------------------------------------------|------------------------------|----------------|-----------|
| Sampling Location                                                                                                            | Monitoring Period | Date & Time                                    | Average Noise Level (in dBA) | NPCC Standards |           |
|                                                                                                                              |                   |                                                |                              | Class B*       | Class C** |
| Sta. 1<br>Aguinaldo Highway<br>Brgy. Biga II, Silang Cavite                                                                  | Morning           | 23 December 2011<br>5:03:48-6:08:18 AM         | 74.0                         | 60             | 65        |
|                                                                                                                              | Daytime           | 23 December 2011<br>10:44:25-11:48:55 AM       | 80.8                         | 65             | 70        |
|                                                                                                                              | Evening           | 22 December 2011<br>7:49:09-8:43:39 PM         | 70.1                         | 60             | 65        |
|                                                                                                                              | Nighttime         | 23-24 December 2011<br>11:55:05 PM-12:59:35 AM | 66.2                         | 55             | 60        |
| Sta. 2<br>Along Silang-GMA Road<br>Brgy Sabutan, Silang, Cavite                                                              | Morning           | 23 December 2011<br>7:50:01-8:54:31 AM         | 58.7                         | 60             | 65        |
|                                                                                                                              | Daytime           | 22 December 2011<br>2:04:09-3:08:39PM          | 59.6                         | 65             | 70        |
|                                                                                                                              | Evening           | 22 December 2011<br>6:31:19-7:36:09 PM         | 59.4                         | 60             | 65        |
|                                                                                                                              | Nighttime         | 22 December 2011<br>10:29:25-11:33:55 PM       | 57.5                         | 55             | 60        |
| Sta. 3<br>Along Sabutan-Tibig Barangay Road<br>Brgy. Tibig, Silang, Cavite                                                   | Morning           | 23 December 2011<br>5:03:48-6:08:18 AM         | 52.4                         | 60             | 65        |
|                                                                                                                              | Daytime           | 22 December 2011<br>3:33:46-4:38:16 PM         | 52.6                         | 65             | 70        |
|                                                                                                                              | Evening           | 22 December 2011<br>8:57:11-10:01:41 PM        | 54.9                         | 60             | 65        |
|                                                                                                                              | Nighttime         | 23 December 2011<br>1:17:26-2:21:56 AM         | 47.6                         | 55             | 60        |

**Class B\*** "A section which is primarily use for commercial purposes"

**Class C\*\*** “A section which is primarily reserved as a light industrial area”.

| <b>Table 2.3.3-1 Observed Ambient Noise Level at the Selected Sampling Sites Along the Proposed CALA Expressway Alignment (2/2)</b> |                   |                                         |                              |                |           |
|-------------------------------------------------------------------------------------------------------------------------------------|-------------------|-----------------------------------------|------------------------------|----------------|-----------|
| Sampling Location                                                                                                                   | Monitoring Period | Date & Time                             | Average Noise Level (in dBA) | NPCC Standards |           |
|                                                                                                                                     |                   |                                         |                              | Class B*       | Class C** |
| Sta. 4<br>Nuvali-Laguna Blvd<br>Near Entrance Gate of West Groove Subdivision, Santo Domingo, Santa Rosa City, Laguna               | Morning           |                                         | 69.4                         | 60             | 65        |
|                                                                                                                                     | Daytime           | 06 January 2012<br>10:21:17-11:25:47 AM | 66.4                         | 65             | 70        |
|                                                                                                                                     | Evening           | 06 January 2012<br>6:05:17-7:09:47 PM   | 55.6                         | 60             | 65        |
|                                                                                                                                     | Nighttime         | 07 January 2012<br>1:02:25-2:06:55 AM   | 51.5                         | 55             | 60        |
| Sta. 5<br>Laguna Blvd<br>Near Laguna Techno Park Gate Brgy. Malamig, Biñan City, Laguna                                             | Morning           |                                         | 64.5                         | 60             | 65        |
|                                                                                                                                     | Daytime           | 06 January 2012<br>2:28:54-3:33:24 PM   | 63.6                         | 65             | 70        |
|                                                                                                                                     | Evening           | 06 January 2012<br>7:21:54-8:26:24 PM   | 70.6                         | 60             | 65        |
|                                                                                                                                     | Nighttime         | 07 January 2012<br>11:43:11-12:47:41 AM | 49.6                         | 55             | 60        |
| Sta. 6<br>Mamplasan Interchange<br>Fronting Greenfields Subdivision Gate, Mamplasan, Biñan City, Laguna                             | Morning           | 13 January 2012<br>7:24:49–8:29:19 AM   | 63.8                         | 60             | 65        |
|                                                                                                                                     | Daytime           | 13 January 2012<br>12:05:10-1:09:40 PM  | 68.1                         | 65             | 70        |
|                                                                                                                                     | Evening           | 06 January 2012<br>8:51:46-9:56:16 PM   | 63.1                         | 60             | 65        |
|                                                                                                                                     | Nighttime         | 06 January 2012<br>10:10:46-11:15:16 PM | 60.0                         | 55             | 60        |

**Class B\*** “A section which is primarily use for commercial purposes”

**Class C\*\*** “A section which is primarily reserved as a light industrial area”

### 2.3.3.2 Noise Level Modeling

Please refer to **Appendix B** for the result of the noise level modeling conducted in the study area.



**Plate No. 24** Daytime noise level monitoring at sampling **Sta. 1**.



**Plate No. 25** Morning time noise level measurement in Brgy. Sabutan, Silang, Cavite (**Sta. 2**).



**Plate No. 26** Daytime noise level monitoring using a portable **Noise Meter** at sampling **Sta. 3**, Brgy. Tibig, Silang, Cavite.



**Plate No. 27** Daytime noise level monitoring along the Nuvali-Laguna Blvd. (**Sta. 4**), Sta. Rosa City, Laguna.



**Plate No. 28** Noise level monitoring at sampling **Sta. 5**, Laguna Boulevard, Brgy. Malamig, Biñan City, Laguna.



**Plate No. 29** Daytime time noise level monitoring in Brgy. Mamplasan, Biñan City, Laguna.

## 2.4 THE PEOPLE

### 2.4.1 Socio-Economic Survey

Socioeconomic survey of project-affected persons was conducted from February 22, 2012 to March 14, 2012. **Four (4)** types of PAPs were interviewed, namely:

- **Type A** - Residential Structure Owner;
- **Type B** - those whose farm land would be affected (landowner/tenant and free occupation of land with permit)
- **Type C** is for Secondary Impact Areas (i.e. youth sector, aged sector, business sector, transport group, residential, women's and NGO/POs); and
- **Type D** for Big Land Developers & Real Estate Companies (the team had a hard time in interviewing Type D respondents due to company protocol).

Presented below are basic demographic data followed by an assessment of the affected persons' socio-economic status. Their standard of living and socio-economic status are evaluated using the following data and indicators:

- (i) demography and basic information;
- (ii) primary and secondary source of income;
- (iii) household income and expenditures;
- (iv) type of ownership of structure occupied; and
- (v) type of lighting, water supply and sanitation

#### 2.4.1.1 Demography and Basic Information

##### Household Population

The household population of respondents is presented in **Table 2.4.1-1**. There is a total of **32** residential structure owner-respondents (Type A) and **31** landowner/tenant/free occupation with permit respondents (Type B). It can be discerned from said table that for both types, there are **more than one household** per dwelling structure; i.e., **Type A – 32 respondents with 44 households**, and **Type B respondents – 31 respondents with 47 households**.

**Table 2.4.1-1 Household Population of PAPs Interviewed**

| Municipality/Barangay                                                                            |         | No. of Respondents | Number of HH <sup>a</sup> | Population |        | Total |
|--------------------------------------------------------------------------------------------------|---------|--------------------|---------------------------|------------|--------|-------|
|                                                                                                  |         |                    |                           | Male       | Female |       |
| Type A - Residential/Household Structure                                                         |         |                    |                           |            |        |       |
| Silang, Cavite                                                                                   | Sabutan | 14                 | 18                        | 28         | 35     | 63    |
|                                                                                                  | Kaong   | 2                  | 3                         | 8          | 5      | 13    |
|                                                                                                  | Tibig   | 11                 | 13                        | 28         | 23     | 51    |
| Biñan, Laguna                                                                                    | Timbao  | 5                  | 10                        | 15         | 21     | 36    |
| Total of Type A Respondents                                                                      |         | 32                 | 44                        | 79         | 84     | 163   |
| Type B – Farm Lands <sup>b</sup>                                                                 |         |                    |                           |            |        |       |
| Silang, Cavite                                                                                   | Sabutan | 6                  | 17                        | 12         | 21     | 33    |
|                                                                                                  | Kaong   | 2                  | 3                         | 8          | 5      | 13    |
|                                                                                                  | Tibig   | 7                  | 9                         | 19         | 19     | 38    |
|                                                                                                  | Carmen  | 16                 | 18                        | 44         | 57     | 101   |
| Total of Type B Respondents                                                                      |         | 31                 | 47                        | 83         | 102    | 185   |
| Total of Type A and B Respondents                                                                |         | 63                 | 91                        | 162        | 186    | 348   |
| Note:                                                                                            |         |                    |                           |            |        |       |
| a. There are cases where there is more than one (1) household per dwelling structure.            |         |                    |                           |            |        |       |
| b. For columns <b>shaded yellow</b> , only land will be affected; no structures to be displaced. |         |                    |                           |            |        |       |

### Household Structure

Majority of the respondents have a nuclear (54%) structure of household, 19% are living alone, 22% are family with extension and 5% sharing in one structure (Please refer to **Table 2.4.1-2**).

**Table 2.4.1-2 Households Structure of PAPs Interviewed**

| Municipality/Barangay                    |         |                   | Single | Nuclear | Extended | Joint | Total |
|------------------------------------------|---------|-------------------|--------|---------|----------|-------|-------|
| Type A - Residential/Household Structure |         |                   |        |         |          |       |       |
| Silang, Cavite                           | Sabutan | Count             | 2      | 8       | 3        | 1     | 14    |
|                                          |         | % within Barangay | 14%    | 57%     | 21%      | 7%    | 100%  |
|                                          | Kaong   | Count             | 0      | 1       | 1        | 0     | 2     |
|                                          |         | % within Barangay | 0%     | 50%     | 50%      | 0%    | 100%  |
|                                          | Tibig   | Count             | 1      | 8       | 2        | 0     | 11    |
|                                          |         | % within Barangay | 9%     | 73%     | 0%       | 0%    | 82%   |
| Biñan, Laguna                            | Timbao  | Count             | 0      | 3       | 0        | 2     | 5     |
|                                          |         | % within Barangay | 0%     | 60%     | 0%       | 0%    | 60%   |
| Total of Type A Respondents              |         | Count             | 3      | 20      | 6        | 3     | 32    |
|                                          |         | % within Barangay | 9%     | 63%     | 19%      | 9%    | 100%  |
| Type B - Farm Lands                      |         |                   |        |         |          |       |       |
| Silang, Cavite                           | Sabutan | Count             | 2      | 2       | 4        | 0     | 6     |
|                                          |         | % within Barangay | 33%    | 0%      | 67%      | 0%    | 100%  |
|                                          | Kaong   | Count             | 0      | 1       | 1        | 0     | 2     |
|                                          |         | % within Barangay | 0%     | 50%     | 50%      | 0%    | 100%  |
|                                          | Tibig   | Count             | 2      | 5       | 0        | 0     | 7     |
|                                          |         | % within Barangay | 29%    | 71%     | 0%       | 0%    | 100%  |
|                                          | Carmen  | Count             | 5      | 8       | 3        | 0     | 16    |
|                                          |         | % within Barangay | 31%    | 50%     | 19%      | 0%    | 100%  |
| Total Type B Respondents                 |         | Count             | 9      | 14      | 8        | 0     | 31    |
|                                          |         | % within Barangay | 29%    | 45%     | 26%      | 0%    | 100%  |
| Total of Type A and B Respondents        |         | Count             | 12     | 34      | 14       | 3     | 63    |
|                                          |         | % within Barangay | 19%    | 54%     | 22%      | 5%    | 100%  |

## Language

The dialect used by **95%** of the respondents is Tagalog. This is followed by “Ilocano”, “Bicolano”, and “Ilongo”. Details are shown in **Table 2.4.1-3**.

**Table 2.4.1-3 Ethno Linguistic Affiliation of the Respondents (1 of 2)**

| City/Municipality/Barangay               |         |                   | Tagalog | Ilocano | Bicolano | Ilonggo | Total |
|------------------------------------------|---------|-------------------|---------|---------|----------|---------|-------|
| Type A - Residential/Household Structure |         |                   |         |         |          |         |       |
| Silang, Cavite                           | Sabutan | Count             | 13      | 1       | 0        | 0       | 14    |
|                                          |         | % within Barangay | 93%     | 7%      | 0%       | 0%      | 100%  |
|                                          |         | Count             | 2       | 0       | 0        | 0       | 2     |
|                                          |         | % within Barangay | 100%    | 0%      | 0%       | 0%      | 100%  |
|                                          | Tibig   | Count             | 11      | 0       | 0        | 0       | 11    |
|                                          |         | % within Barangay | 100%    | 0%      | 0%       | 0%      | 100%  |
| Biñan, Laguna                            | Timbao  | Count             | 5       | 0       | 0        | 0       | 5     |
|                                          |         | % within Barangay | 100%    | 0%      | 0%       | 0%      | 100%  |
| Total                                    |         | Count             | 31      | 1       | 0        | 0       | 32    |
|                                          |         | % within Barangay | 97%     | 3%      | 0%       | 0%      | 100%  |
| Type B - Farm Lands                      |         |                   |         |         |          |         |       |
| Silang, Cavite                           | Sabutan | Count             | 5       | 0       | 1        | 0       | 6     |
|                                          |         | % within Barangay | 83%     | 0%      | 17%      | 0%      | 100%  |
|                                          | Kaong   | Count             | 2       | 0       | 0        | 0       | 2     |
|                                          |         | % within Barangay | 100%    | 0%      | 0%       | 0%      | 100%  |
|                                          | Tibig   | Count             | 7       | 0       | 0        | 0       | 7     |
|                                          |         | % within Barangay | 100%    | 0%      | 0%       | 0%      | 100%  |

**Table 2.4.1-3 Ethno Linguistic Affiliations of the Respondents (2 of 2)**

| City/Municipality/Barangay        |        |                      | Tagalog | Ilocano | Bicolano | Ilonggo | Total |
|-----------------------------------|--------|----------------------|---------|---------|----------|---------|-------|
| Type B - Farm Lands               |        |                      |         |         |          |         |       |
|                                   | Carmen | Count                | 15      | 0       | 0        | 1       | 16    |
|                                   |        | % within<br>Barangay | 94%     | 0%      | 0%       | 6%      | 100%  |
| Total Type B Respondents          |        | Count                | 29      | 0       | 1        | 1       | 31    |
|                                   |        | % within<br>Barangay | 94%     | 0%      | 3%       | 3%      | 100%  |
| Total of Type A and B Respondents |        | Count                | 60      | 1       | 1        | 1       | 63    |
|                                   |        | % within<br>Barangay | 95%     | 2%      | 2%       | 2%      | 100%  |

### Educational Attainment

The level of educational attainment of the male project affected respondents in the host cities/municipality is presented in **Table 2.4.1-4**. Majority of the male were able to finish secondary schooling. As seen from this table, **52%** of the respondents were able to finish the secondary education, **30%** primary education and **11%** successfully finished college. The **4%** has taken up vocational and postgraduate level while the remaining **3%** was not able to go to school.

**Table 2.4.1-4 Educational Attainment of Male (1 of 2)**

| City/Municipality/Barangay                      |         |                   | A   | B   | C   | D  | E  | F  | Total |
|-------------------------------------------------|---------|-------------------|-----|-----|-----|----|----|----|-------|
| <b>Type A - Residential/Household Structure</b> |         |                   |     |     |     |    |    |    |       |
| Silang, Cavite                                  | Sabutan | Count             | 4   | 8   | 2   | 0  | 0  | 0  | 14    |
|                                                 |         | % within Barangay | 29% | 57% | 14% | 0% | 0% | 0% | 100%  |
|                                                 | Kaong   | Count             | 1   | 1   | 0   | 0  | 0  | 0  | 2     |
|                                                 |         | % within Barangay | 50% | 50% | 0%  | 0% | 0% | 0% | 100%  |
|                                                 | Tibig   | Count             | 3   | 7   | 1   | 0  | 0  | 0  | 11    |
|                                                 |         | % within Barangay | 27% | 64% | 9%  | 0% | 0% | 0% | 100%  |

**Table 2.4.1-4 Educational Attainment of Male (2 of 2)**

| City/Municipality/Barangay                                                                     |         |                   | A   | B   | C   | D   | E   | F   | Total |
|------------------------------------------------------------------------------------------------|---------|-------------------|-----|-----|-----|-----|-----|-----|-------|
| Type A - Residential/Household Structure                                                       |         |                   |     |     |     |     |     |     |       |
| Biñan, Laguna                                                                                  | Timbao  | Count             | 1   | 3   | 1   | 0   | 0   | 0   | 5     |
|                                                                                                |         | % within Barangay | 20% | 60% | 20% | 0%  | 0%  | 0%  | 100%  |
| Total of Type A - Respondents                                                                  |         | Count             | 9   | 19  | 4   | 0   | 0   | 0   | 32    |
|                                                                                                |         | % within Barangay | 28% | 59% | 13% | 0%  | 0%  | 0%  | 100%  |
| Type B - Farm Lands                                                                            |         |                   |     |     |     |     |     |     |       |
| Silang, Cavite                                                                                 | Sabutan | Count             | 1   | 1   | 1   | 1   | 1   | 1   | 6     |
|                                                                                                |         | % within Barangay | 17% | 17% | 17% | 17% | 17% | 17% | 100%  |
|                                                                                                | Kaong   | Count             | 1   | 1   | 0   | 0   | 0   | 0   | 2     |
|                                                                                                |         | % within Barangay | 50% | 50% | 0%  | 0%  | 0%  | 0%  | 100%  |
|                                                                                                | Tibig   | Count             | 2   | 2   | 2   | 0   | 0   | 1   | 7     |
|                                                                                                |         | % within Barangay | 29% | 29% | 29% | 0%  | 0%  | 14% | 100%  |
|                                                                                                | Carmen  | Count             | 6   | 10  | 0   | 0   | 0   | 0   | 16    |
|                                                                                                |         | % within Barangay | 38% | 63% | 0%  | 0%  | 0%  | 0%  | 100%  |
| Total of Type B Respondents                                                                    |         | Count             | 10  | 14  | 3   | 1   | 1   | 2   | 31    |
|                                                                                                |         | % within Barangay | 32% | 45% | 10% | 3%  | 3%  | 6%  | 100%  |
| Total of Type A and B Respondents                                                              |         | Count             | 19  | 33  | 7   | 1   | 1   | 2   | 63    |
|                                                                                                |         | % within Barangay | 30% | 52% | 11% | 2%  | 2%  | 3%  | 100%  |
| Note:<br>A – Primary; B – Secondary; C – Tertiary; D – Vocational; E – Post-Graduate; F - None |         |                   |     |     |     |     |     |     |       |

Table 2.4.1-5 shows the educational attainment of women, which has majority (41%) who are able to finish secondary or high school education, seconded by 24% primary education. Female respondents who were able to finish college has a higher percentage (17%) compared to the male respondents.

**Table 2.4.1-5 Educational Attainment of Female**

| City/Municipality/Barangay                                                                     |         |                   | Primary | Secondary | Tertiary | Vocational | Post Graduate | None | Total |
|------------------------------------------------------------------------------------------------|---------|-------------------|---------|-----------|----------|------------|---------------|------|-------|
| Type A - Residential/Household Structure                                                       |         |                   |         |           |          |            |               |      |       |
| Silang, Cavite                                                                                 | Sabutan | Count             | 2       | 8         | 1        | 1          | 0             | 2    | 14    |
|                                                                                                |         | % within Barangay | 18%     | 45%       | 9%       | 9%         | 0%            | 18%  | 100%  |
|                                                                                                | Kaong   | Count             | 0       | 2         | 0        | 0          | 0             | 0    | 2     |
|                                                                                                |         | % within Barangay | 0%      | 100%      | 0%       | 0%         | 0%            | 0%   | 100%  |
|                                                                                                | Tibig   | Count             | 2       | 5         | 1        | 1          | 0             | 2    | 11    |
|                                                                                                |         | % within Barangay | 18%     | 45%       | 9%       | 9%         | 0%            | 18%  | 100%  |
| Biñan, Laguna                                                                                  | Timbao  | Count             | 1       | 3         | 1        | 0          | 0             | 0    | 5     |
|                                                                                                |         | % within Barangay | 18%     | 45%       | 9%       | 9%         | 0%            | 18%  | 100%  |
| Total of Type A Respondents                                                                    |         | Count             | 5       | 18        | 3        | 2          | 0             | 4    | 32    |
|                                                                                                |         | % within Barangay | 16%     | 56%       | 9%       | 6%         | 0%            | 13%  | 100%  |
| Type B – Farm Lands                                                                            |         |                   |         |           |          |            |               |      |       |
| Silang, Cavite                                                                                 | Sabutan | Count             | 2       | 1         | 2        | 0          | 1             | 0    | 6     |
|                                                                                                |         | % within Barangay | 33%     | 17%       | 33%      | 0%         | 17%           | 0%   | 100%  |
|                                                                                                | Kaong   | Count             | 0       | 2         | 0        | 0          | 0             | 0    | 2     |
|                                                                                                |         | % within Barangay | 0%      | 100%      | 0%       | 0%         | 0%            | 0%   | 100%  |
|                                                                                                | Tibig   | Count             | 2       | 1         | 3        | 0          | 0             | 1    | 7     |
|                                                                                                |         | % within Barangay | 29%     | 14%       | 43%      | 0%         | 0%            | 14%  | 100%  |
|                                                                                                | Carmen  | Count             | 6       | 4         | 3        | 0          | 3             | 0    | 16    |
|                                                                                                |         | % within Barangay | 38%     | 25%       | 19%      | 0%         | 19%           | 0%   | 100%  |
| Total of Type B Respondents                                                                    |         | Count             | 10      | 8         | 8        | 0          | 4             | 1    | 31    |
|                                                                                                |         | % within Barangay | 32%     | 26%       | 26%      | 0%         | 13%           | 3%   | 100%  |
| Total of Type A and B Respondents                                                              |         | Count             | 15      | 26        | 11       | 2          | 4             | 5    | 63    |
|                                                                                                |         | % within Barangay | 24%     | 41%       | 17%      | 3%         | 6%            | 8%   | 100%  |
| Note:<br>A – Primary; B – Secondary; C – Tertiary; D – Vocational; E – Post-Graduate; F - None |         |                   |         |           |          |            |               |      |       |

**Table 2.4.1-6** shows that children who were able to finish college education have a high percentage of **32%** and **50%** are still studying. Approximately **18%** of the children are out of school youth.

**Table 2.4.1-6 Education of Children**

| City/Municipality/Barangay               |         |                   | Finished College | Schooling | Out of School | Total |
|------------------------------------------|---------|-------------------|------------------|-----------|---------------|-------|
| Type A - Residential/Household Structure |         |                   |                  |           |               |       |
| Silang, Cavite                           | Sabutan | Count             | 4                | 15        | 7             | 26    |
|                                          |         | % within Barangay | 15%              | 58%       | 27%           | 100%  |
|                                          | Kaong   | Count             | 1                | 2         | 0             | 3     |
|                                          |         | % within Barangay | 33%              | 67%       | 0%            | 100%  |
|                                          | Tibig   | Count             | 2                | 5         | 2             | 9     |
|                                          |         | % within Barangay | 22%              | 56%       | 22%           | 100%  |
| Biñan, Laguna                            | Timbao  | Count             | 1                | 3         | 0             | 4     |
|                                          |         | % within Barangay | 25%              | 75%       | 0%            | 100%  |
| Total of Type A Respondents              |         | Count             | 8                | 25        | 9             | 42    |
|                                          |         | % within Barangay | 19%              | 60%       | 21%           | 100%  |
| Type B – Farm Lands                      |         |                   |                  |           |               |       |
| Silang, Cavite                           | Sabutan | Count             | 6                | 5         | 1             | 12    |
|                                          |         | % within Barangay | 50%              | 42%       | 8%            | 100%  |
|                                          | Kaong   | Count             | 1                | 2         | 0             | 3     |
|                                          |         | % within Barangay | 33%              | 67%       | 0%            | 100%  |
|                                          | Tibig   | Count             | 3                | 6         | 2             | 11    |
|                                          |         | % within Barangay | 27%              | 55%       | 18%           | 100%  |
|                                          | Carmen  | Count             | 17               | 17        | 8             | 42    |
|                                          |         | % within Barangay | 40%              | 40%       | 19%           | 100%  |
| Total of Type B Respondents              |         | Count             | 27               | 30        | 11            | 68    |
|                                          |         | % within Barangay | 40%              | 44%       | 16%           | 100%  |
| Total of Type A and B Respondents        |         | Count             | 35               | 55        | 20            | 110   |
|                                          |         | % within Barangay | 32%              | 50%       | 18%           | 100%  |

## 2.4.2 Socioeconomic Characteristics

Socioeconomic characteristics of the PAPs are described in this section based on the results of the survey conducted for Type A and B respondents. The Project-affected persons' standard of living and socioeconomic status shall be evaluated using the following indicators:

- (i) household income and expenditures;
- (ii) type and ownership of structure occupied;
- (iii) source of lighting,
- (iv) source of water supply, and
- (v) type of sanitation facilities

### 2.4.2.1 Household Income and Expenditures

The occupations of Project-affected persons interviewed primarily are farming (43%) and employment (24%). Shown on **Table 2.4.2-1** are the primary occupations of PAPs and **Table 2.4.2-2**, the secondary. These results show that majority of the affected land is agricultural land and that the main livelihood to be displaced is farm income.

**Table 2.4.2-1 Primary Occupation of PAPs (1 of 2)**

| City/Municipality/Barangay               |         |                   | Employee | Driver | Construction | Farmer | Factory Worker | Own business | OFW | Total |
|------------------------------------------|---------|-------------------|----------|--------|--------------|--------|----------------|--------------|-----|-------|
| Type A - Residential/Household Structure |         |                   |          |        |              |        |                |              |     |       |
| Silang, Cavite                           | Sabutan | Count             | 4        | 1      | 3            | 3      | 2              | 1            | 0   | 14    |
|                                          |         | % within Barangay | 29%      | 7%     | 21%          | 21%    | 14%            | 7%           | 0%  | 100%  |
|                                          | Kaong   | Count             | 0        | 0      | 0            | 2      | 0              | 0            | 0   | 2     |
|                                          |         | % within Barangay | 0%       | 0%     | 0%           | 100%   | 0%             | 0%           | 0%  | 100%  |
|                                          | Tibig   | Count             | 4        | 2      | 0            | 1      | 3              | 1            | 0   | 11    |
|                                          |         | % within Barangay | 36%      | 18%    | 0%           | 9%     | 27%            | 9%           | 0%  | 100%  |
| Biñan, Laguna                            | Timbao  | Count             | 3        | 1      | 0            | 0      | 0              | 1            | 0   | 5     |
|                                          |         | % within Barangay | 60%      | 20%    | 0%           | 0%     | 0%             | 20%          | 0%  | 100%  |
| Total of Type A                          |         | Count             | 11       | 4      | 3            | 6      | 5              | 3            | 0   | 32    |
|                                          |         | % within Barangay | 18%      | 9%     | 18%          | 27%    | 18%            | 9%           | 0%  | 100%  |

**Table 2.4.2-1 Primary Occupation of PAPs (2 of 2)**

| City/Municipality/Barangay        |         |                   | Employee | Driver | Construction | Farmer | Factory Worker | Own business | OFW | Total |
|-----------------------------------|---------|-------------------|----------|--------|--------------|--------|----------------|--------------|-----|-------|
| Type B – Farm Lands               |         |                   |          |        |              |        |                |              |     |       |
| Silang, Cavite                    | Sabutan | Count             | 2        | 1      | 0            | 2      | 0              | 0            | 1   | 6     |
|                                   |         | % within Barangay | 33%      | 17%    | 0%           | 33%    | 0%             | 0%           | 17% | 100%  |
|                                   | Kaong   | Count             | 0        | 0      | 0            | 2      | 0              | 0            | 0   | 2     |
|                                   |         | % within Barangay | 0%       | 0%     | 0%           | 100%   | 0%             | 0%           | 0%  | 100%  |
|                                   | Tibig   | Count             | 1        | 0      | 0            | 6      | 0              | 0            | 0   | 7     |
|                                   |         | % within Barangay | 14%      | 0%     | 0%           | 86%    | 0%             | 0%           | 0%  | 100%  |
|                                   | Carmen  | Count             | 1        | 0      | 0            | 12     | 2              | 1            | 0   | 16    |
|                                   |         | % within Barangay | 6%       | 0%     | 0%           | 75%    | 13%            | 6%           | 0%  | 100%  |
| Total of Type B                   |         | Count             | 4        | 2      | 0            | 21     | 2              | 1            | 1   | 31    |
|                                   |         | % within Barangay | 13%      | 6%     | 0%           | 68%    | 6%             | 3%           | 3%  | 100%  |
| Total of Type A and B Respondents |         | Count             | 15       | 6      | 3            | 27     | 7              | 4            | 1   | 63    |
|                                   |         | % within Barangay | 24%      | 10%    | 5%           | 43%    | 11%            | 6%           | 2%  | 100%  |

When asked if the Project-affected persons have other source of income aside from the primary income mentioned above, majority of them have no (52%) other income and are dependent only on farming.

**Table 2.4.2-2 Secondary Occupation of PAPs**

| City/Municipality/Barangay               |         |                   | Employee | Driver | Pensioner | Const Worker | Farmer | OFW | Own business | None | Total |
|------------------------------------------|---------|-------------------|----------|--------|-----------|--------------|--------|-----|--------------|------|-------|
| Type A - Residential/Household Structure |         |                   |          |        |           |              |        |     |              |      |       |
| Silang, Cavite                           | Sabutan | Count             | 0        | 2      | 0         | 1            | 2      | 0   | 3            | 6    | 14    |
|                                          |         | % within Barangay | 0%       | 14%    | 0%        | 7%           | 14%    | 0%  | 21%          | 43%  | 100%  |
|                                          | Kaong   | Count             | 0        | 0      | 0         | 0            | 0      | 0   | 0            | 2    | 2     |
|                                          |         | % within Barangay | 0%       | 0%     | 0%        | 0%           | 0%     | 0%  | 0%           | 100% | 100%  |
|                                          | Tibig   | Count             | 3        | 1      | 0         | 1            | 0      | 0   | 0            | 6    | 11    |
|                                          |         | % within Barangay | 27%      | 9%     | 0%        | 9%           | 0%     | 0%  | 0%           | 55%  | 100%  |
| Biñan, Laguna                            | Timbao  | Count             | 0        | 1      | 0         | 0            | 0      | 0   | 0            | 4    | 5     |
|                                          |         | % within Barangay | 0%       | 20%    | 0%        | 0%           | 0%     | 0%  | 0%           | 80%  | 100%  |
| Total of Type A                          |         | Count             | 3        | 4      | 0         | 2            | 2      | 0   | 3            | 18   | 32    |
|                                          |         | % within Barangay | 9%       | 13%    | 0%        | 6%           | 6%     | 0%  | 9%           | 56%  | 100%  |
| Type B – Farm Lands                      |         |                   |          |        |           |              |        |     |              |      |       |
| Silang, Cavite                           | Sabutan | Count             | 0        | 1      | 0         | 0            | 3      | 1   | 0            | 1    | 6     |
|                                          |         | % within Barangay | 0%       | 17%    | 0%        | 0%           | 50%    | 17% | 0%           | 17%  | 100%  |
|                                          | Kaong   | Count             | 0        | 0      | 0         | 0            | 0      | 0   | 0            | 2    | 2     |
|                                          |         | % within Barangay | 0%       | 0%     | 0%        | 0%           | 0%     | 0%  | 0%           | 100% | 100%  |
|                                          | Tibig   | Count             | 1        | 1      | 1         | 0            | 1      | 0   | 0            | 3    | 7     |
|                                          |         | % within Barangay | 14%      | 14%    | 14%       | 0%           | 14%    | 0%  | 0%           | 43%  | 100%  |
|                                          | Carmen  | Count             | 3        | 0      | 0         | 2            | 2      | 0   | 0            | 9    | 16    |
|                                          |         | % within Barangay | 19%      | 0%     | 0%        | 13%          | 13%    | 0%  | 0%           | 56%  | 100%  |
| Total of Type B                          |         | Count             | 4        | 2      | 1         | 2            | 6      | 1   | 0            | 15   | 31    |
|                                          |         | % within Barangay | 13%      | 6%     | 3%        | 6%           | 19%    | 3%  | 0%           | 48%  | 100%  |
| Total of Type A and B Respondents        |         | Count             | 7        | 6      | 1         | 4            | 8      | 1   | 3            | 33   | 63    |
|                                          |         | % within Barangay | 11%      | 10%    | 2%        | 6%           | 13%    | 2%  | 5%           | 52%  | 100%  |

**Table 2.4.2-3** shows the monthly family income bracket of the Project-affected persons interviewed, **24%** of them are earning between 6,001 to 15,000 and **22%**

have income bracket of 10,001 to 15,000. Five percent **5%** of them are earning 3,000 or less and fall below the annual food threshold for family of **four (4)** for the Provinces of Cavite and Laguna; that is, **Php46,120** and **Php43,071** respectively based on National Statistical Yearbook 2010 under Region IV-A.

**Table 2.4.2-3 Monthly Family Income (1 of 2)**

| City/Municipality/Barangay               |         |                   | 3,000 or less | 3,001 to 6,000 | 6,001 to 10,000 | 10,001 to 15,000 | 15,001 to 20,000 | 20,001 to 30,000 | 30,001 to 40,000 | 40,001 to 50,000 | 50,001 to 60,000 | 60,001 or more | TOTAL |
|------------------------------------------|---------|-------------------|---------------|----------------|-----------------|------------------|------------------|------------------|------------------|------------------|------------------|----------------|-------|
| Type A - Residential/Household Structure |         |                   |               |                |                 |                  |                  |                  |                  |                  |                  |                |       |
| Silang, Cavite                           | Sabutan | Count             | 1             | 1              | 3               | 6                | 0                | 1                | 1                | 0                | 0                | 1              | 14    |
|                                          |         | % within Barangay | 7%            | 7%             | 21%             | 43%              | 0%               | 7%               | 7%               | 0%               | 0%               | 7%             | 100%  |
|                                          | Kaong   | Count             | 0             | 0              | 0               | 1                | 0                | 0                | 0                | 0                | 0                | 1              | 2     |
|                                          |         | % within Barangay | 0%            | 0%             | 0%              | 50%              | 0%               | 0%               | 0%               | 0%               | 0%               | 50%            | 100%  |
|                                          | Tibig   | Count             | 1             | 1              | 1               | 3                | 3                | 1                | 1                | 0                | 0                | 0              | 11    |
|                                          |         | % within Barangay | 9%            | 9%             | 9%              | 27%              | 27%              | 9%               | 9%               | 0%               | 0%               | 0%             | 100%  |
| Biñan, Laguna                            | Timbao  | Count             | 0             | 0              | 2               | 0                | 1                | 0                | 0                | 1                | 0                | 1              | 5     |
|                                          |         | % within Barangay | 0%            | 0%             | 40%             | 0%               | 20%              | 0%               | 0%               | 20%              | 0%               | 20%            | 100%  |
| Total of Type A                          |         | Count             | 2             | 2              | 6               | 10               | 4                | 2                | 2                | 1                | 0                | 3              | 32    |
|                                          |         | % within Barangay | 6%            | 6%             | 19%             | 31%              | 13%              | 6%               | 6%               | 3%               | 0%               | 9%             | 100%  |
| Type B – Farm Lands                      |         |                   |               |                |                 |                  |                  |                  |                  |                  |                  |                |       |
| Silang, Cavite                           | Sabutan | Count             | 0             | 0              | 1               | 2                | 0                | 1                | 0                | 0                | 1                | 1              | 6     |
|                                          |         | % within Barangay | 0%            | 0%             | 17%             | 33%              | 0%               | 17%              | 0%               | 0%               | 17%              | 17%            | 100%  |
|                                          | Kaong   | Count             | 0             | 0              | 1               | 0                | 0                | 0                | 0                | 1                | 0                | 0              | 2     |
|                                          |         | % within Barangay | 0%            | 0%             | 50%             | 0%               | 0%               | 0%               | 0%               | 50%              | 0%               | 0%             | 100%  |
|                                          | Tibig   | Count             | 0             | 0              | 2               | 0                | 0                | 1                | 2                | 2                | 0                | 0              | 7     |
|                                          |         | % within Barangay | 0%            | 0%             | 29%             | 0%               | 0%               | 14%              | 29%              | 29%              | 0%               | 0%             | 100%  |
|                                          | Carmen  | Count             | 1             | 0              | 5               | 2                | 2                | 5                | 0                | 1                | 0                | 0              | 16    |
|                                          |         | % within Barangay | 6%            | 0%             | 31%             | 13%              | 13%              | 31%              | 0%               | 6%               | 0%               | 0%             | 100%  |
| Total of Type B                          |         | Count             | 1             | 0              | 9               | 4                | 2                | 7                | 2                | 4                | 1                | 1              | 31    |
|                                          |         | % within Barangay | 3%            | 0%             | 29%             | 13%              | 6%               | 23%              | 6%               | 13%              | 3%               | 3%             | 100%  |
| Total of Type A and B Respondents        |         | Count             | 3             | 2              | 15              | 14               | 6                | 9                | 4                | 5                | 1                | 4              | 63    |
|                                          |         | % within Barangay | 5%            | 3%             | 24%             | 22%              | 10%              | 14%              | 6%               | 8%               | 2%               | 6%             | 100%  |

**Table 2.4.2-4** shows the household expenditures. The bulk of the household expenditures comprises of food (**51%**) followed by education (**25%**). The Respondents considered that if farming will be lost from their livelihood, food security problem will arise from their displacement. They believe that having a farmland sustain their meal from planting backyard vegetables for daily consumption.

**Table 2.4.2-4 Average Annual Household Expenditures of Respondent PAPs (1 of 2)**

| Municipality/Barangay                    |         |                   | Food    | Utilities | Education | Rent  | Health | Transportation | Total   |
|------------------------------------------|---------|-------------------|---------|-----------|-----------|-------|--------|----------------|---------|
| Type A – Residential/Household Structure |         |                   |         |           |           |       |        |                |         |
| Silang, Cavite                           | Sabutan | Average           | 68,092  | 12,678    | 17,371    | 1,714 | 1,653  | 5,867          | 7,669   |
|                                          |         | % within Barangay | 64%     | 12%       | 16%       | 2%    | 2%     | 5%             | 100%    |
|                                          | Kaong   | Average           | 60,000  | 2,250     | 12,000    | 300   | 2,500  | 50,000         | 127,050 |
|                                          |         | % within Barangay | 47%     | 2%        | 9%        | 0%    | 2%     | 39%            | 100%    |
|                                          | Tibig   | Average           | 72,245  | 7,690     | 14,463    | 2,181 | 2,181  | 9,796          | 108,560 |
|                                          |         | % within Barangay | 67%     | 7%        | 13%       | 2%    | 2%     | 9%             | 100%    |
| Biñan, Laguna                            | Timbao  | Average           | 174,720 | 22,800    | 6,700     | 0     | 0      | 5,840          | 210,060 |
|                                          |         | % within Barangay | 83%     | 11%       | 3%        | 0%    | 0%     | 3%             | 100%    |
| Total of Type A                          |         | Average           | 375,057 | 45,418    | 50,534    | 4,195 | 6,334  | 71,503         | 453,339 |
|                                          |         | % within Barangay | 69%     | 10%       | 12%       | 1%    | 1%     | 8%             | 100%    |

Source: ECOSYSCORP RAP Team, actual site investigation

**Table 2.4.2-4 Average Annual Household Expenditures of Respondent PAPs (2 of 2)**

| Municipality/Barangay |         |                   | Food    | Utilities | Education | Rent  | Health  | Transportation | Total   |
|-----------------------|---------|-------------------|---------|-----------|-----------|-------|---------|----------------|---------|
| Type B – Farm Lands   |         |                   |         |           |           |       |         |                |         |
| Silang, Cavite        | Sabutan | Count             | 32,578  | 32,408    | 5,688     | 0     | 2,835   | 3,857          | 10,808  |
|                       |         | % within Barangay | 22%     | 21%       | 53%       | 0%    | 2%      | 3%             | 100%    |
|                       | Kaong   | Count             | 61,200  | 4,500     | 11,250    | 300   | 2,700   | 5,625          | 52,725  |
|                       |         | % within Barangay | 58%     | 4%        | 21%       | 1%    | 5%      | 11%            | 100%    |
|                       | Tibig   | Count             | 49,745  | 23,650    | 3,861     | 0     | 38      | 19.81          | 10,591  |
|                       |         | % within Barangay | 43%     | 20%       | 36%       | 0%    | 0%      | 0%             | 100%    |
|                       | Carmen  | Count             | 68,321  | 15,820    | 1,395     | 111   | 918     | 409.3          | 8,093   |
|                       |         | % within Barangay | 53%     | 12%       | 17%       | 1%    | 11%     | 5%             | 100%    |
| Total of Type B       |         | Count             | 211,844 | 76,378    | 22,194    | 411   | 6,453   | 9,911          | 82,217  |
|                       |         | % within Barangay | 39%     | 17%       | 35%       | 1%    | 5%      | 3%             | 100%    |
| Total of Type A and B |         | Count             | 586,901 | 121,796   | 2,444,240 | 4,606 | 342,441 | 81,414         | 535,556 |
|                       |         | % within Barangay | 51%     | 14%       | 25%       | 1%    | 4%      | 5%             | 100%    |

Source: ECOSYSCORP RAP Team, actual site investigation

## Land Ownership

### Residential Lands

The respondents' landownership shows in **Table 2.4.2-5** that out of **32** Type A respondents **27** owned the land as well, while the remaining **five (5)** are renting the land where their structures are built.

### Farm Lands

With regards to Type B respondents, **12** owned the land, **three (3)** are tenants and **16** are occupying the farmland with permit from the owner. The said **16** are within Brgy. Carmen. Based on coordination meeting with the SAMACA NGO in Carmen, almost all of the tenants were paid by the developers and signed a waiver in exchange for their farmland. According to said NGO, since the land is not yet used by the developer, the tenants who received payments have been given a permit to continue their farming activity. Please refer to **Table 2.4.2-5** for the tenure status of Type B respondents.

**Table 2.4.2-5a Land Tenure Status of Impacted Structures**

| City/Municipality/Barangay               |         |                   | Owner | Renter | Total |
|------------------------------------------|---------|-------------------|-------|--------|-------|
| Type A - Residential/Household Structure |         |                   |       |        |       |
| Silang, Cavite                           | Sabutan | Count             | 12    | 2      | 14    |
|                                          |         | % within Barangay | 86%   | 14%    | 100%  |
|                                          | Kaong   | Count             | 1     | 1      | 2     |
|                                          |         | % within Barangay | 50%   | 50%    | 100%  |
|                                          | Tibig   | Count             | 9     | 2      | 11    |
|                                          |         | % within Barangay | 82%   | 18%    | 100%  |
| Biñan, Laguna                            | Timbao  | Count             | 5     | 0      | 5     |
|                                          |         | % within Barangay | 100%  | 0%     | 100%  |
| Total of Type A Respondents              |         | Count             | 27    | 5      | 32    |
|                                          |         | % within Barangay | 84%   | 16%    | 100%  |

**Table 2.4.2-5b Land Tenure Status of Impacted Farm Lands**

| City/Municipality/Barangay  |         |                   | Owner | Tenant | Free occupation with Permit | Total |
|-----------------------------|---------|-------------------|-------|--------|-----------------------------|-------|
| Type B – Farm Lands         |         |                   |       |        |                             |       |
| Silang, Cavite              | Sabutan | Count             | 6     | 0      | 0                           | 6     |
|                             |         | % within Barangay | 100%  | 0%     | 0%                          | 100%  |
|                             | Kaong   | Count             | 1     | 1      | 0                           | 2     |
|                             |         | % within Barangay | 50%   | 50%    | 0%                          | 100%  |
|                             | Tibig   | Count             | 5     | 2      | 0                           | 7     |
|                             |         | % within Barangay | 58%   | 42%    | 0%                          | 100%  |
|                             | Carmen  | Count             | 0     | 0      | 16                          | 16    |
|                             |         | % within Barangay | 0%    | 0%     | 100%                        | 100%  |
| Total of Type B Respondents |         | Count             | 12    | 3      | 16                          | 31    |
|                             |         | % within Barangay | 39%   | 10%    | 51%                         | 100%  |

### Structure Ownership

**Table 2.4.2-6** shows that out of 32 households interviewed, 27 of them own the structure and only **five (5)** are renting.

**Table 2.4.2-6 Ownership of Residential Structures**

| City/Municipality/Barangay  |         |                   | Owner | Renter | Total |
|-----------------------------|---------|-------------------|-------|--------|-------|
| Silang, Cavite              | Sabutan | Count             | 11    | 3      | 14    |
|                             |         | % within Barangay | 79%   | 21%    | 100%  |
|                             | Kaong   | Count             | 2     | 0      | 2     |
|                             |         | % within Barangay | 100%  | 0%     | 100%  |
|                             | Tibig   | Count             | 9     | 2      | 11    |
|                             |         | % within Barangay | 82%   | 18%    | 100%  |
| Biñan, Laguna               | Timbao  | Count             | 5     | 0      | 5     |
|                             |         | % within Barangay | 100%  | 0%     | 100%  |
| Total of Type A Respondents |         | Count             | 27    | 5      | 32    |
|                             |         | % within Barangay | 84%   | 16%    | 100%  |

## Availability of Social Services

### Power and Water Supply

All the barangays' **power supply** is provided by MERALCO. In terms of **water supply**, majority of the respondents get their water from artesian well for domestic use such as washing of clothes and dishes (**10%**), and from barangay water district (**46%**), while drinking water is being purchased like mineral and distilled water (**48%**). Please refer to **Tables 2.4.2-7a and 2.4.2-7b**.

**Table 2.4.2-7a Source of Water for Washing Clothes and Dishes**

| City/Municipality/Barangay               |         |                   | Dug well | Artesian well | Pump well | Piped | Purchase | Total |
|------------------------------------------|---------|-------------------|----------|---------------|-----------|-------|----------|-------|
| Type A - Residential/Household Structure |         |                   |          |               |           |       |          |       |
| Silang, Cavite                           | Sabutan | Count             | 10       | 1             | 0         | 2     | 1        | 14    |
|                                          |         | % within Barangay | 71%      | 7%            | 0%        | 14%   | 7%       | 100%  |
|                                          | Kaong   | Count             | 0        | 0             | 0         | 1     | 1        | 2     |
|                                          |         | % within Barangay | 0%       | 0%            | 0%        | 50%   | 50%      | 100%  |
|                                          | Tibig   | Count             | 1        | 0             | 0         | 8     | 2        | 11    |
|                                          |         | % within Barangay | 9%       | 0%            | 0%        | 73%   | 18%      | 100%  |
| Biñan, Laguna                            | Timbao  | Count             | 0        | 0             | 0         | 3     | 2        | 5     |
|                                          |         | % within Barangay | 0%       | 0%            | 0%        | 60%   | 40%      | 100%  |
| Total of Type A Respondents              |         | Count             | 11       | 1             | 0         | 14    | 6        | 32    |
|                                          |         | % within Barangay | 34%      | 3%            | 0%        | 44%   | 19%      | 100%  |
|                                          |         |                   |          |               |           |       |          |       |

**Table 2.4.2-7a Source of Water for Washing Clothes and Dishes**

| Type B – Farm Lands               |         |                   |     |     |     |     |     |      |
|-----------------------------------|---------|-------------------|-----|-----|-----|-----|-----|------|
| Silang, Cavite                    | Sabutan | Count             | 1   | 1   | 1   | 2   | 1   | 6    |
|                                   |         | % within Barangay | 17% | 17% | 17% | 33% | 17% | 100% |
|                                   | Kaong   | Count             | 0   | 0   | 0   | 1   | 1   | 2    |
|                                   |         | % within Barangay | 0%  | 0%  | 0%  | 50% | 50% | 100% |
|                                   | Tibig   | Count             | 2   | 0   | 0   | 4   | 1   | 7    |
|                                   |         | % within Barangay | 29% | 0%  | 0%  | 57% | 14% | 100% |
|                                   | Carmen  | Count             | 4   | 4   | 0   | 8   | 0   | 16   |
|                                   |         | % within Barangay | 25% | 25% | 0%  | 50% | 0%  | 100% |
| Total of Type B Respondents       |         | Count             | 7   | 5   | 1   | 15  | 3   | 31   |
|                                   |         | % within Barangay | 23% | 16% | 3%  | 48% | 10% | 100% |
| Total of Type A and B Respondents |         | Count             | 18  | 6   | 1   | 29  | 9   | 63   |
|                                   |         | % within Barangay | 29% | 10% | 2%  | 46% | 14% | 100% |

**Table 2.4.2-7b Source of Water Supply for Drinking**

| City/Municipality/Barangay               |         |                   | Dug well | Artesian | Piped | Purchase | Total |
|------------------------------------------|---------|-------------------|----------|----------|-------|----------|-------|
| Type A - Residential/Household Structure |         |                   |          |          |       |          |       |
| Silang, Cavite                           | Sabutan | Count             | 3        | 3        | 3     | 5        | 14    |
|                                          |         | % within Barangay | 21%      | 21%      | 21%   | 36%      | 100%  |
|                                          | Kaong   | Count             | 0        | 0        | 0     | 2        | 2     |
|                                          |         | % within Barangay | 0%       | 0%       | 0%    | 100%     | 100%  |
|                                          | Tibig   | Count             | 2        | 3        | 3     | 3        | 11    |
|                                          |         | % within Barangay | 18%      | 27%      | 27%   | 27%      | 100%  |
| Biñan, Laguna                            | Timbao  | Count             | 0        | 0        | 2     | 3        | 5     |
|                                          |         | % within Barangay | 0%       | 0%       | 40%   | 60%      | 100%  |
| Total of Type A Respondents              |         | Count             | 5        | 6        | 8     | 13       | 32    |
|                                          |         | % within Barangay | 27%      | 9%       | 18%   | 45%      | 100%  |
| Type B – Farm Lands                      |         |                   |          |          |       |          |       |
| Silang, Cavite                           | Sabutan | Count             | 0        | 1        | 2     | 3        | 6     |
|                                          |         | % within Barangay | 0%       | 17%      | 33%   | 50%      | 100%  |
|                                          | Kaong   | Count             | 0        | 0        | 0     | 2        | 2     |
|                                          |         | % within Barangay | 0%       | 0%       | 0%    | 100%     | 100%  |
|                                          | Tibig   | Count             | 2        | 0        | 0     | 5        | 7     |
|                                          |         | % within Barangay | 29%      | 0%       | 0%    | 71%      | 100%  |
|                                          | Carmen  | Count             | 2        | 0        | 7     | 7        | 16    |
|                                          |         | % within Barangay | 13%      | 0%       | 44%   | 44%      | 100%  |
| Total of Type B Respondents              |         | Count             | 4        | 1        | 9     | 17       | 31    |
|                                          |         | % within Barangay | 13%      | 3%       | 29%   | 55%      | 100%  |
| Total of Type A and B Respondents        |         | Count             | 9        | 7        | 17    | 30       | 63    |
|                                          |         | % within Barangay | 14%      | 11%      | 27%   | 48%      | 100%  |

## River Use

To determine the stakeholders' dependency on rivers found in the project area, several questions were included in the survey of **198** stakeholders<sup>1</sup>. Specifically they were asked the following questions:

- If they wash their clothes in the river;
- If they have laundry business utilizing the river;
- If they bathe in the river; and
- If they engage in fishing in the river

Presented in **Tables 2.4.2-8 to 2.4.2-11** are the results of the survey pertaining to river use. As shown in Table 2.2-1, only **22 out of 198**, or **11%** are using the river for washing clothes.

**Table 2.4.2-8 Use of River for Washing Clothes (1 of 2)**

| City/Municipality/Barangay/Respondents                  |         | Yes                      | No  | Total |      |
|---------------------------------------------------------|---------|--------------------------|-----|-------|------|
| Type A Respondents – Residential Sector                 |         |                          |     |       |      |
| Silang, Cavite                                          | Sabutan | 6                        | 8   | 14    |      |
|                                                         | Kaong   | 0                        | 2   | 2     |      |
|                                                         | Tibig   | 6                        | 5   | 11    |      |
| Binan, Laguna                                           | Timbao  | 0                        | 5   | 5     |      |
| Total Type A Respondents – Residential Sector           |         | Count                    | 12  | 20    | 32   |
|                                                         |         | % for Type A Respondents | 38% | 63%   | 100% |
| Type B Respondents – Agricultural Farmland Sector       |         |                          |     |       |      |
| Silang, Cavite                                          | Sabutan | 1                        | 5   | 6     |      |
|                                                         | Kaong   | 0                        | 2   | 2     |      |
|                                                         | Tibig   | 0                        | 7   | 7     |      |
|                                                         | Carmen  | 1                        | 15  | 16    |      |
| Total Type B Respondents – Agricultural Farmland Sector |         | Count                    | 2   | 29    | 31   |
|                                                         |         | % for Type B Respondents | 6%  | 94%   | 100% |

<sup>1</sup> Interviewed stakeholders consist of: (i) **32** Type A respondents (residential structure owners); (ii) **31** Type B respondents (PAPs at farm lands); and (iii) **135** Type C respondents (indirectly affected respondents from residential, business, youth, transportation, senior, NGO/POs sectors)

**Table 2.4.2-8 Use of River for Washing Clothes (2 of 2)**

| City/Municipality/Barangay/Respondents            |                                                         | Yes                         | No  | Total |      |
|---------------------------------------------------|---------------------------------------------------------|-----------------------------|-----|-------|------|
| Type C Respondents - Secondary Impact Areas       |                                                         |                             |     |       |      |
| Type of Respondent                                | Residential Sector                                      | 0                           | 35  | 35    |      |
|                                                   | Business Sector                                         | 4                           | 25  | 29    |      |
|                                                   | Youth Sector                                            | 1                           | 18  | 19    |      |
|                                                   | Transportation Sector                                   | 1                           | 20  | 21    |      |
|                                                   | Aged Sector                                             | 2                           | 19  | 21    |      |
|                                                   | NGO/PO/ Homeowners Association/Agricultural Cooperative | 0                           | 10  | 10    |      |
| Total Type C Respondents - Secondary Impact Areas |                                                         | Count                       | 8   | 127   | 135  |
|                                                   |                                                         | % within Type of Respondent | 6%  | 94%   | 100% |
| Grand Total of Type A, B & C                      |                                                         | Count                       | 22  | 176   | 198  |
|                                                   |                                                         | % to Total                  | 11% | 89%   | 100% |

It can be discerned from **Table 2.4.2-9** that in terms of use of the river for laundry business, only **10 out of 198**, or **10%** are using the river for their laundry business.

**Table 2.4.2-9 Use of River for Laundry Business (1 of 2)**

| CityMunicipality/Barangay/Respondents                   |         |                   | Yes | No  | Total |
|---------------------------------------------------------|---------|-------------------|-----|-----|-------|
| Type A Respondents - Residential Sector                 |         |                   |     |     |       |
| Silang, Cavite                                          | Sabutan |                   | 4   | 10  | 14    |
|                                                         | Kaong   |                   | 0   | 2   | 2     |
|                                                         | Tibig   |                   | 4   | 7   | 11    |
| Binan, Laguna                                           | Timbao  |                   | 0   | 5   | 5     |
| Total Type A                                            |         | Count             | 8   | 24  | 32    |
|                                                         |         | % within Barangay | 25% | 75% | 100%  |
| Type B Respondents - Agricultural Farmland Sector       |         |                   |     |     |       |
| Silang, Cavite                                          | Sabutan |                   | 1   | 5   | 6     |
|                                                         | Kaong   |                   | 0   | 2   | 2     |
|                                                         | Tibig   |                   | 0   | 7   | 7     |
|                                                         | Carmen  |                   | 0   | 16  | 16    |
| Total Type B Respondents - Agricultural Farmland Sector |         | Count             | 1   | 30  | 31    |
|                                                         |         | % within Barangay | 3%  | 97% | 100%  |

**Table 2.4.2-9 Use of River for Laundry Business (2 of 2)**

| CityMunicipality/Barangay/Respondents             |                                                        | Yes                         | No | Total |      |
|---------------------------------------------------|--------------------------------------------------------|-----------------------------|----|-------|------|
| Type C Respondents - Secondary Impact Areas       |                                                        |                             |    |       |      |
| Type of Respondent                                | Residential Sector                                     | 0                           | 35 | 35    |      |
|                                                   | Business Sector                                        | 1                           | 28 | 29    |      |
|                                                   | Youth Sector                                           | 0                           | 19 | 19    |      |
|                                                   | Transportation Sector                                  | 0                           | 21 | 21    |      |
|                                                   | Aged Sector                                            | 0                           | 21 | 21    |      |
|                                                   | NGO/PO/Homeowners Association/Agricultural Cooperative | 0                           | 10 | 10    |      |
| Total Type C Respondents - Secondary Impact Areas |                                                        | Count                       | 1  | 134   | 135  |
|                                                   |                                                        | % within Type of Respondent | 1% | 99%   | 100% |
| Grand Total of Type A, B and C                    |                                                        | Count                       | 10 | 188   | 198  |
|                                                   |                                                        | % to Total                  | 5% | 95%   | 100% |

When asked if they bathe in the river, **28 out of 198**, or **14%** said “Yes”. It is interesting to note that majority of these are those from Type A (Residential Sector) respondents, particularly from Brgy. Sabutan (Please refer to **Table 2.4.2-10**).

**Table 2.4.2-10 Use of River for Bathing (1 of 2)**

| CityMunicipality/Barangay/Respondents                   |         |                   | Yes | No  | Total |
|---------------------------------------------------------|---------|-------------------|-----|-----|-------|
| Type A Respondents - Residential Sector                 |         |                   |     |     |       |
| Silang, Cavite                                          | Sabutan |                   | 9   | 5   | 14    |
|                                                         | Kaong   |                   | 0   | 2   | 2     |
|                                                         | Tibig   |                   | 4   | 7   | 11    |
| Binan, Laguna                                           | Timbao  |                   | 0   | 5   | 5     |
| Total Type A                                            |         | Count             | 13  | 19  | 32    |
|                                                         |         | % within Barangay | 41% | 59% | 100%  |
| Type B Respondents - Agricultural Farmland Sector       |         |                   |     |     |       |
| Silang, Cavite                                          | Sabutan |                   | 1   | 5   | 6     |
|                                                         | Kaong   |                   | 0   | 2   | 2     |
|                                                         | Tibig   |                   | 2   | 5   | 7     |
|                                                         | Carmen  |                   | 6   | 10  | 16    |
| Total Type B Respondents - Agricultural Farmland Sector |         | Count             | 9   | 22  | 31    |
|                                                         |         | % within Barangay | 29% | 71% | 100%  |

**Table 2.4.2-10 Use of River for Bathing (2 of 2)**

| CityMunicipality/Barangay/Respondents             |                                                        | Yes                         | No  | Total |      |
|---------------------------------------------------|--------------------------------------------------------|-----------------------------|-----|-------|------|
| Type C Respondents - Secondary Impact Areas       |                                                        |                             |     |       |      |
| Type of Respondent                                | Residential Sector                                     | 0                           | 35  | 35    |      |
|                                                   | Business Sector                                        | 3                           | 26  | 29    |      |
|                                                   | Youth Sector                                           | 0                           | 19  | 19    |      |
|                                                   | Transportation Sector                                  | 2                           | 19  | 21    |      |
|                                                   | Aged Sector                                            | 1                           | 20  | 21    |      |
|                                                   | NGO/PO/Homeowners Association/Agricultural Cooperative | 0                           | 10  | 10    |      |
| Total Type C Respondents - Secondary Impact Areas |                                                        | Count                       | 6   | 129   | 135  |
|                                                   |                                                        | % within Type of Respondent | 4%  | 96%   | 100% |
| Grand Total of Type A, B and C                    |                                                        | Count                       | 28  | 170   | 198  |
|                                                   |                                                        | % to Total                  | 14% | 86%   | 100% |

**Table 2.4.2-11** shows that among all the respondents, the directly impacted show higher percentage of people fishing on the river with **28%** (9 out of 32) and **26%** (8 out of 31) for **Type A** and **Type B**, respectively, compared to only **4%** (6 out of 129) of those who are indirectly affected, **Type C**.

**Table 2.4.2-11 Use of River for Fishing (1 of 2)**

| City/Municipality/Barangay/Respondents                  |         | Yes               | No  | Total |      |
|---------------------------------------------------------|---------|-------------------|-----|-------|------|
| Type A Respondents - Residential Sector                 |         |                   |     |       |      |
| Silang, Cavite                                          | Sabutan | 5                 | 9   | 14    |      |
|                                                         | Kaong   | 0                 | 2   | 2     |      |
|                                                         | Tibig   | 4                 | 7   | 11    |      |
| Binan, Laguna                                           | Timbao  | 0                 | 5   | 5     |      |
| Total Type A Respondents - Residential Sector           |         | Count             | 9   | 23    | 32   |
|                                                         |         | % within Barangay | 28% | 72%   | 100% |
| Type B Respondents - Agricultural Farmland Sector       |         |                   |     |       |      |
| Barangay                                                | Sabutan | 1                 | 5   | 6     |      |
|                                                         | Kaong   | 0                 | 2   | 2     |      |
|                                                         | Tibig   | 2                 | 5   | 7     |      |
|                                                         | Carmen  | 5                 | 11  | 16    |      |
| Total Type B Respondents - Agricultural Farmland Sector |         | Count             | 8   | 23    | 31   |
|                                                         |         | % within Barangay | 26% | 74%   | 100% |

**Table 2.4.2-11 Use of River for Fishing (2 of 2)**

| City/Municipality/Barangay/Respondents            |                                                        | Yes                         | No  | Total |      |
|---------------------------------------------------|--------------------------------------------------------|-----------------------------|-----|-------|------|
| Type C Respondents - Secondary Impact Areas       |                                                        |                             |     |       |      |
| Type of Respondent                                | Residential Sector                                     | 2                           | 33  | 35    |      |
|                                                   | Business Sector                                        | 1                           | 28  | 29    |      |
|                                                   | Youth Sector                                           | 0                           | 19  | 19    |      |
|                                                   | Transportation Sector                                  | 2                           | 19  | 21    |      |
|                                                   | Aged Sector                                            | 0                           | 21  | 21    |      |
|                                                   | NGO/PO/Homeowners Association/Agricultural Cooperative | 1                           | 9   | 10    |      |
| Total Type C Respondents - Secondary Impact Areas |                                                        | Count                       | 6   | 129   | 135  |
|                                                   |                                                        | % within Type of Respondent | 4%  | 96%   | 100% |
| Grand Total of Type A, B and C                    |                                                        | Count                       | 23  | 175   | 198  |
|                                                   |                                                        | %                           | 12% | 88%   | 100% |

## Health

Health personnel visit all the barangays, but for more modern health facilities the nearest hospitals are located in *poblacions*. There are **five (5)** hospitals in the Municipality of Silang, **one (1)** of which is a private hospital located in Brgy. Sabutan (Please refer to **Table 2.4.2-12**). There are **three (3)** hospitals in Biñan and also **three (3)** major hospitals in Sta. Rosa. Based on the survey interview the nearest health facility in the barangay is the health center (**87%**).

**Table 2.4.2-12 Nearest Health Facilities in the Community**

| City/Municipality/Barangay               |         |                   | Health Center | Private Clinic | Public Hospital | Private Hospital | Total |
|------------------------------------------|---------|-------------------|---------------|----------------|-----------------|------------------|-------|
| Type A - Residential/Household Structure |         |                   |               |                |                 |                  |       |
| Silang, Cavite                           | Sabutan | Count             | 14            | 0              | 0               | 0                | 14    |
|                                          |         | % within Barangay | 100%          | 0%             | 0%              | 0%               | 100%  |
|                                          | Kaong   | Count             | 2             | 0              | 0               | 0                | 2     |
|                                          |         | % within Barangay | 100%          | 0%             | 0%              | 0%               | 100%  |
|                                          | Tibig   | Count             | 11            | 0              | 0               | 0                | 11    |
|                                          |         | % within Barangay | 100%          | 0%             | 0%              | 0%               | 100%  |
| Biñan, Laguna                            | Timbao  | Count             | 0             | 3              | 2               | 0                | 5     |
|                                          |         | % within Barangay | 0%            | 60%            | 40%             | 0%               | 100%  |
| Total of Type A Respondents              |         | Count             | 27            | 3              | 2               | 0                | 32    |
|                                          |         | % within Barangay | 84%           | 9%             | 6%              | 0%               | 100%  |
| Type B – Farm Lands                      |         |                   |               |                |                 |                  |       |
| Silang, Cavite                           | Sabutan | Count             | 4             | 1              | 0               | 1                | 6     |
|                                          |         | % within Barangay | 67%           | 17%            | 0%              | 17%              | 100%  |
|                                          | Kaong   | Count             | 2             | 0              | 0               | 0                | 2     |
|                                          |         | % within Barangay | 100%          | 0%             | 0%              | 0%               | 100%  |
|                                          | Tibig   | Count             | 7             | 0              | 0               | 0                | 7     |
|                                          |         | % within Barangay | 100%          | 0%             | 0%              | 0%               | 100%  |
|                                          | Carmen  | Count             | 15            | 0              | 1               | 0                | 16    |
|                                          |         | % within Barangay | 94%           | 0%             | 6%              | 0%               | 100%  |
| Total of Type B Respondents              |         | Count             | 28            | 1              | 1               | 1                | 31    |
|                                          |         | % within Barangay | 90%           | 3%             | 3%              | 3%               | 100%  |
| Total of Type A and B Respondents        |         | Count             | 55            | 4              | 3               | 1                | 63    |
|                                          |         | % within Barangay | 87%           | 6%             | 5%              | 2%               | 100%  |

### Transportation

The means of transportation going to the above mentioned health facilities are by means of tricycle (70%), *pedicab* (5%), jeepney (10%); others are by walking (16%); i.e., those who are near the health center of the barangay. Refer to **Table 2.4.2-13**

**Table 2.4.2-13 Means of Transportation Going to Health Facilities**

| Municipality/Barangay                    |         |                   | Walking | Pedicab | Tricycle | Jeepney | Total |
|------------------------------------------|---------|-------------------|---------|---------|----------|---------|-------|
| Type A - Residential/Household Structure |         |                   |         |         |          |         |       |
| Silang, Cavite                           | Sabutan | Count             | 0       | 1       | 13       | 0       | 14    |
|                                          |         | % within Barangay | 0%      | 7%      | 93%      | 0%      | 100%  |
|                                          | Kaong   | Count             | 0       | 0       | 2        | 0       | 2     |
|                                          |         | % within Barangay | 0%      | 0%      | 100%     | 0%      | 100%  |
|                                          | Tibig   | Count             | 6       | 0       | 5        | 0       | 11    |
|                                          |         | % within Barangay | 55%     | 0%      | 45%      | 0%      | 100%  |
| Biñan, Laguna                            | Timbao  | Count             | 0       | 0       | 0        | 5       | 5     |
|                                          |         | % within Barangay | 0%      | 0%      | 0%       | 100%    | 100%  |
| Total of Type A Respondents              |         | Count             | 6       | 1       | 20       | 5       | 32    |
|                                          |         | % within Barangay | 19%     | 3%      | 63%      | 16%     | 100%  |
| Type B – Farm Lands                      |         |                   |         |         |          |         |       |
| Silang, Cavite                           | Sabutan | Count             | 0       | 1       | 5        | 0       | 6     |
|                                          |         | % within Barangay | 0%      | 17%     | 83%      | 0%      | 100%  |
|                                          | Kaong   | Count             | 0       | 0       | 2        | 0       | 2     |
|                                          |         | % within Barangay | 0%      | 0%      | 100%     | 0%      | 100%  |
|                                          | Tibig   | Count             | 1       | 0       | 5        | 1       | 7     |
|                                          |         | % within Barangay | 14%     | 0%      | 71%      | 14%     | 100%  |
|                                          | Carmen  | Count             | 3       | 1       | 12       | 0       | 16    |
|                                          |         | % within Barangay | 19%     | 6%      | 75%      | 0%      | 100%  |
| Total of Type B Respondents              |         | Count             | 4       | 2       | 24       | 1       | 31    |
|                                          |         | % within Barangay | 13%     | 6%      | 77%      | 3%      | 100%  |
| Total of Type A and B Respondents        |         | Count             | 10      | 3       | 44       | 6       | 63    |
|                                          |         | % within Barangay | 16%     | 5%      | 70%      | 10%     | 100%  |

## Education

With regards to educational facilities, elementary schools are available in every barangay. In terms of secondary education, the barangays with educational facilities offering secondary education Sabutan National High School, Kaong National High School, Munting Ilog National High School. There are seven (7)

tertiary schools in the Municipality of Silang. Of them there are two (2) public schools namely Cavite State University and Philippine National Police Academy located in Silang Proper. In the city of Biñan and Sta. Rosa primary educational facilities are also available in every barangay, while secondary education facilities are located in the poblacions of each city. There are eight (8) tertiary educational facilities in Biñan. Polytechnic University of the Philippines is the available tertiary educational facility in Sta. Rosa that is managed by the government. **Table 2.4.2-14** shows the nearest available facilities in the community of the interviewed PAPs.

**Table 2.4.2-14a      Nearest Available Educational Facilities in the Community (1 of 2)**

| Municipality/Barangay                    |         |                   | Elementary | High School | Total |
|------------------------------------------|---------|-------------------|------------|-------------|-------|
| Type A - Residential/Household Structure |         |                   |            |             |       |
| Silang, Cavite                           | Sabutan | Count             | 14         | 0           | 14    |
|                                          |         | % within Barangay | 100%       | 0%          | 100%  |
|                                          | Kaong   | Count             | 2          | 0           | 2     |
|                                          |         | % within Barangay | 100%       | 0%          | 100%  |
|                                          | Tibig   | Count             | 11         | 0           | 11    |
|                                          |         | % within Barangay | 100%       | 0%          | 100%  |
| Biñan, Laguna                            | Timbao  | Count             | 5          | 0           | 5     |
|                                          |         | % within Barangay | 100%       | 0%          | 100%  |
| Total of Type A Respondents              |         | Count             | 32         | 0           | 32    |
|                                          |         | % within Barangay | 100%       | 0%          | 100%  |

**Table 2.4.2-14a Nearest Available Educational Facilities in the Community (2 of 2)**

| Municipality/Barangay             |         |                   | Elementary | High School | Total |
|-----------------------------------|---------|-------------------|------------|-------------|-------|
| Type B – Farm Lands               |         |                   |            |             |       |
| Silang, Cavite                    | Sabutan | Count             | 5          | 1           | 6     |
|                                   |         | % within Barangay | 83%        | 17%         | 100%  |
|                                   | Kaong   | Count             | 2          | 0           | 2     |
|                                   |         | % within Barangay | 100%       | 0%          | 100%  |
|                                   | Tibig   | Count             | 7          | 0           | 7     |
|                                   |         | % within Barangay | 100%       | 0%          | 100%  |
|                                   | Carmen  | Count             | 16         | 0           | 16    |
|                                   |         | % within Barangay | 100%       | 0%          | 100%  |
| Total of Type B Respondents       |         | Count             | 30         | 1           | 31    |
|                                   |         | % within Barangay | 97%        | 3%          | 100%  |
| Total of Type A and B Respondents |         | Count             | 62         | 1           | 63    |
|                                   |         | % within Barangay | 98%        | 2%          | 100%  |

**Table 2.4.2-14b** shows the means of transportation going to the nearest educational facilities in the abovementioned table. Result showed that (83%) of them are riding tricycle which is the common means of transportation in each barangay. Around 17% live near schools and just walk.

**Table 2.4.2-14b Means of Transportation Going to Educational Facilities**

| City/Municipality/Barangay               |         |                   | Walking | Tricycle | Total |
|------------------------------------------|---------|-------------------|---------|----------|-------|
| Type A - Residential/Household Structure |         |                   |         |          |       |
| Silang, Cavite                           | Sabutan | Count             | 0       | 14       | 14    |
|                                          |         | % within Barangay | 0%      | 100%     | 100%  |
|                                          | Kaong   | Count             | 5       | 6        | 11    |
|                                          |         | % within Barangay | 45%     | 55%      | 100%  |
|                                          | Tibig   | Count             | 0       | 2        | 2     |
|                                          |         | % within Barangay | 0%      | 100%     | 100%  |
| Biñan, Laguna                            | Timbao  | Count             | 0       | 5        | 5     |
|                                          |         | % within Barangay | 0%      | 100%     | 100%  |
| Total of Type A Respondents              |         | Count             | 5       | 27       | 32    |
|                                          |         | % within Barangay | 16%     | 84%      | 100%  |
| Type B – Farm Lands                      |         |                   |         |          |       |
| Silang, Cavite                           | Sabutan | Count             | 1       | 5        | 6     |
|                                          |         | % within Barangay | 17%     | 83%      | 100%  |
|                                          | Kaong   | Count             | 0       | 2        | 2     |
|                                          |         | % within Barangay | 0%      | 100%     | 100%  |
|                                          | Tibig   | Count             | 1       | 6        | 7     |
|                                          |         | % within Barangay | 14%     | 86%      | 100%  |
|                                          | Carmen  | Count             | 4       | 12       | 16    |
|                                          |         | % within Barangay | 25%     | 75%      | 100%  |
| Total of Type B Respondents              |         | Count             | 6       | 25       | 31    |
|                                          |         | % within Barangay | 19%     | 81%      | 100%  |
| Total of Type A and B Respondents        |         | Count             | 11      | 52       | 63    |
|                                          |         | % within Barangay | 17%     | 83%      | 100%  |

## Sanitation

All of the respondents have toilet facilities, **97%** have toilet facilities installed inside their house while the remaining 3% are outside their house. **Table 2.4.2-15a** shows the type of toilet facilities that the respondents have. Majority of them have semi-flush (**95%**) toilet and only **three (3)** has a flush type toilet facility living in Brgy. Sabutan, Silang, Cavite and Brgy. Timbao, Biñan, Laguna. Location of the Respondents toilet facility is presented in **Table 2.4.2-15b**.

**Table 2.4.2-15a Type of Toilet Facilities of PAPs Interviewed**

| City/Municipality/Barangay               |         |                   | Semi-Flush | Flush | Total |
|------------------------------------------|---------|-------------------|------------|-------|-------|
| Type A - Residential/Household Structure |         |                   |            |       |       |
| Silang, Cavite                           | Sabutan | Count             | 14         | 0     | 14    |
|                                          |         | % within Barangay | 100%       | 0%    | 100%  |
|                                          | Kaong   | Count             | 2          | 0     | 2     |
|                                          |         | % within Barangay | 100%       | 0%    | 100%  |
|                                          | Tibig   | Count             | 11         | 0     | 11    |
|                                          |         | % within Barangay | 100%       | 0%    | 100%  |
| Biñan, Laguna                            | Timbao  | Count             | 3          | 2     | 5     |
|                                          |         | % within Barangay | 60%        | 40%   | 100%  |
| Total of Type A Respondents              |         | Count             | 30         | 2     | 32    |
|                                          |         | % within Barangay | 94%        | 6%    | 100%  |
| Type B – Farm Lands                      |         |                   |            |       |       |
| Silang, Cavite                           | Sabutan | Count             | 5          | 1     | 6     |
|                                          |         | % within Barangay | 83%        | 17%   | 100%  |
|                                          | Kaong   | Count             | 2          | 0     | 2     |
|                                          |         | % within Barangay | 100%       | 0%    | 100%  |
|                                          | Tibig   | Count             | 7          | 0     | 7     |
|                                          |         | % within Barangay | 100%       | 0%    | 100%  |
|                                          | Carmen  | Count             | 16         | 0     | 16    |
|                                          |         | % within Barangay | 100%       | 0%    | 100%  |
| Total of Type B Respondents              |         | Count             | 30         | 1     | 31    |
|                                          |         | % within Barangay | 97%        | 3%    | 100%  |
| Total of Type A and B Respondents        |         | Count             | 60         | 3     | 63    |
|                                          |         | % within Barangay | 95%        | 5%    | 100%  |

**Table 2.4.2-15b Location of Toilet Facilities of PAPs Interviewed**

| City/Municipality/Barangay               |         |                   | Inside the house | Outside the house | Total |
|------------------------------------------|---------|-------------------|------------------|-------------------|-------|
| Type A - Residential/Household Structure |         |                   |                  |                   |       |
| Silang, Cavite                           | Sabutan | Count             | 13               | 1                 | 14    |
|                                          |         | % within Barangay | 93%              | 7%                | 100%  |
|                                          | Kaong   | Count             | 2                | 1                 | 2     |
|                                          |         | % within Barangay | 100%             | 0%                | 100%  |
|                                          | Tibig   | Count             | 11               | 0                 | 11    |
|                                          |         | % within Barangay | 100%             | 0%                | 100%  |
| Biñan, Laguna                            | Timbao  | Count             | 5                | 0                 | 5     |
|                                          |         | % within Barangay | 100%             | 0%                | 100%  |
| Total of Type A Respondents              |         | Count             | 31               | 1                 | 32    |
|                                          |         | % within Barangay | 97%              | 3%                | 100%  |
| Type B – Farm Lands                      |         |                   |                  |                   |       |
| Silang, Cavite                           | Sabutan | Count             | 6                | 0                 | 6     |
|                                          |         | % within Barangay | 100%             | 0%                | 100%  |
|                                          | Kaong   | Count             | 2                | 0                 | 2     |
|                                          |         | % within Barangay | 100%             | 0%                | 100%  |
|                                          | Tibig   | Count             | 6                | 1                 | 7     |
|                                          |         | % within Barangay | 86%              | 14%               | 100%  |
|                                          | Carmen  | Count             | 16               | 0                 | 16    |
|                                          |         | % within Barangay | 100%             | 0%                | 100%  |
| Total of Type B Respondents              |         | Count             | 31               | 1                 | 31    |
|                                          |         | % within Barangay | 97%              | 3%                | 100%  |
| Total of Type A and B Respondents        |         | Count             | 61               | 2                 | 63    |
|                                          |         | % within Barangay | 97%              | 3%                | 100%  |

## Solid Waste Management

Collection of garbage in barangays is very limited; only (**11%**) and mostly those who are near the *poblacions* area such as Brgy. Sabutan are serviced. The project-affected barangays generally bury (**14%**) or burn (**71%**) their waste in their backyard while **3%** of them throw their trash in the nearby river. Please see **Table 2.4.2-16**.

**Table 2.4.2-16 Solid Disposal (1 of 2)**

| City/Municipality/Barangay               |         |                   | River | Open pit | Garbage Collector | Burn | Total |
|------------------------------------------|---------|-------------------|-------|----------|-------------------|------|-------|
| Type A - Residential/Household Structure |         |                   |       |          |                   |      |       |
| Silang, Cavite                           | Sabutan | Count             | 0     | 1        | 1                 | 12   | 14    |
|                                          |         | % within Barangay | 0%    | 7%       | 7%                | 86%  | 100%  |
|                                          | Kaong   | Count             | 0     | 0        | 0                 | 2    | 2     |
|                                          |         | % within Barangay | 0%    | 0%       | 0%                | 100% | 100%  |
|                                          | Tibig   | Count             | 0     | 1        | 1                 | 9    | 11    |
|                                          |         | % within Barangay | 0%    | 9%       | 9%                | 82%  | 100%  |
| Biñan, Laguna                            | Timbao  | Count             | 0     | 0        | 3                 | 2    | 5     |
|                                          |         | % within Barangay | 0%    | 0%       | 60%               | 40%  | 100%  |
| Total of Type A Respondents              |         | Count             | 0     | 2        | 5                 | 25   | 32    |
|                                          |         | % within Barangay | 0%    | 6%       | 16%               | 78%  | 100%  |
| Type B – Farm Lands                      |         |                   |       |          |                   |      |       |
| Silang, Cavite                           | Sabutan | Count             | 0     | 0        | 2                 | 4    | 6     |
|                                          |         | % within Barangay | 0%    | 0%       | 33%               | 67%  | 100%  |
|                                          | Kaong   | Count             | 0     | 1        | 0                 | 1    | 2     |
|                                          |         | % within Barangay | 0%    | 50%      | 0%                | 50%  | 100%  |
|                                          | Tibig   | Count             | 1     | 5        | 0                 | 1    | 7     |
|                                          |         | % within Barangay | 14%   | 71%      | 0%                | 14%  | 100%  |

**Table 2.4.2-16 Solid Disposal (2 of 2)**

| City/Municipality/Barangay        |        |                   | River | Open pit | Garbage Collector | Burn | Total |
|-----------------------------------|--------|-------------------|-------|----------|-------------------|------|-------|
| Type B – Farm Lands               |        |                   |       |          |                   |      |       |
|                                   | Carmen | Count             | 1     | 1        | 0                 | 14   | 16    |
|                                   |        | % within Barangay | 6%    | 6%       | 0%                | 88%  | 100%  |
| Total of Type B Respondents       |        | Count             | 2     | 7        | 2                 | 20   | 31    |
|                                   |        | % within Barangay | 6%    | 23%      | 6%                | 65%  | 100%  |
| Total of Type A and B Respondents |        | Count             | 2     | 9        | 7                 | 45   | 63    |
|                                   |        | % within Barangay | 3%    | 14%      | 11%               | 71%  | 100%  |

### Transportation

The common means of public utility transportation in the project area is tricycle. Barangays along the provincial roads are accessible by *jeepneys*. **Table 2.4.2-17** shows the various types of public transportation in the area.

**Table 2.4.2-17 Mode of Transportation in the Area (1 of 2)**

| City/Municipality/Barangay               |         |                   | Jeepney | Tricycle | Total |
|------------------------------------------|---------|-------------------|---------|----------|-------|
| Type A - Residential/Household Structure |         |                   |         |          |       |
| Silang, Cavite                           | Sabutan | Count             | 1       | 13       | 14    |
|                                          |         | % within Barangay | 7%      | 93%      | 100%  |
|                                          | Kaong   | Count             | 0       | 2        | 2     |
|                                          |         | % within Barangay | 0%      | 100%     | 100%  |
|                                          | Tibig   | Count             | 1       | 10       | 11    |
|                                          |         | % within Barangay | 9%      | 91%      | 100%  |
| Biñan, Laguna                            | Timbao  | Count             | 5       | 0        | 5     |
|                                          |         | % within Barangay | 100%    | 0%       | 100%  |
| Total of Type A Respondents              |         | Count             | 7       | 25       | 32    |
|                                          |         | % within Barangay | 22%     | 78%      | 100%  |

**Table 2.4.2-17 Mode of Transportation in the Area (2 of 2)**

| City/Municipality/Barangay        |         |                   | Jeepney | Tricycle | Total |
|-----------------------------------|---------|-------------------|---------|----------|-------|
| Type B – Farm Lands               |         |                   |         |          |       |
| Silang, Cavite                    | Sabutan | Count             | 0       | 6        | 6     |
|                                   |         | % within Barangay | 0%      | 100%     | 100%  |
|                                   | Kaong   | Count             | 0       | 2        | 2     |
|                                   |         | % within Barangay | 0%      | 100%     | 100%  |
|                                   | Tibig   | Count             | 3       | 4        | 7     |
|                                   |         | % within Barangay | 43%     | 57%      | 100%  |
|                                   | Carmen  | Count             | 5       | 11       | 16    |
|                                   |         | % within Barangay | 31%     | 69%      | 100%  |
| Total of Type B Respondents       |         | Count             | 8       | 23       | 31    |
|                                   |         | % within Barangay | 26%     | 74%      | 100%  |
| Total of Type A and B Respondents |         | Count             | 15      | 48       | 63    |
|                                   |         | % within Barangay | 24%     | 76%      | 100%  |

### 2.4.3 Project Awareness

There are a total of **199** respondents who were asked on project awareness regarding the proposed Cavite –Laguna Expressway Project (Laguna Section). These consist of:

- (i) 32 Type A respondents (residential structure owners);
- (ii) 31 Type B respondents (PAPs at farm lands);
- (iii) 135 Type C respondents or the indirectly affected respondents from residential, business, youth, transportation, senior, NGO/POs sectors

The respondents' awareness of the proposed project is presented in **Table 2.4.3-1**, which shows that majority (**56%**) of the respondents are well informed of the project. **Table 2.4.3-2** on the other hand shows their respective sources of information about the Project.

As seen from these tables, the main sources of information were from the LGUs (**26%**) and Surveyors (**21%**). According to the Respondents who attended in the IEC, the project has been presented to them since 2004. The surveyors also informed them during their staking of the alignment. Other sources of information include Consultants (JICA-ECOSYSCORP, INC.), neighbors and friends, and relatives who attended the PCMs, and relayed the information to them.

**Table 2.4.3-1 Knowledge About CALA Expressway Project (1 of 2)**

| City/Municipality/Barangay/Respondents   |         |                   | Yes  | No  | Total |
|------------------------------------------|---------|-------------------|------|-----|-------|
| Type A – Residential/Household Structure |         |                   |      |     |       |
| Silang, Cavite                           | Sabutan | Count             | 13   | 1   | 14    |
|                                          |         | % within Barangay | 93%  | 7%  | 100%  |
|                                          | Kaong   | Count             | 2    | 0   | 2     |
|                                          |         | % within Barangay | 100% | 0%  | 100%  |
|                                          | Tibig   | Count             | 9    | 2   | 11    |
|                                          |         | % within Barangay | 82%  | 18% | 100%  |
| Biñan, Laguna                            | Timbao  | Count             | 2    | 3   | 5     |
|                                          |         | % within Barangay | 40%  | 60% | 100%  |
| Total Type A Respondents                 |         | Count             | 26   | 6   | 32    |
|                                          |         | % within Barangay | 81%  | 19% | 100%  |

**Table 2.4.3-1 Knowledge About CALA Expressway Project (2 of 2)**

| City/Municipality/Barangay/Respondents |                                                        |                             | Yes  | No  | Total |
|----------------------------------------|--------------------------------------------------------|-----------------------------|------|-----|-------|
| Type B – Farm Lands                    |                                                        |                             |      |     |       |
| Silang, Cavite                         | Sabutan                                                | Count                       | 6    | 0   | 6     |
|                                        |                                                        | % within Barangay           | 100% | 0%  | 100%  |
|                                        | Kaong                                                  | Count                       | 1    | 1   | 2     |
|                                        |                                                        | % within Barangay           | 50%  | 50% | 100%  |
|                                        | Tibig                                                  | Count                       | 6    | 1   | 7     |
|                                        |                                                        | % within Barangay           | 86%  | 14% | 100%  |
|                                        | Carmen                                                 | Count                       | 9    | 7   | 16    |
|                                        |                                                        | % within Barangay           | 56%  | 44% | 100%  |
| Total Type B Respondents               |                                                        | Count                       | 22   | 9   | 31    |
|                                        |                                                        | % within Barangay           | 71%  | 29% | 100%  |
| Type C – Indirectly Affected           |                                                        |                             |      |     |       |
| Type of Respondent                     | Residential Sector                                     |                             | 24   | 11  | 35    |
|                                        | Business Sector                                        |                             | 14   | 15  | 29    |
|                                        | Youth Sector                                           |                             | 3    | 16  | 19    |
|                                        | Transportation Sector                                  |                             | 9    | 12  | 21    |
|                                        | Aged Sector                                            |                             | 8    | 13  | 21    |
|                                        | NGO/PO/Homeowners Association/Agricultural Cooperative |                             | 5    | 5   | 10    |
| Total Type C Respondents               |                                                        | Count                       | 63   | 72  | 135   |
|                                        |                                                        | % within Type of Respondent | 47%  | 53% | 100%  |
| Total of Type A, B, and C Respondents  |                                                        | Count                       | 112  | 87  | 199   |
|                                        |                                                        | % to Total                  | 56%  | 44% | 100%  |

**Table 2.4.3-2 Source of Information (1 of 2)**

| City/Municipality/Barangay/Respondents   |         |                      | LGU's | JICA/<br>ECOSYS | Relatives | Neighbors/<br>Friends | Surveyor | Total |
|------------------------------------------|---------|----------------------|-------|-----------------|-----------|-----------------------|----------|-------|
| Type A – Residential/Household Structure |         |                      |       |                 |           |                       |          |       |
| Silang, Cavite                           | Sabutan | Count                | 3     | 3               | 1         | 2                     | 4        | 13    |
|                                          |         | % within<br>Barangay | 23%   | 23%             | 8%        | 15%                   | 31%      | 100%  |
|                                          | Kaong   | Count                | 2     | 0               | 0         | 0                     | 0        | 2     |
|                                          |         | % within<br>Barangay | 100%  | 0%              | 0%        | 0%                    | 0%       | 100%  |
|                                          | Tibig   | Count                | 4     | 2               | 0         | 0                     | 3        | 9     |
|                                          |         | % within<br>Barangay | 44%   | 22%             | 0%        | 0%                    | 33%      | 100%  |
| Biñan, Laguna                            | Timbao  | Count                | 0     | 2               | 0         | 0                     | 0        | 2     |
|                                          |         | % within<br>Barangay | 0%    | 100%            | 0%        | 0%                    | 0%       | 100%  |
| Total Type A Respondents                 |         | Count                | 9     | 7               | 1         | 2                     | 7        | 26    |
|                                          |         | % within<br>Barangay | 35%   | 27%             | 4%        | 8%                    | 27%      | 100%  |
| Type B – Farm Lands                      |         |                      |       |                 |           |                       |          |       |
| Silang, Cavite                           | Sabutan | Count                | 2     | 2               |           |                       | 2        | 6     |
|                                          |         | % within<br>Barangay | 33%   | 33%             | 0%        | 0%                    | 33%      | 100%  |
|                                          | Kaong   | Count                | 0     | 0               |           |                       | 1        | 1     |
|                                          |         | % within<br>Barangay | 0%    | 0%              | 0%        | 0%                    | 100%     | 100%  |
|                                          | Tibig   | Count                | 0     | 4               |           |                       | 2        | 6     |
|                                          |         | % within<br>Barangay | 0%    | 67%             | 0%        | 0%                    | 33%      | 100%  |
|                                          | Carmen  | Count                | 3     | 3               |           |                       | 3        | 9     |
|                                          |         | % within<br>Barangay | 33%   | 33%             | 0%        | 0%                    | 33%      | 100%  |
| Total Type B Respondents                 |         | Count                | 5     | 9               | 0         | 0                     | 8        | 22    |
|                                          |         | % within<br>Barangay | 23%   | 41%             | 0%        | 0%                    | 36%      | 100%  |

**Table 2.4.3-2 Source of Information (2 of 2)**

| City/Municipality/Barangay/Respondents   |                                                              |                                | LGU's | JICA/<br>ECOSYS | Relatives | Neighbors/<br>Friends | Surveyor | Total    |
|------------------------------------------|--------------------------------------------------------------|--------------------------------|-------|-----------------|-----------|-----------------------|----------|----------|
| Type C – Indirectly Affected             |                                                              |                                |       |                 |           |                       |          |          |
| Type of<br>Respondent                    | Residential Sector                                           |                                | 7     | 1               | 7         | 5                     | 4        | 24       |
|                                          | Business Sector                                              |                                | 2     | 2               | 4         | 4                     | 2        | 14       |
|                                          | Youth Sector                                                 |                                | 1     | 0               | 1         | 1                     | 0        | 3        |
|                                          | Transportation Sector                                        |                                | 2     | 0               | 3         | 3                     | 1        | 9        |
|                                          | Aged Sector                                                  |                                | 2     | 2               | 3         | 1                     | 0        | 8        |
|                                          | NGO/PO/Homeowners<br>Association/Agricultural<br>Cooperative |                                | 1     | 0               | 2         | 1                     | 1        | 5        |
| Total Type C Respondents                 |                                                              | Count                          | 15    | 5               | 20        | 15                    | 8        | 63       |
|                                          |                                                              | % within Type of<br>Respondent | 24%   | 8%              | 32%       | 24%                   | 13%      | 100<br>% |
| Total of Type A, B, and C<br>Respondents |                                                              | Count                          | 29    | 22              | 21        | 17                    | 23       | 112      |
|                                          |                                                              | % to Total                     | 26%   | 20%             | 19%       | 15%                   | 21%      | 100<br>% |

#### 2.4.4 Social Acceptability

Out of **199** respondents who were asked on their social acceptability on the proposed Cavite –Laguna Expressway Project (Laguna Section), majority (**74%**) are in favor of the Project. Their common reasons are:

- For improvement of accessibility and for the future development of their province;
- Others said that since that this is a government project, they have no other choice but to accept it;

The remaining **26%** not in favor of the project worries too much on the loss of their land.

As seen in **Table 2.4.4-1**, the highest percentage of respondents who refuses the project are those losing their dwelling structures (Type A).

**Table 2.4.4-1 Social Acceptability of the Respondents (1 of 2)**

| City/Municipality/Barangay/Respondents   |         |                   | Yes  | No  | Total |
|------------------------------------------|---------|-------------------|------|-----|-------|
| Type A – Residential/Household Structure |         |                   |      |     |       |
| Silang, Cavite                           | Sabutan | Count             | 3    | 11  | 14    |
|                                          |         | % within Barangay | 21%  | 79% | 100%  |
|                                          | Kaong   | Count             | 1    | 1   | 2     |
|                                          |         | % within Barangay | 50%  | 50% | 100%  |
|                                          | Tibig   | Count             | 1    | 10  | 11    |
|                                          |         | % within Barangay | 9%   | 91% | 100%  |
| Binan, Laguna                            | Timbao  | Count             | 5    | 0   | 5     |
|                                          |         | % within Barangay | 100% | 0%  | 100%  |
| Total Type A                             |         | Count             | 10   | 22  | 32    |
|                                          |         | % within Barangay | 31%  | 69% | 100%  |
| Type B – Farm Lands                      |         |                   |      |     |       |
| Silang, Cavite                           | Sabutan | Count             | 5    | 1   | 6     |
|                                          |         | % within Barangay | 83%  | 17% | 100%  |
|                                          | Kaong   | Count             | 1    | 1   | 2     |
|                                          |         | % within Barangay | 50%  | 50% | 100%  |
|                                          | Tibig   | Count             | 4    | 3   | 7     |
|                                          |         | % within Barangay | 57%  | 43% | 100%  |
|                                          | Carmen  | Count             | 8    | 8   | 16    |
|                                          |         | % within Barangay | 50%  | 50% | 100%  |
| Total Type B                             |         | Count             | 18   | 13  | 31    |
|                                          |         | % within Barangay | 58%  | 42% | 100%  |

**Table 2.4.4-1 Social Acceptability of the Respondents (2 of 2)**

| City/Municipality/Barangay/Respondents |                                                         | Yes                         | No  | Total |      |
|----------------------------------------|---------------------------------------------------------|-----------------------------|-----|-------|------|
| Type C – Indirectly Affected           |                                                         |                             |     |       |      |
| Type of Respondent                     | Residential Sector                                      | 31                          | 4   | 35    |      |
|                                        | Business Sector                                         | 27                          | 2   | 29    |      |
|                                        | Youth Sector                                            | 12                          | 7   | 19    |      |
|                                        | Transportation Sector                                   | 20                          | 1   | 21    |      |
|                                        | Aged Sector                                             | 18                          | 3   | 21    |      |
|                                        | NGO/PO/ Homeowners Association/Agricultural Cooperative | 10                          | 0   | 10    |      |
| Total Type C                           |                                                         | Count                       | 118 | 17    | 135  |
|                                        |                                                         | % within Type of Respondent | 87% | 13%   | 100% |
| Total of Type A, B, and C Respondents  |                                                         | Count                       | 147 | 52    | 199  |
|                                        |                                                         | % to Total                  | 74% | 26%   | 100% |

#### 2.4.5 Informal Settlers

There are **no identified informal settlers to be affected by the CALAX Project.**

#### 2.4.6 Farmlands and Livelihood to be Affected

As mentioned in this report, the western section of this project is mostly agricultural land which is located in the municipality of Silang. The loss of livelihood to be mostly affected is farming. Details on **livelihood** to be affected and the corresponding eligibilities and entitlements are presented in the **Resettlement Action Plan (RAP)**.

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**Chapter 3**

**Environmental/Ecological  
Risk Assessment**

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### 3 ENVIRONMENTAL/ECOLOGICAL RISK ASSESSMENT

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There are no expected sources of chronic and acute risks/worst case scenarios. As such it is deemed not necessary to provide an environmental/ecological risk assessment for this Project.

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## **Chapter 4**

# **Impacts Management Plan**

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## 4 IMPACTS MANAGEMENT PLAN

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### 4.1 ENVIRONMENTAL IMPACTS, MITIGATION AND ENHANCEMENT MEASURES

**Table 4.1-1** presents the potential impacts of the proposed CALA Expressway Project (Laguna Section) that may affect the receiving environment during its implementation. Also discussed in the Tables are the recommended mitigation (if negative) and enhancement (if positive) measures for each identified impact. The duration and types of impacts are likewise included.

A separate discussion on the potential impacts of the project to the geological aspect of the environment, particularly seismicity is presented in the succeeding sections. The recommended mitigation measures that correspond to the identified impacts are also described.

#### Impacts of Seismicity and Mitigation Measures

It is recognized that seismic shaking will have effect on the structures of the project road such as but not limited to the bridges and interchanges. However, the design parameters to be adopted for these structures cannot be provided for the time being since the Detailed Engineering Design (DED) for the project remains to be completed.

Seismic design is site specific, thus the following measures are presented:

- 1) **Section 208.4.4** of the Structural Code of the Philippines states that “The seismic hazard characteristics for the site shall be established based on the seismic zone and proximity of the site to active seismic sources, site soil profile characteristics and structure importance factor”.

This requirement can be done specifically for the site through the following:

- Analysis of aerial photographs/radar images of the site to establish the possible location of the fault trace on the ground;
  - Geo-resistivity survey to determine the exact location, trend, and zone width of the fault trace/s; and
  - Trenching essentially:
    - a) For detailed study/mapping of the fault to establish the onsite lateral/vertical movement;
    - b) Determine the primary and secondary rupturing; and
    - c) Datable samples, if available can be collected for dating to determine the age of movement
- 2) For the bridge and fly over component of the project, a site specific Probabilistic Seismic Hazard Assessment (PSHA) can be undertaken. In PSHA seismic hazard is defined as the annual probability of a specified size of earthquake being exceeded at a specified location. The inverse of the annual probability of exceedance is the return period (recurrence interval).

The objectives of the PSHA analysis are to:

- a) Estimate the Maximum Considered Earthquake (MCE) defined as the largest earthquake that appears possible along presently recognized faults having **2%** probability of not being exceeded in **50 years** corresponding to typical return period of approximately **2,500 years** at the site. While stronger shaking than this could occur, it was judged that it would be economically impractical to design for such very rare ground motions and the selection of the **2%** in **50 years** likelihood as the maximum considered earthquake ground motion would result in acceptable levels of seismic safety; and
- b) Estimate the Design Basis Earthquake (DBE) usually defined in practice as the earthquake with a ground motion that has **10%** probability of being exceeded at least once over a period of **50 years** and a corresponding statistical return period of **475 years**.

## **Recommended Mitigating Measures to Prevent Failures of Bridges and Flyovers during Earthquake**

The project can be divided into **two (2)** components namely the road and the bridge/flyover component. These components in general will behave differently during an earthquake each will require distinct design features.

Mitigation measures are based on structures has to withstand large horizontal and vertical accelerations and dynamic forces during earthquakes. This creates special requirements on the stiffness and load-bearing capacity of the structural members as well as on their connections.

The main concern will be to keep the roadway open and standing after an earthquake and prevent collapse that can shut down the roadways in time of emergencies.

The design of bridge/flyover is "site specific" or based on the maximum credible earth movement expected at that location determined by PSHA. The calculation depends on many factors, including the nearest active earthquake fault, type of geology beneath the bridge and the original bridge design

### **Design Features for Bridges and Flyovers**

Recent development on earthquake engineering led to a number of design features to help structures withstand ground shaking which can be applied to structures of the project which includes but not limited to the following:

- Single-column bridges and flyovers are known to be most vulnerable to earthquake damage. This design features now uses steel jackets to increase the strength of columns. Other practices in strengthening the columns are by encircling the columns with a steel casing to prevent the bridge column from crumbling apart during an earthquake. Aside from steel, advanced woven fiber casing / composite materials are used due to their light weight, high stiffness-to-weight and strength-to-weight ratios, and potentially high resistance to environmental degradation, resulting in lower life-cycle costs;

- In addition to the column casing, bridge footings can be made bigger and given more support by placing additional pilings in the ground or by using steel tie-down rods to better anchor the footings to the ground;
- Bridge abutments can be made larger and the restrainer units are made stronger since encasing the columns make them stiffer and can change the way forces are transmitted within the bridge;
- Uses of "hinge seat extensions" which enlarge the size of the hinges that connect sections of bridge decks and helps prevent them from separating during severe ground movement; and
- Design which will provide flexibility to the structure rather than rigidity

These design features are summarized in the succeeding illustrations.

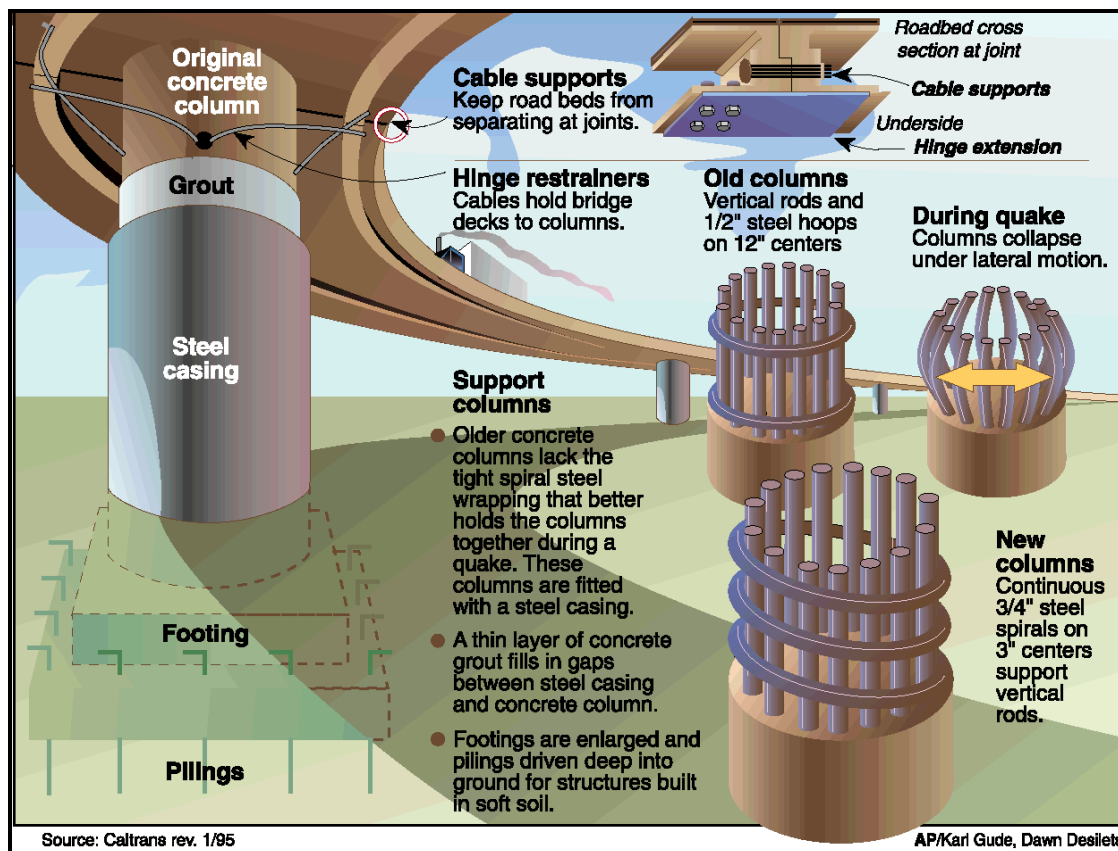
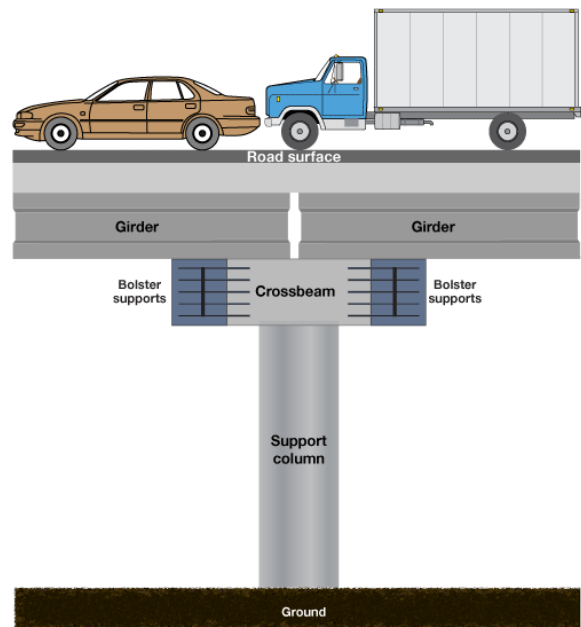


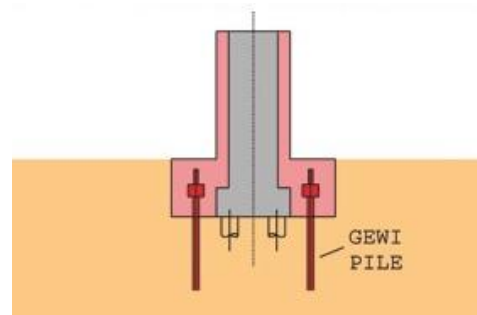
Illustration summarizing engineering design features to strengthen bridges and flyovers to withstand failures during earthquake (from California Civil Engineering Review website)

Other design innovations that can be adopted are the following:

- Widening of cross beams, installation of girder supports, steel column jackets, and walls to reinforce bridges to improve the integrity and performance of the bridges in the event of an earthquake;
- Bolsters to extend the crossbeam below the girders thus prevent the girder from slipping sideways during an earthquake. Girders support the road surface making it important they remain in place during an earthquake (from Washington State Department of Transport); and
- Filling the gaps between columns with a support wall. The support wall will better hold the bridge in place during a severe earthquake (from Washington State Department of Transport).
- Use of girder stops to prevent girders from sliding or tipping over during an earthquake;
- Firming up of beams, increasing the width of the pillars that bridges sit on and reinforcing the pillars;
- Reinforcing the concrete encasement of the pier stem columns and pile caps;
- Reinforcing the brackets at the abutment;



- Securing brackets to the beam and the abutment and then running a cable between them to restrict the beams from dislodging in a seismic event. (*Drillco website*);
- Widening of column thickness and footing width in addition to installation of additional / bigger piles to enhance load-bearing capacity and to prevent damage to foundations during seismic events.
- Increasing the stability of the structure using post-tensioning tendons to avoid the loss of support for the bearings due to large relative displacements between the superstructure and the substructure. So as not impede free movement of the structure due to temperature variation or other effects the pier cap beams are widened and strengthened and the superstructure is restrained to the support.
- Widening or adding of skirt spread footings and or extending it downward further into bedrock.



### Design Features for the Road Component

The best approach to mitigate ground rupture is avoidance. However, in the case of the project, this measure cannot be applied since a section of the road alignment will cross the trace of the West Marikina Fault Zone.

The key here is to always remember the West Valley Fault is a zone and not a line where rupture can occur in case of fault movement. The success of the mitigation measure will depend on identifying all likely rupture zones, and on characterization of the fault movement / displacement.

In designing the mitigation measure, it will be safe to assume that damage to the road section cannot be avoided, thus the key in the design will be the ease of rendering the road section operational with minimum use of materials, equipment and man-power. At best, the partial road repair can be undertaken even by the Barangay to immediately reopen the road immediately though damaged after the earthquake.

More realistic criteria can be established on a project/site-specific basis (e.g. Bray et al. 1993a). Once detailed studies of the geology and local site conditions (soil and topography) are completed, a combination of the methods described below may be employed to reduce damage resulting from surface rupturing.

- Use the inherent capability of unconsolidated geomaterials to “locally absorb” and distribute distinct bedrock fault movements. This can be done by detailed geotechnical investigation. It should be noted that differential movement across distinct bedrock faults dissipates as the shear rupture plane rises through overlying fills, especially if the fills are reinforced (*Bray et al 1993a*);
- The road component crossing the fault zone can be engineered to undergo ground deformation without significant structural damage. This is now in use in design of structures subjected to ground deformation resulting from mining subsidence and is applicable (*e.g. Kratzsch 1983*). The main consideration here is increasing ductility;
- The area within the known fault zone can be trenched and backfilled with loose materials to reduce lateral earth pressure. Road pavement laid on

top of the backfill within the trench of the known fracture zone can be designed as reinforced slab isolated from road section resting outside the fracture zone. Reinforced slabs can perform better than unreinforced slabs and can minimize damage due to ground movements from seismic compaction. In addition, it would be preferable if the slabs are underlain by polyethylene (plastic) sheets overlaying the granular soil-bedding layer to limit the ground strain that can be transmitted to the reinforced road pavement slab (*J.D. Bray 2001*); and

- The design measures can include establishing non-arbitrary setbacks based on fault geometry, fault displacement, and the overlying soil; constructing earth fills, reinforced with geosynthetics, to partially absorb and spread out the underlying ground movements; using slip layers to decouple ground movements from the road slab element.

| Table 4.1-1 Impacts Management Plan (1/17)      |                                                                                                                                                                                                                                          |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental Component Likely to be Affected   | Potential Impact                                                                                                                                                                                                                         | Duration and Type of impacts | Mitigation/Enhancement Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>PRE-CONSTRUCTION AND CONSTRUCTION PHASES</b> |                                                                                                                                                                                                                                          |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>THE LAND</b>                                 |                                                                                                                                                                                                                                          |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Land Use Classification</b>                  | <p>A total of about <b>92.56 ha</b> of <b>non-irrigated</b> agricultural lands (approximately <b>34.5 ha</b> of corn fields and <b>58.06</b> pineapple plantation) will be traversed by the alignment</p> <p>Loss of fertile topsoil</p> | <i>Long-term, Negative</i>   | <ul style="list-style-type: none"> <li>• Just compensation in accordance with the Land Acquisition Resettlement and Rehabilitation Indigenous People (LARRIPP)/World Bank Operational Procedure (WBOP) <b>4.12</b> will be accorded to the property owners for loss of agricultural farmlands;</li> <li>• Construction activities will be limited to the required ROW limit of <b>50-60 m</b> to minimize crop damage and loss of farmlands;</li> <li>• Unnecessary earth moving and related activities will be minimized to prevent extensive loss of fertile topsoil; and</li> <li>• Un-recycled/unused topsoil will be replaced/delivered to adjacent farmlands</li> </ul> |
| <b>Geology</b>                                  | Possible occurrence of rain-induced landslide and soil erosion along cut sections and slope areas                                                                                                                                        | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• Suitable angle of repose along cut areas will be maintained to prevent occurrence of landslides and soil erosion;</li> <li>• Slope and pier protection with retaining structures will be constructed along unstable slopes;</li> <li>• Removal of vegetation and tree cutting will be limited to the required ROW of <b>50-60 m</b>; and</li> <li>• Re-vegetation of identified erosion prone areas with suitable grass species (e.g. vetiver) and other common slope protection plant species will be considered</li> </ul>                                                                                                         |
|                                                 | Possible occurrence of earthquake-induced landslides                                                                                                                                                                                     | <i>Long-term, Negative</i>   | <ul style="list-style-type: none"> <li>• Landslides due to earthquake if ever it will occur will be confined on gully walls and possibly at the escarpment at the eastern margin of the volcanic slope;</li> <li>• The alignment will not pass along escarpments; and</li> <li>• Bridges crossing gullies will have well-engineered abutments founded into the gully floor or imbedded into the gully walls</li> </ul>                                                                                                                                                                                                                                                        |

**Table 4.1-1 Impacts Management Plan (2/17)**

| Environmental Component Likely to be Affected   | Potential Impact                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Duration and Type of impacts | Mitigation/Enhancement Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>PRE-CONSTRUCTION AND CONSTRUCTION PHASES</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>THE LAND</b>                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Geology</b>                                  | <p>Occurrence of ash fall due to Taal Volcano eruption:</p> <ul style="list-style-type: none"> <li>• Ash can clog drainage;</li> <li>• Fine ash is extremely slippery, hampering driving and walking;</li> <li>• Volcanic ash is gritty, abrasive and corrosive and can trouble infants, the elderly and those with respiratory ailments. ;</li> <li>• Ash can abrade and damage machinery and sensitive electronic/electrical equipment; and</li> <li>• Long-term exposure to wet ash can corrode metal</li> </ul> | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• Volcanic ash accumulation along the project roadway should be cleared immediately;</li> <li>• Vulnerable people must wear face mask or cover their nose &amp; mouth with damp handkerchief or cloth;</li> <li>• Public buildings and critical infrastructures are most vulnerable. Identify and organize ash clearing teams to monitor and clear ash accumulation;</li> <li>• Closely monitor the bulletin of PHIVOLCS and heed their advice; and</li> <li>• Issue warning bulletin to road users</li> </ul> |
|                                                 | <p>Occurrence of volcanic smog due to Taal Volcano eruption:</p> <ul style="list-style-type: none"> <li>• Generally associated with eruption clouds/ash fall;</li> <li>• Can aggravate respiratory problems; and</li> <li>• Can form acid rain that can corrode metals and contaminate drinking water if collected or sourced from rainwater catchment systems</li> </ul>                                                                                                                                           | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• Closely monitor the bulletin of PHIVOLCS and heed their advice; and</li> <li>• Issue warning bulletin to road users</li> </ul>                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Flooding</b>                                 | Possible aggravation of existing localized flooding at adjacent areas of the alignment, particularly in Sta. Rosa and Biñan Cities                                                                                                                                                                                                                                                                                                                                                                                  | <i>Long-term, Negative</i>   | <ul style="list-style-type: none"> <li>• The alignment crosses a number of deep gullies which acts as a discharge points for engineered drainage lines. These gullies are relatively deep and flow towards the receiving bodies of water (e.g. Laguna de Bay etc.);</li> <li>• Executive subdivisions and developed areas in Sta. Rosa and Biñan Cities adjacent to the alignment have existing well-engineered drainage systems that can accommodate storm water discharge from the CALA Expressway alignment;</li> </ul>                            |

| Table 4.1-1 Impacts Management Plan (3/17)                           |                                                                                                                                    |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|----------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental Component Likely to be Affected                        | Potential Impact                                                                                                                   | Duration and Type of impacts | Mitigation/Enhancement Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>PRE-CONSTRUCTION AND CONSTRUCTION PHASES</b>                      |                                                                                                                                    |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>THE LAND</b>                                                      |                                                                                                                                    |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Flooding</b>                                                      | Possible aggravation of existing localized flooding at adjacent areas of the alignment, particularly in Sta. Rosa and Biñan Cities | <i>Long-term, Negative</i>   | <ul style="list-style-type: none"> <li>• Dumping of garbage along the natural waterways must be prohibited; and</li> <li>• Engineered drainage lines on both private and public properties/development areas adjacent to the alignment must be regularly de-clogged to ensure unhampered flow of water</li> </ul>                                                                                                                                                                                                                                                                                                                           |
| <b>Terrestrial Biology (Flora)</b><br><b>Forest Vegetation</b>       | Minimal loss of natural secondary forest vegetation at bridge sites                                                                | <i>Long-term, Negative</i>   | <ul style="list-style-type: none"> <li>• “Permit To Cut” will be secured prior to any tree cutting activities along the alignment;</li> <li>• Tree cutting will be limited within the required ROW of 50-60 m;</li> <li>• Balling/relocation of trees will be carefully undertaken;</li> <li>• Replacement of cut trees in reforestation area/s designated by the DENR-FMB Region IV-A will be undertaken. Ratio and type of species to be introduced will be determined by the DENR Region IV-A; and</li> <li>• Planting of trees along National Roads as per <b>DPWH D.O. 131, Series of 1995</b> will be strictly implemented</li> </ul> |
| <b>Terrestrial Biology (Flora)</b><br><b>Agricultural Vegetation</b> | Minimal loss of natural secondary agricultural vegetation covers along the areas traversed by the proposed CALAX alignment         | <i>Long-term, Negative</i>   | <ul style="list-style-type: none"> <li>• Unavoidable but loss of vegetation is expected to be minimal. In addition, most of the areas crossed by the alignment are open grasslands;</li> <li>• Just compensation in accordance with the <b>LARRIPP/WBOP 4.12</b> will be accorded to the farmers for loss of agricultural crops such as pineapple, coffee, coconut, banana, and cassava;</li> </ul>                                                                                                                                                                                                                                         |
| <b>Terrestrial Biology (Fauna)</b>                                   | Temporary disturbance to wildlife movements and activities, particularly avifauna (bird)                                           | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• Temporary but unavoidable. Significant bird activities such as feeding and nesting can be performed at adjacent forest patches and grassland areas;</li> <li>• Bird poaching will be strictly prohibited; and</li> <li>• Workers will be educated on wildlife fauna conservation and protection, especially avifauna to discourage possible poaching</li> </ul>                                                                                                                                                                                                                                    |

| Table 4.1-1 Impacts Management Plan (4/17)      |                                                                                                                                                                                                                                                                                                                                                  |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental Component Likely to be Affected   | Potential Impact                                                                                                                                                                                                                                                                                                                                 | Duration and Type of impacts | Mitigation/Enhancement Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>PRE-CONSTRUCTION AND CONSTRUCTION PHASES</b> |                                                                                                                                                                                                                                                                                                                                                  |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>THE WATER</b>                                |                                                                                                                                                                                                                                                                                                                                                  |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Surface Hydrology</b>                        | Possible decrease in water flow rate of the rivers and creeks crossed by the CALA Expressway alignment due to impediment caused by improper management of construction spoils and debris, particularly stripped vegetation                                                                                                                       | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• Nets will be provided at bridge construction sites to prevent debris from falling into the waterways and cause water flow impediment;</li> <li>• Temporary rechanneling of stream flow along major waterways such as Malaking Ilog River, Lumbia River, and Malindig River will be considered; and</li> <li>• Construction spoils and debris, particularly stripped vegetation will be regularly hauled and disposed to designated dumpsite in Brgy. Lalaan I and Brgy. Tubuan I, Silang, Cavite and designated dumpsites in Bifan Santa Rosa Cities</li> </ul> |
| <b>Groundwater</b>                              | Possible contamination of groundwater table due to oil seepage and indiscriminate disposal of toxic chemicals (i.e. paints and used oils)                                                                                                                                                                                                        | <i>Long-term, Negative</i>   | <ul style="list-style-type: none"> <li>• Motor pool area will be located away from existing groundwater sources to prevent contamination; and</li> <li>• Storage depots for used oils and other toxic wastes will be provided in the motor pool area to temporarily hold these materials prior to disposal; and</li> <li>• Regular disposal of hazardous wastes such as used oils, worn out parts, and related materials will be handled by DENR-accredited company and will be disposed to DENR-approved sites</li> </ul>                                                                               |
| <b>THE WATER</b>                                |                                                                                                                                                                                                                                                                                                                                                  |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Water Quality</b>                            | Possible increase in the present level of total coliform content of the waterways crossed by the proposed CALA Expressway alignment, particularly Malaking Ilog River, Lumbia River, and Malindig River due to improper management of solid and domestic wastes to be generated by the construction workers during implementation of the project | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• Temporary sanitation facilities, particularly portable toilets and garbage bins will be provided at all construction sites, temporary field offices, and workers' camp sites to ensure proper solid and domestic wastes management;</li> <li>• Proper waste segregation will be strictly implemented;</li> <li>• Solid and domestic wastes generated by the workers will be regularly hauled and disposed to designated dumpsite in Brgy. Lalaan I and Brgy. Tubuan I, Silang, Cavite and designated dumpsites in Bifan Santa Rosa Cities;</li> </ul>           |

| Table 4.1-1 Impacts Management Plan (5/17)      |                                                                                                                                                                                                                                                                                                                                                  |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental Component Likely to be Affected   | Potential Impact                                                                                                                                                                                                                                                                                                                                 | Duration and Type of impacts | Mitigation/Enhancement Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>PRE-CONSTRUCTION AND CONSTRUCTION PHASES</b> |                                                                                                                                                                                                                                                                                                                                                  |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>THE WATER</b>                                |                                                                                                                                                                                                                                                                                                                                                  |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Water Quality</b>                            | Possible increase in the present level of total coliform content of the waterways crossed by the proposed CALA Expressway alignment, particularly Malaking Ilog River, Lumbia River, and Malindig River due to improper management of solid and domestic wastes to be generated by the construction workers during implementation of the project | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• Daily inspection of the workers' camp sites, temporary field offices, and all construction areas provided with temporary sanitation facilities will be strictly implemented to ensure proper wastes and sanitation management; and</li> <li>• Coliform level monitoring along selected waterways will be conducted twice a year</li> </ul>                                                                                                                                                                                                                                                                                                                          |
|                                                 | Possible increase in the siltation level of the waterways crossed by the proposed CALA Expressway alignment, particularly Malaking Ilog River, Lumbia River, and Malindig River due to surface run-off                                                                                                                                           | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• Earth moving activities and related construction works particularly along cut and slope areas, and bridge sites will be cautiously undertaken to minimize soil disturbance that may cause surface run off;</li> <li>• Temporary silt traps will be constructed along the waterways to prevent siltation caused by surface run-off, particularly during high precipitation periods;</li> <li>• Exposed and open construction areas adjacent to the waterways will be re-vegetated to prevent surface run-off, particularly during high precipitation periods; and</li> <li>• TSS level monitoring along selected waterways will be conducted twice a year</li> </ul> |
|                                                 | Possible increase in pH level of the waterways crossed by the proposed CALA Expressway alignment, particularly Malaking Ilog River, Lumbia River, and Malindig River during bridge construction due to concrete spillage                                                                                                                         | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• Concrete pouring and road surfacing at bridge construction sites will be closely supervised to prevent spillage into the waterways;</li> <li>• Nets will be installed at bridge construction sites to prevent contamination of the waterways in case of accidental concrete spillage during pouring; and</li> <li>• Washing of transit mixers and related construction equipment along the waterways will be strictly prohibited to prevent increase in pH level</li> </ul>                                                                                                                                                                                         |

| Table 4.1-1 Impacts Management Plan (6/17)      |                                                                                                                                                                                                                                                                        |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental Component Likely to be Affected   | Potential Impact                                                                                                                                                                                                                                                       | Duration and Type of impacts | Mitigation/Enhancement Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>PRE-CONSTRUCTION AND CONSTRUCTION PHASES</b> |                                                                                                                                                                                                                                                                        |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>THE WATER</b>                                |                                                                                                                                                                                                                                                                        |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Water Quality</b>                            | Possible increase in the oil & grease level of the waterways crossed by the proposed CALA Expressway alignment, particularly Malaking Ilog River, Lumbia River, and Malindig River due to oil spillage from heavy equipment and machineries during bridge construction | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• Periodic Service Maintenance (PMS) of the construction equipment and machineries will be strictly complied with to ensure that these are in good working conditions at all times;</li> <li>• Washing of construction equipment and machineries along the waterways will be strictly prohibited to prevent oil &amp; grease contamination; and</li> <li>• On-site repair and maintenance of the construction equipment will be strictly prohibited</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>THE AIR</b>                                  |                                                                                                                                                                                                                                                                        |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Air Quality</b>                              | Possible increase in the TSP level at the construction sites and adjacent areas, particularly dust pollution sensitive receptors areas such as residential, hospitals, and schools due to dust re-suspension                                                           | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• Exposed and cleared construction areas will be regularly sprayed with water to minimize dust re-suspension;</li> <li>• A 20 kph speed limit along the construction areas, particularly at dust pollution sensitive receptor areas will be strictly enforced;</li> <li>• Temporary stockpiles of un-recycled materials and construction spoils will be covered with tarpaulin or sack materials to prevent re-suspension of particulate matters;</li> <li>• Construction spoils will be regularly hauled and disposed to areas duly-approved by the DENR and/or concerned LGUs;</li> <li>• Delivery and hauling trucks will be provided with tarpaulin or sack material to minimize dust re-suspension;</li> <li>• Quarterly TSP monitoring at dust sensitive receptor areas will be conducted during the pre-construction and construction phases of the project</li> </ul> |

| Table 4.1-1 Impact Management Plan (7/17)       |                                                                                                                                                                                                                         |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental Component Likely to be Affected   | Potential Impact                                                                                                                                                                                                        | Duration and Type of impacts | Mitigation/Enhancement Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>PRE-CONSTRUCTION AND CONSTRUCTION PHASES</b> |                                                                                                                                                                                                                         |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>THE AIR</b>                                  |                                                                                                                                                                                                                         |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Air Quality</b>                              | Possible increase in the TSP level in the affected areas due to dust re-suspension                                                                                                                                      | <i>Short-term, Negative</i>  | •                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|                                                 | Possible increase in the concentration levels of SO <sub>2</sub> and NO <sub>2</sub> due to exhaust gas emissions from various construction vehicles, equipment, and machineries                                        | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• PMS of construction equipment and machineries, and vehicles will be strictly complied with to ensure these are in good working condition at all times;</li> <li>• Daily routine check-up of construction vehicles, equipment, and machineries must be strictly complied with; and</li> <li>• Quarterly SO<sub>2</sub> and NO<sub>2</sub> sampling at air pollution sensitive areas will be conducted during the pre-construction and construction phases of the project</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Noise Level and Vibration</b>                | <p>Possible increase in the noise level in the area due to operation of various construction equipment and machineries</p> <p>Possible incidence of ground vibration due to foundation works and related activities</p> | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• Bored piles using a special boring equipment will be adopted during foundation works instead of pile driving to prevent ground vibration;</li> <li>• Noise suppressors will be installed to construction equipment and machineries whenever necessary to maintain noise generated at permissible level;</li> <li>• High noise generating construction activities will be undertaken during the daytime only to minimize noise disturbance to nearby residential and other noise sensitive receptors areas;</li> <li>• Temporary noise barriers will be installed at noise sensitive receptor areas such as residential, schools, hospitals, and places of worships to maintain noise level at permissible limit; and</li> <li>• PMS of the construction equipment and machineries will be strictly complied with to ensure that these are in good working conditions at all times</li> </ul> |

| Table 4.1-1 Impact Management Plan (8/17)       |                                                                                                                                                                                                                                                                                                                                                                                                                |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental Component Likely to be Affected   | Potential Impact                                                                                                                                                                                                                                                                                                                                                                                               | Duration and Type of impacts | Mitigation/Enhancement Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>PRE-CONSTRUCTION AND CONSTRUCTION PHASES</b> |                                                                                                                                                                                                                                                                                                                                                                                                                |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>THE PEOPLE</b>                               |                                                                                                                                                                                                                                                                                                                                                                                                                |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Assets and Income</b>                        | A total of <b>36 residential structures (45 households or 175 people)</b> and <b>two (2) commercial structures</b> (i.e. small-scale eatery/carenderia) will be affected by the alignment<br><br>Approximately <b>67 farm land lots (104 ha)</b> will be affected. About <b>39%</b> are landowners; about <b>10%</b> are tenants; and about <b>51%</b> are rent-free occupants with permission from the owners | <i>Long-term, Negative</i>   | <ul style="list-style-type: none"> <li>• A final Resettlement Action Plan (RAP) with full consensus with the PAPs, and inventories of land and other properties will be prepared prior to implementation of the project;</li> <li>• Just compensation in accordance with <b>LARRIPP/WBOP 4.12</b> will be accorded to PAPs for loss of assets and source of livelihood;</li> <li>• Construction activities will limited within the required ROW of <b>50-60 m</b> to avoid further displacement of residential and commercial structures, and loss of assets and livelihood</li> </ul> |
|                                                 | Loss of commercial crops like pineapple, coffee, coconut, papaya, cassava, and banana                                                                                                                                                                                                                                                                                                                          | <i>Long-term, Negative</i>   | <ul style="list-style-type: none"> <li>• A final RAP with full consensus with the PAPs, and inventories of land and other properties will be prepared prior to implementation of the project; and</li> <li>• Just compensation in accordance with <b>LARRIPP/WBOP 4.12</b> will be accorded to PAPs for loss of assets and source of livelihood</li> </ul>                                                                                                                                                                                                                             |
|                                                 | Disturbance to agricultural activities along the proposed CALA Expressway alignment                                                                                                                                                                                                                                                                                                                            | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• Temporary crossings will be provided to ensure safe and unhampered movements of farmers to and from their agricultural lands; and</li> <li>• Just compensation in accordance with <b>LARRIPP/ WBOP 4.12</b> will be accorded to PAPs for loss of assets and source of livelihood</li> </ul>                                                                                                                                                                                                                                                   |
|                                                 | Accidental filling up of farmlands adjacent to the construction areas                                                                                                                                                                                                                                                                                                                                          | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• Temporary stockpiles of construction materials, construction spoils and debris will be located away from agricultural lands to prevent accidental filling up of farmlands adjacent to the construction sites; and</li> <li>• In case of accidental filling up, damage compensation in accordance with <b>LARRIPP/WBOP 4.12</b> will be accorded to farmers for loss of income</li> </ul>                                                                                                                                                      |

| Table 4.1-1 Impacts Management Plan (9/17)      |                                                                                                                                                                                                                                                                                                                                                                   |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental Component Likely to be Affected   | Potential Impact                                                                                                                                                                                                                                                                                                                                                  | Duration and Type of impacts | Mitigation/Enhancement Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>PRE-CONSTRUCTION AND CONSTRUCTION PHASES</b> |                                                                                                                                                                                                                                                                                                                                                                   |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>THE PEOPLE</b>                               |                                                                                                                                                                                                                                                                                                                                                                   |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Temporary Employment</b>                     | Generation of temporary employment to qualified residents in the direct and indirect impact areas                                                                                                                                                                                                                                                                 | <i>Short-term, Positive</i>  | <ul style="list-style-type: none"> <li>• Qualified workers duly endorsed by the Brgy. Captains from the impact areas will be given priority in hiring during implementation of the project</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Basic Social Service Utilities</b>           | <p>Interruption of water supply in areas serviced by the wells located in Brgy. Sabutan, Silang, Cavite</p> <p>Possible interruption of power supply and telecommunication service</p>                                                                                                                                                                            | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• Displaced wells in Brgy. Sabutan will be restored and replaced;</li> <li>• Close coordination with concerned utility companies will be undertaken to expedite relocation and restoration of the affected utilities;</li> <li>• Relocation and restoration of affected social service utilities will be undertaken in the shortest possible time to minimize inconvenience to the affected public; and</li> <li>• Affected residents will be notified in advance to enable them to prepare and undertake necessary measures. Notice to the public shall be posted at conspicuous areas such as municipal and barangay halls, schools, and places of worships</li> </ul> |
| <b>Social Service Facilities</b>                | Increase in demand of basic social service facilities such as health centers and places of worships due to in-migration of workers                                                                                                                                                                                                                                | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• Basic social service facilities such as health care center, eating spaces, and places of worships will be provided in the work sites so as to eliminate competition between migrant workers and local residents</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Occupational Health and Safety</b>           | <p>Long-term exposure of workers, especially heavy equipment operators to high noise level may lead to hearing impairment</p> <p>Long-term exposure of workers, especially heavy equipment operators to exhaust gas emissions may result to upper respiratory ailments</p> <p>Direct contact of workers handling toxic materials may lead to chronic diseases</p> | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• Workers will be provided with adequate Personal Protective Equipment (PPE) such as ear muffs, gas/protective masks, hard hats, safety boots, safety gloves, reflectorized vests, and other related safety gears;</li> <li>• Wearing of the provided PPEs will be strictly implemented;</li> <li>• Personnel will be trained on safety procedures and educated on health standards;</li> <li>• Personnel will be comprehensively trained on handling of toxic materials;</li> </ul>                                                                                                                                                                                     |

| Table 4.1-1 Impacts Management Plan (10/17)            |                                                                                                                                                                                                                                                                                                                                                                   |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental Component Likely to be Affected          | Potential Impact                                                                                                                                                                                                                                                                                                                                                  | Duration and Type of impacts | Mitigation/Enhancement Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>PRE-CONSTRUCTION AND CONSTRUCTION PHASES</b>        |                                                                                                                                                                                                                                                                                                                                                                   |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>THE PEOPLE</b>                                      |                                                                                                                                                                                                                                                                                                                                                                   |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Occupational Health and Safety</b>                  | <p>Long-term exposure of workers, especially heavy equipment operators to high noise level may lead to hearing impairment</p> <p>Long-term exposure of workers, especially heavy equipment operators to exhaust gas emissions may result to upper respiratory ailments</p> <p>Direct contact of workers handling toxic materials may lead to chronic diseases</p> | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• Medical clinic and first aid station facilities supervised by a registered nurse will be provided in the work areas and field offices;</li> <li>• An Emergency Response Plan will be formulated to quickly respond to any type of emergency situation within the construction area;</li> <li>• Medical check-up of workers will be regularly conducted;</li> <li>• PMS of the heavy equipment, machineries, and vehicles is strictly complied with to ensure that these are in good conditions at all times;</li> <li>• An emergency vehicle on stand-by will be provided within the construction areas at all times</li> </ul>                                                                                                                                                                                                                                                                          |
| <b>Waste Management, Sanitation, and Public Health</b> | <p>Possible spread of communicable diseases due to improper wastes management within the construction sites, workers' camps, and field offices</p> <p>Potential spread of communicable diseases in the receiving communities due to in-migration of workers</p> <p>Possible spread of sexually transmitted diseases (STDs)</p>                                    | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• Adequate temporary sanitation facilities such as portable toilets and trash bins will be provided at all construction sites, workers' camps, and field offices;</li> <li>• Proper waste segregation scheme will be strictly enforced;</li> <li>• Domestic and solid wastes generated by the workers will be regularly hauled and disposed to designated dumpsite in Brgy. Lalaan I and Brgy. Tubuan I, Silang, Cavite, and approved dumpsites in Biñan and Santa Rosa Cities;</li> <li>• Inspection of workers' camps and field offices will be conducted daily to ensure good housekeeping;</li> <li>• Medical screening of migrant workers will be undertaken during hiring period;</li> <li>• Regular medical check-up of workers will be conducted; and</li> <li>• Group consultations will be undertaken to promote awareness among the community on how to prevent transmission of STDs</li> </ul> |

| Table 4.1-1 Impact Management Plan (11/17)      |                                                                                                                                                                                                                                                                                                                                               |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental Component Likely to be Affected   | Potential Impact                                                                                                                                                                                                                                                                                                                              | Duration and Type of impacts | Mitigation/Enhancement Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>PRE-CONSTRUCTION AND CONSTRUCTION PHASES</b> |                                                                                                                                                                                                                                                                                                                                               |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>THE PEOPLE</b>                               |                                                                                                                                                                                                                                                                                                                                               |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Public Safety</b>                            | Safety of residents and pedestrians near the construction areas                                                                                                                                                                                                                                                                               | <i>Short-term, negative</i>  | <ul style="list-style-type: none"> <li>• All excavation areas will be enclosed with metal sheets and barriers will be installed at the construction areas to limit access to the public, especially children;</li> <li>• Pedestrians crosswalks will be provided at critical construction areas such as built-up areas, schools, places of worships, hospitals, and residential areas;</li> <li>• Adequate lighting and reflectorized warning signs will be installed within the construction sites to ensure safety of public, especially during nighttime; and</li> <li>• Well-trained traffic aides and flagmen will be designated at critical construction sites such as those adjacent to residential and built-up areas to assist pedestrians;</li> </ul>                                                                                                                                                     |
| <b>Safety of Motorists</b>                      | <p>Safety of motorists plying the E. Aguinaldo Highway, Silang, Cavite section, Nuvali Spine Road, Laguna Boulevard, Nuvali Road, Mamlasan Overpass-Greenfield Parkway Road, and other main and secondary roads crossed by the proposed CALA Expressway alignment</p> <p>Safety of motorists at bridge and interchange construction sites</p> | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• Adequate lighting and reflectorized warning signs will be installed along the entire construction sites, particularly at critical areas such as bridge sites and interchange locations to ensure safety of motorists, especially during nighttime;</li> <li>• A sound Traffic Management Plan (TMP) and re-routing schemes along major roads, bridge sites and interchange locations duly approved by the concerned LGUs will be strictly implemented;</li> <li>• Well-trained traffic aides and flagmen will be assigned along the major roads, bridge sites, interchange locations, and other critical construction sites such as those adjacent to residential and built-up areas to direct traffic and assist motorists; and</li> <li>• Parking of idle construction equipment and vehicles along the roads will be prohibited, especially during nighttime</li> </ul> |

| Table 4.1-1 Impacts Management Plan (12/18)     |                                                                                                                                                                                                                                                                                                                                                     |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental Component Likely to be Affected   | Potential Impact                                                                                                                                                                                                                                                                                                                                    | Duration and Type of impacts | Mitigation/Enhancement Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>PRE-CONSTRUCTION AND CONSTRUCTION PHASES</b> |                                                                                                                                                                                                                                                                                                                                                     |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>THE PEOPLE</b>                               |                                                                                                                                                                                                                                                                                                                                                     |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Traffic</b>                                  | <p>Possible traffic congestion along E. Aguinaldo Highway, Silang, Cavite section, Nuvali Spine Road, Laguna Boulevard, Nuvali Road, Mamlasan Overpass-Greenfield Parkway Road, and other main and secondary roads intersected by the proposed CALA Expressway alignment</p> <p>Traffic congestion at bridge and interchange construction sites</p> | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• A comprehensive Traffic Impact Assessment (TIA) will be prepared during the DED to address the traffic congestion issues that may arise during implementation of the project along the major arterial roads surrounding the study area;</li> <li>• A sound TMP and re-routing schemes duly approved by the concerned LGUs will be strictly implemented to minimize traffic congestions along bridge sites, interchange locations, and other busy construction areas;</li> <li>• Well-trained traffic aides and flagmen will be assigned along the major roads, bridge sites, interchange locations, and other busy areas to direct traffic;</li> <li>• Parking/waiting time of construction vehicles and equipment along major roads and busy areas will be limited; and</li> <li>• Delivery and transport of fabricated construction materials will be done during nighttime</li> </ul> |
| <b>DEMOBILIZATION/DECOMMISSIONING PHASE</b>     |                                                                                                                                                                                                                                                                                                                                                     |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>THE LAND</b>                                 |                                                                                                                                                                                                                                                                                                                                                     |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Geology</b>                                  | Stability of cut slopes, landslide and erosion prone areas                                                                                                                                                                                                                                                                                          | <i>Long-term, Negative</i>   | <ul style="list-style-type: none"> <li>• The Contractor must ensure that: <ul style="list-style-type: none"> <li>➢ Re-vegetation of the exposed and cleared slopes is in place;</li> <li>➢ Slope and pier protection with retaining structures are in place; and</li> <li>➢ Angle of repose along cut sections are maintained</li> </ul> </li> <li>• A joint site inspection between the Environmental Safety and Health Officer (ESHO) of the Contractor, representatives from the DPWH, concerned LGUs, representatives from the DENR Region IV-A, and community leaders of affected barangays will be undertaken to ensure that protection measures along cut slopes, landslide and erosion prone areas are in place</li> </ul>                                                                                                                                                                                                |

| Table 4.1-1 Impacts Management Plan (13/18)                          |                                                                                                                         |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|----------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental Component Likely to be Affected                        | Potential Impact                                                                                                        | Duration and Type of impacts | Mitigation/Enhancement Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>DEMOBILIZATION/DECOMMISSIONING PHASE</b>                          |                                                                                                                         |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>THE LAND</b>                                                      |                                                                                                                         |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Terrestrial Biology (Flora)</b><br><b>Forest Vegetation</b>       | Replacement of cut trees<br><br>Tree planting along the National Roads/newly constructed CALA Expressway                | <i>Long-term, Positive</i>   | <ul style="list-style-type: none"> <li>The Contractor must ensure that: <ul style="list-style-type: none"> <li>➤ The survival rate of the tree species introduced at the reforestation area designated by the DENR Region IV-a is established;</li> <li>➤ The survival rate of the trees planted along the National Roads as per <b>DPWH D.O. 131, Series of 1995</b>, is established</li> </ul> </li> <li>A joint site inspection between the (ESHO) of the Contractor, DPWH representatives, representatives from the concerned LGUs, representatives of DENR Region IV-A, and community leaders of affected barangays will be conducted to ensure that reforestation and tree planting activities are in place</li> </ul> |
| <b>Terrestrial Biology (Flora)</b><br><b>Agricultural Vegetation</b> | Revegetation of cut slopes and embankment areas, and landscaping of areas stripped of vegetation cover                  | <i>Long-term, Positive</i>   | <ul style="list-style-type: none"> <li>The Contractor must ensure that: <ul style="list-style-type: none"> <li>➤ Revegetation of the cut slopes and embankment areas is in place;</li> <li>➤ Landscaping of areas stripped of vegetation cover is in place; and</li> </ul> </li> <li>A joint site inspection between the (ESHO) of the Contractor, DPWH representatives, representatives from the concerned LGUs, representatives of DENR Region IV-A, and community leaders of affected barangays will be conducted to ensure that re-vegetation activities are in place</li> </ul>                                                                                                                                         |
| <b>THE WATER</b>                                                     |                                                                                                                         |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Surface Hydrology</b>                                             | Possible impediment of water flow of waterways crossed by the alignment due to abandoned construction spoils and debris | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>The Contractor must ensure that all temporary stockpiles of construction spoils and debris are totally removed from the construction areas and are properly disposed to the designated dumpsite in Brgy. Lalaan I and Brgy. Tubuan I in Silang, Cavite and approved dumpsites in Biñan and Santa Rosa Cities and not abandoned in the construction areas; and</li> </ul>                                                                                                                                                                                                                                                                                                              |

| Table 4.1-1 Impacts Management Plan (14/18)   |                                                                                                                             |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental Component Likely to be Affected | Potential Impact                                                                                                            | Duration and Type of impacts | Mitigation/Enhancement Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>DEMOBILIZATION/DECOMMISSIONING PHASE</b>   |                                                                                                                             |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>THE WATER</b>                              |                                                                                                                             |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Surface Hydrology</b>                      | Possible impediment of water flow of waterways crossed by the alignment due to abandoned construction spoils and debris     | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• A joint site inspection between the ESHO of the Contractor, DPWH representatives, representatives from the Solid Waste Management and Disposal Office of the concerned LGUs, representatives of DENR Region IV-A, and community leaders of affected barangays will be conducted to ensure that all bridge sites are free from construction spoils and debris, and water along the rivers and creeks are free flowing</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Groundwater</b>                            | Possible contamination of water tables due to abandoned used oils and other toxic materials                                 | <i>Long-term, Negative</i>   | <ul style="list-style-type: none"> <li>• The Contractor must ensure complete closure of motor pool area;</li> <li>• The temporary storage depot provided in the motor pool area will be completely dismantled and all toxic wastes such as used oils worn out motor parts, and other toxic chemicals will be disposed to sites duly approved by DENR Region IV-A; and</li> <li>• A joint site inspection between ESHO of the Contractor, DPWH representatives, representatives from the Solid Waste Management and Disposal Office of the concerned LGUs, representatives of DENR Region IV-A, and community leaders of affected barangays will be conducted to ensure that the motor pool area is completely closed and all temporary storage facilities are dismantled and all toxic wastes are properly disposed to sites duly approved by the DENR Region IV-A</li> </ul> |
| <b>Water Quality</b>                          | Possible contamination of the waterways crossed by the CALA Expressway alignment due to abandoned domestic and solid wastes | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• All temporary sanitation facilities will be dismantled and removed from the construction sites immediately after construction works are completed, particularly those near the waterways;</li> <li>• All remaining solid and domestic wastes will be properly disposed to the designated dumpsite in Brgy. Lalaan I and Brgy. Tubuan I in Silang, Cavite and approved dumpsites in Biñan and Santa Rosa Cities; and</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                       |

| Table 4.1-1 Impacts Management Plan (15/18)   |                                                                                                                             |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental Component Likely to be Affected | Potential Impact                                                                                                            | Duration and Type of impacts | Mitigation/Enhancement Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>DEMOBILIZATION/DECOMMISSIONING PHASE</b>   |                                                                                                                             |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>THE WATER</b>                              |                                                                                                                             |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Water Quality</b>                          | Possible contamination of the waterways crossed by the CALA Expressway alignment due to abandoned domestic and solid wastes | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• A joint site inspection between the ESHO of the Contractor, representatives from DPWH, representatives from the Solid Waste Management and Sanitation Office of the concerned LGUs, and community leaders of affected barangays will be conducted to ensure that all temporary sanitation facilities are dismantled and no wastes are abandoned at the construction sites, particularly those adjacent to the waterways</li> </ul>                                                                                                                                                                                                                               |
|                                               | Possible siltation of the waterways crossed by the CALA Expressway alignment                                                | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• All temporary stockpiles of un-recycled soil materials and construction spoils will be removed and properly disposed to the designated dumpsite in Brgy. Lalaan I and Brgy. Tubuan I in Silang, Cavite and approved dumpsites in Biñan and Santa Rosa Cities; and</li> <li>• A joint site inspection between the ESHO of the Contractor, DPWH representatives, representatives from the Solid Waste Management and Disposal Office of the concerned LGUs, and community leaders of affected barangays will be conducted to ensure that stockpiles of un-recycled soil materials and construction spoils are not abandoned anywhere near the waterways</li> </ul> |
| <b>THE PEOPLE</b>                             |                                                                                                                             |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Basic Social Service Utilities</b>         | Extended interruption of water and power supplies, and telecommunication lines                                              | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• The Contractor must ensure that the displaced wells in Brgy. Sabutan, Silang, Cavite are relocated and restored to normal function;</li> <li>• Prompt relocation and restoration to normal functions of water and power supplies, and telecommunication lines must be ensured by the Contractor;</li> </ul>                                                                                                                                                                                                                                                                                                                                                      |

| Table 4.1-1 Impacts Management Plan (16/18)            |                                                                                     |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------------------------------------------|-------------------------------------------------------------------------------------|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental Component Likely to be Affected          | Potential Impact                                                                    | Duration and Type of impacts | Mitigation/Enhancement Measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>DEMOBILIZATION/DECOMMISSIONING PHASE</b>            |                                                                                     |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>THE PEOPLE</b>                                      |                                                                                     |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Basic Social Service Utilities</b>                  | Extended interruption of water and power supplies, and telecommunication lines      | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• A joint site inspection between the ESHO of the Contractor, representatives from the concerned utility companies, representatives from the concerned LGUs, representative from the DPWH, and leaders of affected communities will be conducted to ensure replacement, relocation, and complete restoration of affected utility service facilities</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Waste Management, Sanitation, and Public Health</b> | Possible spread of communicable diseases due to abandoned solid and domestic wastes | <i>Short-term, Negative</i>  | <ul style="list-style-type: none"> <li>• All temporary sanitation facilities will be dismantled and removed from the construction sites, workers' camps, and field offices immediately after construction works are completed;</li> <li>• All remaining solid and domestic wastes will be properly disposed to the designated dumpsite in Brgy. Lalaan I and Brgy. Tubuan I in Silang, Cavite and approved dumpsites in Biñan and Santa Rosa Cities; and</li> <li>• A joint site inspection between the ESHO of the Contractor, representatives from DPWH, representatives from the Solid Waste Management and Sanitation Office of the concerned LGUs, and community leaders of affected barangays will be conducted to ensure that all temporary sanitation facilities are completely dismantled and no wastes are abandoned at the construction sites, workers' camps, and temporary field offices</li> </ul> |
| <b>Illegal Settlement</b>                              | Permanent and illegal settlement at workers camps and field offices                 | <i>Long-term, Negative</i>   | <ul style="list-style-type: none"> <li>• The Contractor must ensure complete closure of all temporary facilities such as bunk houses and field offices to prevent permanent and illegal settlement; and</li> <li>• A joint site inspection between the ESHO of the Contractor, representatives from DPWH, concerned LGUs, and community leaders of affected barangays will be conducted to ensure complete closure of workers' camps and temporary field offices</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                      |

| Table 4.1-1 Impacts Management Plan (17/18)   |                                                                                                                                                                                                                             |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental Component Likely to be Affected | Potential Impact                                                                                                                                                                                                            | Duration and Type of impacts | Mitigation/Enhancement Measures                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>OPERATIONAL PHASE</b>                      |                                                                                                                                                                                                                             |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>THE LAND</b>                               |                                                                                                                                                                                                                             |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Land Use</b>                               | Possible conversion of <b>marginally utilized</b> agricultural lands adjacent to the newly constructed CALA Expressway, particularly in Brgy. Kaong, Sabutan, Tibig, Carmen, and Inchican in Silang, Cavite into other uses | <i>Long-term, Negative</i>   | <ul style="list-style-type: none"> <li>Concerned LGUs must pass necessary ordinances and strictly implement such to support existing legislations prohibiting illegal conversion of agricultural lands into other uses</li> </ul>                                                                                                                                                                                                                                    |
| <b>THE AIR</b>                                |                                                                                                                                                                                                                             |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Air Quality</b>                            | Possible increase in TSP level in areas along the newly constructed CALA Expressway due to increase in vehicular traffic volume                                                                                             | <i>Long-term, Negative</i>   | <ul style="list-style-type: none"> <li>Survival rate of the trees planted along the newly constructed CALA Expressway (<b>DPWH D.O. 131, Series of 1995</b>) will be continuously monitored. Trees not only act as natural sieves for re-suspended dust particles, but also enhance aesthetics of the road sides; and</li> <li>The Philippine Clean Air Act and Anti-Smoke Belching Law will be strictly implemented by the concerned government agencies</li> </ul> |
|                                               | Possible increase in the level of gaseous air contaminants such as SO <sub>2</sub> and NO <sub>2</sub> due to increase in vehicular traffic volume                                                                          | <i>Long-term, Negative</i>   | <ul style="list-style-type: none"> <li>Survival rate of the trees planted along the newly constructed CALA Expressway (<b>DPWH D.O. 131, Series of 1995</b>) will be continuously monitored. Trees absorb gaseous air pollutants and convert them into oxygen through transpiration process; and</li> <li>The Philippine Clean Air Act and Anti-Smoke Belching Law will be strictly implemented by the concerned government agencies</li> </ul>                      |
| <b>Noise Level</b>                            | Possible increase in the present level of noise along the newly constructed CALA Expressway, particularly at noise sensitive receptor areas due to increase in volume of vehicular traffic                                  | <i>Long-term, Negative</i>   | <ul style="list-style-type: none"> <li>The “No Blowing of Horns” at noise sensitive receptor areas such as schools, hospitals, and places of worships will be strictly enforced;</li> <li>If necessary, adequate noise barriers will be installed at noise sensitive receptors adjacent to the CALA Expressway such as residential areas, schools, hospitals, and places of worships</li> </ul>                                                                      |

| Table 4.1-1 Impacts Management Plan (18/18)   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental Component Likely to be Affected | Potential Impact                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Duration and Type of impacts | Mitigation/Enhancement Measures                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>THE PEOPLE</b>                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                              |                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Economy</b>                                | <p>The newly constructed CALAX Expressway will:</p> <ul style="list-style-type: none"> <li>➤ Provide fast, safe, comfortable and reliable means of transport in Cavite and Laguna Provinces;</li> <li>➤ Decongest traffic of roads in Cavite and Laguna Provinces;</li> <li>➤ Support economic development by providing better transport access to economic/industrial zones in the area; and</li> <li>➤ Support sound urbanization in the areas traversed by the CALA Expressway</li> </ul> | <i>Long-term, Positive</i>   | <ul style="list-style-type: none"> <li>• Periodic inspection and maintenance of the newly constructed CALA Expressway based on standard DPWH inspection and maintenance procedures for roads and bridges will be undertaken to maximize optimum service to road users</li> </ul>                                                                                                                                                             |
| <b>Road Safety</b>                            | Safety of motorists plying the newly constructed CALA Expressway                                                                                                                                                                                                                                                                                                                                                                                                                             | <i>Long-term, Negative</i>   | <ul style="list-style-type: none"> <li>• Road signs and markings, information display board, and streetlights, especially along bridges and interchanges will be properly maintained; and</li> <li>• Periodic inspection and maintenance of the newly constructed CALA Expressway based on standard DPWH inspection and maintenance procedures for roads and bridges will be undertaken to maximize optimum service to road users</li> </ul> |

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**Chapter 5**

**Social Development Plan  
and  
Information Education and  
Communication (IEC)**

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## 5 SOCIAL DEVELOPMENT PLAN (SDP), AND INFORMATION EDUCATION AND COMMUNICATION (IEC)

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### 5.1 SDP AND IEC FRAMEWORK IMPLEMENTATION

#### 5.1.1 Social Development Plan

Implementation of Social Development Plan (SDP) shall be in terms of providing livelihood restoration and improvement for Project-Affected Persons (PAPs) who will be severely affected by land acquisition. As defined in DPWH's Land Acquisition, Resettlement, Rehabilitation, and Indigenous Peoples Policy (LARRIPP), Series of 2007, "severe" effect refers to cases wherein acquisition of land is more than 20% of the landholding, or less than 20% but the remaining portion is no longer economically viable. Whenever the livelihood of PAPs is land-based, e.g., as in the case of Silang, Cavite, wherein the primary source of livelihood is farming, livelihood restoration shall be provided, if land-for-land is not feasible. Details on the SDP shall be included in the full-blown RAP to be prepared after the completion of the Parcellary Survey (during conduct of Detailed Engineering Design).

#### 5.1.2 Information Education and Communication (IEC)

IEC meetings were held at various levels of concerned Local Government Units (LGUs) to ensure that all identified stakeholders are fully informed, consulted, and encouraged to participate in any decision-making that will affect their lives. These meetings open opportunities for discussion, which allowed the DPWH and Environmental Consultant to address issues raised. Upon careful consideration, such concerns can be incorporated in detailed engineering design and resettlement plan. By doing so, delays in implementation due to unforeseen conflicts are avoided.

During the said consultation meetings the **Scoping matrix** was also presented and discussed. Information campaign materials were also given to provide information on the process of acquiring the R-O-W. This approach was adopted as part of the Resettlement Action Plan (RAP) prepared for the project.

A total of **14 IEC meetings** were conducted. **Five (5)** of these are with the LGUs--- **two (2)** at the provincial, and **three (3)** city/municipal level; **eight (8)** barangay/PAPs-level and one **(1)** with the officers of *Samahang Magsasaka sa Carmen* (SAMACA) Farmer's Organization in Brgy. Carmen. Highlights of the IEC Meetings, including photographs taken are presented in **Appendix A**.

Aside from IEC Meetings, the Consultant visited the Provincial Assessor's Office (PAO) of Cavite and Laguna, Municipal Assessor Office (MAO) of Silang, City Assessors Offices (CAO) of Biñan and Sta. Rosa as part of RAP preparation. The project was also presented to the different department and offices of the Local Government Unit (LGU) such as Treasury, Municipal Agrarian Reform Office (MARO), Provincial Agrarian Reform Office (PARO), National Irrigation Authority (NIA), National Historical Institute (NHI), and the Department of Agrarian Reform (DAR).

Given in **Table 5.1.2-1** are the IEC meetings completed by the EIA and RAP Teams. Other coordination meetings and activities are presented in **Table 5.1.2-2**.

**Table 5.1.2-1 Meetings Conducted for the Proposed CALA Expressway Project (Laguna Section) 1/3**

| <b>Date/Time</b>              | <b>LGU</b>                                       | <b>Participants</b>                                                                                                                                   | <b>Topic</b>                                                                                                                                                                                                                                                                                                     |
|-------------------------------|--------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| October, 2011 – February 2012 | General area of CALAX alignment                  | Central and Provincial DPWH Offices, Land owners, DENR-EMB, Laguna Lake Development Authority (LLDA)                                                  | Briefing on the Project; Identify the problems and possible routes,                                                                                                                                                                                                                                              |
| February 15, 2012             | Cavite government                                | City Officials                                                                                                                                        | Describe project plan and projected impacts according to the scoping matrix on social and environmental consideration, open discussions                                                                                                                                                                          |
| February 15, 2012             | Municipality of Silang, Cavite and its barangays | PAPs, Municipal Officials, Barangay Officials, People's Organization, Farmer's Association, NGO, Homeowner's Association, Transport Group             |                                                                                                                                                                                                                                                                                                                  |
| February 17, 2012             | Biñan City Government and its barangays          | Municipal Officials, Barangay Officials, Farmer's Association, Senior citizen's association,, Homeowner's Association, Transport Group, women's group | Describe project plan and projected impacts according to the scoping matrix on social and environmental consideration, JICA's policy on relocation and compensation, explain laws and protocols of Philippines government on road projects, bring up and discuss project affected people's concerns and requests |
| February 17, 2012             | Santa Rosa City Government and its barangays     | Municipal Officials, Barangay Officials, Farmer's Association, Senior citizen's association,, Homeowner's Association, Transport Group, women's group |                                                                                                                                                                                                                                                                                                                  |
| February 20, 2012             | Barangays Sabutan and Biga, Silang, Cavite       | Barangay Officials, Farmer's Association, Senior citizen's association,, Land owners, Homeowner's Association, Women's group                          |                                                                                                                                                                                                                                                                                                                  |

**Table 5.1.2-1 Meetings Conducted for the Proposed CALA Expressway Project (Laguna Section) 2/3**

| <b>Date/Time</b>  | <b>LGU</b>                                                | <b>Participants</b>                                                                                                                                                                               | <b>Topic</b>                                                                                                                                                                                                                                                                                                     |
|-------------------|-----------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| February 20, 2012 | Barangay Kaong in Silang                                  | Barangay Officials, Farmer's Association, Senior citizen's association,, Land owners, Homeowner's Association, Women's group                                                                      | Describe project plan and projected impacts according to the scoping matrix on social and environmental consideration, JICA's policy on relocation and compensation, explain laws and protocols of Philippines government on road projects, bring up and discuss project affected people's concerns and requests |
| February 21, 2012 | Barangay Tibig in Silang                                  | Senior Citizens Association Health Organization, Transport Group and Women's Organization;<br>Human Rights Organization, Structure and Landowners (PAPs)                                          |                                                                                                                                                                                                                                                                                                                  |
| February 22, 2012 | Barangay Carmen in Silang                                 | SAMACA (NGO); SAMACA means "SamahanngMagsasakang Carmen" (Farmer's Organization in Brgy. Carmen)                                                                                                  |                                                                                                                                                                                                                                                                                                                  |
| February 23, 2012 | Barangay Biñan, Malamig, Timbao and Loma of Biñan, Laguna | Barangay Officials of Barangay Biñan, Malamig, Timbao and Loma;<br>Senior Citizens Association, Womens Organization, Farmers Organization, Youth Organization and Project Affected Persons (PAPs) | Describe project plan and projected impacts according to the scoping matrix on social and environmental consideration, JICA's policy on relocation and compensation, explain laws and protocols of Philippines government on road projects, bring up and discuss project affected people's concerns and requests |
| February 23, 2012 | Barangays Pulong Sta. Cruz and Malitlit                   | Barangay Officials of Barangays Pulong Sta. Cruz and Malitlit;<br>Senior Citizens Association Health Organization and Women's Organization                                                        |                                                                                                                                                                                                                                                                                                                  |

**Table 5.1.2-1 Meetings Conducted for the Proposed CALA Expressway Project (Laguna Section) 3/3**

| <b>Date/Time</b>  | <b>LGU</b>                                              | <b>Participants</b>                                                                                                                                                                                              | <b>Topic</b>                                                                                                                                                                                                                                                                                                     |
|-------------------|---------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| February 24, 2012 | Barangays Munting Ilog, Carmen and Hukay in Silang      | Barangay Officials of Barangays Munting Ilog, Carmen and Hukay, Senior Citizens Association, Women's Organization, Youth Organization, Farmers Organization, Transport Group and Project Affected Persons (PAPs) | Describe project plan and projected impacts according to the scoping matrix on social and environmental consideration, JICA's policy on relocation and compensation, explain laws and protocols of Philippines government on road projects, bring up and discuss project affected people's concerns and requests |
| February 24, 2012 | Barangays Inchican in Silang                            | Barangay Officials of Barangays Inchican; Senior Citizens Association, Women's Organization, Health Organization, Farmer's Organization, Homeowners and Project Affected Persons (PAPs)                          |                                                                                                                                                                                                                                                                                                                  |
| February 29, 2012 | Provincial official of Laguna province                  | LGUs, CBOs                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                  |
|                   | Barangays Don Jose and Don Domingo in Sta. Rosa, Laguna | Barangay Officials of Barangays Sto. Domingo and Don Jose, Senior Citizens Association, Women's Organization, Youth Organization, Farmers Organization and Transport Group                                       |                                                                                                                                                                                                                                                                                                                  |

**Table 5.1.2-2 Other Coordination Meetings in Relation to the Proposed CALA Expressway Project (Laguna Section) 1/2**

| Date              | Office                                                               | Findings                                                                                                  | Venue                                       |
|-------------------|----------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|---------------------------------------------|
| January 07, 2012  | National Irrigation Authority (NIA)                                  | No irrigation facilities to be affected by the proposed CALAx Project (Laguna Section)                    | NIA Office, Pila, Laguna                    |
| January 16, 2012  | Provincial Assessors Office                                          | Gathered data on landowners to be affected and obtained Schedule of Market Values for land and structures | Trece Martires City, Cavite                 |
| January 16, 2012  | Provincial Agriculture Office                                        | Identified crops and other related data on farming                                                        | Trece Martires City, Cavite                 |
| January 16, 2012  | Provincial Agrarian Reform Office                                    | Identified list of registered tenants within the proposed project alignment                               | Trece Martires City, Cavite                 |
| January 17, 2012  | National Historical Institute                                        | Identified national historical sites and heritage within the project area                                 | Ermita Manila,                              |
| February 02, 2012 | Environmental Remote Sensing and Geo Information Laboratory Forestry | Collected maps of Mt. Makiling                                                                            | UP Los Banos, Laguna                        |
| January 12, 2012  | City Assessor of Santa Rosa, City                                    | Gathered data on landowner's to be affected and the Schedule of Market Values for land and structures     | New Government Center of Santa Rosa, Laguna |

**Table 5.1.2-2 Other Coordination Meetings in Relation to the Proposed CALA Expressway Project (Laguna Section) 1 of 2**

| Date              | Office                                       | Findings                                                                                              | Venue                            |
|-------------------|----------------------------------------------|-------------------------------------------------------------------------------------------------------|----------------------------------|
| January 12, 2012  | City Assessor of Biñan City, Laguna          | Gathered data on landowner's to be affected and the Schedule of Market Values for land and structures | City Hall of Biñan City, Laguna  |
| February 09, 2012 | Municipal Assessors Office of Silang, Cavite |                                                                                                       | Municipal Hall of Silang, Cavite |
| January 31,       | Protected Areas and                          | Collect maps of Taal Volcano Protected Area                                                           | Quezon City                      |

|                  |                                                |                                                             |                                  |
|------------------|------------------------------------------------|-------------------------------------------------------------|----------------------------------|
| 2012             | Wildlife Bureau                                |                                                             |                                  |
| January 12, 2012 | Municipal Agriculture Office of Silang, Cavite | Identify crops and other related data on farming            | Municipal Hall of Silang, Cavite |
| January 16, 2012 | City Agriculture Office of Biñan City, Laguna  |                                                             | City Hall of Biñan City, Laguna  |
| January 16, 2012 | City Environment and Natural Resources Office  | Identify possible location of dumpsite for unsuitable soils | City Hall of Biñan City, Laguna  |

During the IEC meetings, the project in terms of ROW width, type of surfacing, alignments, plan, design including cross sections for different type of road and target implementation schedule, among others, were discussed to the PAPs. The conduct of socioeconomic survey was also described in detail. The summary of issues and concerns raised during the said meetings are summarized in **Table 5.1.2-3**.

**Table 5.1.2-3 Summary of Issues and Concerns Raised during IEC (1/2)**

| <b>Agencies/Organization</b>                            | <b>Issues and Concerns</b>                                                                               | <b>Issue Addressed by</b> |
|---------------------------------------------------------|----------------------------------------------------------------------------------------------------------|---------------------------|
| LGUs of Binan<br>PAPs of Tibig                          | Environmental concerns like vehicular gaseous emissions and noise problems                               | EIA Team                  |
| LGUs of Binan                                           | Asking for more dialogues between JICA and LGUs before the start of the project                          | EIA Team                  |
| LGUs of Binan<br>PAPs of Malamig                        | Benefits of the project                                                                                  | EIA Team                  |
| PAPs of Carmen, Tibig                                   | Right to refuse the project                                                                              | DPWH-ESSO                 |
| PAPs of Carmen                                          | Privatization of road; especially tollway                                                                | DPWH-ESSO                 |
| PAPs of Carmen<br>LGUs of Sta. Rosa                     | Concerns on losing their livelihood; effects on agricultural lands                                       | EIA Team                  |
| PAPs of Carmen, Inchican, Tibig, NGO                    | Request for increase in the disturbance compensation                                                     | DPWH-ESSO                 |
| PAPs of Kaong, Sabutan, Tibig<br>LGUs of Laguna         | Concerned on their land if it will be divided by the project; Accessibility of other land, service roads | EIA Team                  |
| PAPs of Kaong, Malamig                                  | Start of RROW and payment                                                                                | DPWH-ESSO                 |
| PAPs of Kaong, Sabutan, Tibig<br>LGUs of Silang, Laguna | Issues with the alignment; moving the alignment                                                          | DPWH-ESSO                 |
| PAPs of Kaong                                           | Concerns with the width of the road                                                                      | DPWH-ESSO                 |
| PAPs of Malamig<br>LGUs of Cavite                       | Will they benefit from the tollway and toll fees                                                         | DPWH-ESSO                 |
| PAPs of Malamig                                         | Social Impact concerns; long-term programs                                                               | EIA Team                  |

**Table 5.1.2-3 Summary of Issues and Concerns Raised during IEC (2/2)**

| <b>Agencies/Organization</b> | <b>Issues and Concerns</b>                                                          | <b>Issue Addressed by</b> |
|------------------------------|-------------------------------------------------------------------------------------|---------------------------|
| PAPs of Pulong Sta. Cruz     | Employment during construction stage of the project                                 | DPWH-ESSO                 |
| PAPs of Pulong Sta. Cruz     | Complete facility of the CALAx project like lighting, signboards, emergency hotline | DPWH-ESSO                 |
| PAPs of Sabutan, Tibig       | Concern on the project crossing the river                                           | EIA Team                  |
| PAPs of Sabutan              | Feasibility of the project                                                          | DPWH-ESSO                 |
| LGUs of Sta. Rosa            | May cause traffic                                                                   | DPWH-ESSO                 |
| PAPs of Tibig                | Complaining of favoring the developers                                              | DPWH-ESSO                 |

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**Chapter 6**

**Environmental Monitoring  
Plan**

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## 6 ENVIRONMENTAL MONITORING PLAN

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### 6.1 ENVIRONMENTAL MONITORING PLAN (EMOP)

The Environmental Monitoring Plan (EMoP) represented in **Table 6.1-1** is developed in order to institute a workable regulatory means to ascertain compliance to the ECC issued, as well as other environmental laws and regulations during the Pre-Construction and Construction Phases, Demobilization/Decommissioning Phase, and Operational and Maintenance Phase. It shall also serve as guide to Management, Technical Staff and Construction Contractors (and its Sub-Contractors) in ensuring that the least disturbance to the environment is achieved in all aspects of project implementation.

These are environmental commitments that may be validated and assessed during the actual construction and operation of the project.

| Table 6.1-1 Environmental Monitoring Plan (1/11) |                                                                                                                    |                                        |                                            |                                                                                                       |                                                                                                                                                                                |
|--------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|----------------------------------------|--------------------------------------------|-------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Parameters to be Monitored                       | Stations to be Monitored                                                                                           | Frequency of Monitoring                | Methods of Analysis/Execution              | DENR Standard                                                                                         | Implementor/Cost                                                                                                                                                               |
| <b>PRE-CONSTRUCTION AND CONSTRUCTION PHASES</b>  |                                                                                                                    |                                        |                                            |                                                                                                       |                                                                                                                                                                                |
| <b>THE LAND</b>                                  |                                                                                                                    |                                        |                                            |                                                                                                       |                                                                                                                                                                                |
| Landslide and soil erosion                       | Cut slope sections, embankment areas, and bridge sites                                                             | Daily                                  | Site inspection using Monitoring Checklist | Based on IMP                                                                                          | ESHO of the Contractor and DPWH, in close coordination with DENR-Mines and Geosciences Bureau (MGB) Region IV-A<br><br>Part of the construction costs                          |
| Tree Cutting/Balling/Relocation                  | Along the entire stretch of the alignment, particularly bridge sites, interchange location, and agricultural areas | Daily during the tree cutting activity | Site inspection using Monitoring Checklist | Conditions stipulated in the "Permit To Cut" to be secured by the Contractor from DENR-FMB Region IV- | ESHO of the Contractor, DPWH in close coordination with the DENR-FMB Region IV-A<br><br>To be determined during DED                                                            |
| <b>THE WATER</b>                                 |                                                                                                                    |                                        |                                            |                                                                                                       |                                                                                                                                                                                |
| Water flow rate                                  | Along the waterways, particularly Malaking Ilog River, Lumbia River, and Malindig River                            | Daily                                  | Site inspection using Monitoring Checklist | Based on IMP                                                                                          | ESHO of the Contractor, DPWH in close coordination with representatives from the Waste Management and Disposal Office of the concerned LGUS<br><br>To be determined during DED |

| Table 6.1-1 Environmental Monitoring Plan (2/11)                                      |                                                                                                       |                            |                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                         |
|---------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| Parameters to be Monitored                                                            | Stations to be Monitored                                                                              | Frequency of Monitoring    | Methods of Analysis/Execution                                                                                                              | DENR Standard                                                                                                                                                                                                                                                                                                                                                        | Implementor/Cost                                                                                                                                        |
| <b>PRE-CONSTRUCTION AND CONSTRUCTION PHASES</b>                                       |                                                                                                       |                            |                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                         |
| <b>THE WATER</b>                                                                      |                                                                                                       |                            |                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                         |
| Groundwater contamination                                                             | Motor pool area                                                                                       | Daily                      | Site inspection using Monitoring Checklist<br><br>Investigation based on complaints received from affected population                      | Based on IMP                                                                                                                                                                                                                                                                                                                                                         | ESHO of the Contractor, DPWH in close coordination with the DENR-Environmental Quality Division (EQD) Region IV-A<br><br>Part of the construction costs |
| Water Quality (Total Coliform, pH, oil & grease, lead, TSS, BOD, DO, and temperature) | Waterways crossed by the alignment, particularly Malking Ilog River, Lumbia River, and Malindig River | Weekly<br><br>Twice a year | Site inspection of work sites using Monitoring Checklist<br><br>Water sampling along Malaking Ilog River, Lumbia River, and Malindig River | Visual only<br><br>CLASS C WATERS<br><br>Total Coliform<br><b>5,000 MPN/100 ml</b><br><br>Oil & Grease<br><b>5.0 mg/L</b><br><br>pH<br><b>6.5-8.5</b><br><br>TSS<br><b>Max. 30 mg/L increase</b><br><br>BOD<br><b>Max. 20 mg/L increase</b><br><br>DO<br><b>Not less than 5.0 mg/L</b><br><br>Lead<br><b>0.05 mg/L</b><br><br>Temperature<br><b>Not more than 3°</b> | ESHO of the Contractor, DPWH in close coordination with the DENR-EQD Region IV-A<br><br><b>P5,000.00</b> per sampling activity                          |

|                                                         |                                                                                                                                 |                                                                                                                                                                  |                                                                                                                                                                               | increase                                                                                                                                                                                    |                                                                                                                                                                                                  |
|---------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Table 6.1-1 Environmental Monitoring Plan (3/11)</b> |                                                                                                                                 |                                                                                                                                                                  |                                                                                                                                                                               |                                                                                                                                                                                             |                                                                                                                                                                                                  |
| Parameters to be Monitored                              | Stations to be Monitored                                                                                                        | Frequency of Monitoring                                                                                                                                          | Methods of Analysis/Execution                                                                                                                                                 | DENR Standard                                                                                                                                                                               | Implementor/Cost                                                                                                                                                                                 |
| <b>PRE-CONSTRUCTION AND CONSTRUCTION PHASES</b>         |                                                                                                                                 |                                                                                                                                                                  |                                                                                                                                                                               |                                                                                                                                                                                             |                                                                                                                                                                                                  |
| <b>THE AIR</b>                                          |                                                                                                                                 |                                                                                                                                                                  |                                                                                                                                                                               |                                                                                                                                                                                             |                                                                                                                                                                                                  |
| Total Suspended Particulates (TSP)                      | At all cleared construction sites and all identified dust sensitive receptor areas, such as residential, hospitals, and schools | Daily<br><br>Twice a year                                                                                                                                        | Site inspection using Monitoring Checklist<br><br>Air quality monitoring: <b>Gravimetric Method</b>                                                                           | Visual<br><br>TSP<br><b>300 µg/Ncm (1 hour)</b>                                                                                                                                             | ESHO of the Contractor, DPWH in close coordination with the DENR-EQD Region IV-A<br><br>Cost included in Contractor's Bid – Approx. <b>P200,000.00</b> for entire duration of construction phase |
| SO <sub>2</sub> and NO <sub>2</sub>                     | At all identified air pollution sensitive receptor areas, such as residential, hospitals, and schools                           | Daily<br><br>Twice a year                                                                                                                                        | Site inspection using Monitoring Checklist<br><br>Air quality monitoring: <b>Pararosalinine Method for SO<sub>2</sub></b><br><b>Griess Saltzman Method for NO<sub>2</sub></b> | Visual<br><br>NO <sub>2</sub><br><b>260 µg/Ncm (1 hour)</b><br><br>SO <sub>2</sub><br><b>340 µg/Ncm (1 hour)</b>                                                                            | ESHO of the Contractor, DPWH in close coordination with the DENR-EQD Region IV-A<br><br>Cost included in Contractor's Bid – Approx. <b>P400,000.00</b> for entire duration of construction phase |
| Noise Level                                             | At all identified noise sensitive receptor areas, such as residential, hospitals, places of worships, and schools               | Daily for high noise level generating activities; Weekly for other activities during construction<br><br>Investigation on a complaint basis shall be immediately | Digital Noise Level Meter and Monitoring Checklist                                                                                                                            | <b>Class B</b> "A section which is primarily use for commercial purposes"<br><br><b>60 dBA</b> (Daytime)<br><b>65 dBA</b> (Morning)<br><b>60 dBA</b> (Evening)<br><b>55 dBA</b> (Nighttime) | ESHO of the Contractor, DPWH in close coordination with the DENR-EQD Region IV-A<br><br>(Cost already included in Air Quality above)                                                             |

|                                                                                                  |                                                                                                                   | undertaken                                                                                        |                                                                                                      |                                                                                                                                                                                                     |                                                                                                                                      |
|--------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| <b>Table 6.1-1 Environmental Monitoring Plan (4/11)</b>                                          |                                                                                                                   |                                                                                                   |                                                                                                      |                                                                                                                                                                                                     |                                                                                                                                      |
| Parameters to be Monitored                                                                       | Stations to be Monitored                                                                                          | Frequency of Monitoring                                                                           | Methods of Analysis/Execution                                                                        | DENR Standard                                                                                                                                                                                       | Implementor/Cost                                                                                                                     |
| <b>PRE-CONSTRUCTION AND CONSTRUCTION PHASES</b>                                                  |                                                                                                                   |                                                                                                   |                                                                                                      |                                                                                                                                                                                                     |                                                                                                                                      |
| <b>THE AIR</b>                                                                                   |                                                                                                                   |                                                                                                   |                                                                                                      |                                                                                                                                                                                                     |                                                                                                                                      |
| Noise Level                                                                                      | At all identified noise sensitive receptor areas, such as residential, hospitals, places of worships, and schools | Daily for high noise level generating activities; Weekly for other activities during construction | Digital Noise Level Meter and Monitoring Checklist                                                   | <b>Class C</b> "A section which is primarily reserved as a light industrial area"<br><br><b>65 dBA</b> (Daytime)<br><b>70 dBA</b> (Morning)<br><b>55 dBA</b> (Evening)<br><b>60 dBA</b> (Nighttime) | ESHO of the Contractor, DPWH in close coordination with the DENR-EQD Region IV-A<br><br>(Cost already included in Air Quality above) |
| <b>THE PEOPLE</b>                                                                                |                                                                                                                   |                                                                                                   |                                                                                                      |                                                                                                                                                                                                     |                                                                                                                                      |
| Compensation of affected residential and agricultural lands in accordance with LARRIPP/WBOP 4.12 | Along the ROW of the alignment                                                                                    | Prior to Start of Construction                                                                    | Duly completed legal documents, particularly the Deed of Absolute Sale (DAS)                         | Based on full-blown RAP                                                                                                                                                                             | City/Municipal RAP Implementation Committees (CRIC/MRIC) in close coordination with DPWH Regional Offices and Provincial LGUs        |
| Compensation of affected residential and commercial structures                                   | Along the ROW of the alignment                                                                                    | Prior to Start of Construction                                                                    | Duly completed legal documents, particularly the Agreement to Demolish and Remove Improvement (ADRI) | Based on Full-blown RAP                                                                                                                                                                             | CRIC/MRIC in close coordination with DPWH Regional Offices and Provincial LGUs                                                       |
| Compensation for affected perennial crops (trees)                                                | Along the ROW of the alignment                                                                                    | Prior to Start of Construction                                                                    | Duly completed legal documents, particularly the ADRI                                                | Based on Full-blown RAP                                                                                                                                                                             | CRIC/MRIC in close coordination with DPWH Regional Offices and Provincial LGUs                                                       |

| Table 6.1-1 Environmental Monitoring Plan (5/11)                                |                                                                                                                                                                                                               |                                                  |                                                                                                                 |                                                                       |                                                                                                                                                                                                                                                       |
|---------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Parameters to be Monitored                                                      | Stations to be Monitored                                                                                                                                                                                      | Frequency of Monitoring                          | Methods of Analysis/Execution                                                                                   | DENR Standard                                                         | Implementor/Cost                                                                                                                                                                                                                                      |
| <b>PRE-CONSTRUCTION AND CONSTRUCTION PHASES</b>                                 |                                                                                                                                                                                                               |                                                  |                                                                                                                 |                                                                       |                                                                                                                                                                                                                                                       |
| <b>THE PEOPLE</b>                                                               |                                                                                                                                                                                                               |                                                  |                                                                                                                 |                                                                       |                                                                                                                                                                                                                                                       |
| Supply of Basic Social Service Utilities                                        | Areas which will experience power/water supply interruptions due to disturbance of underground and overhead utility lines (water, electricity, telephone) during excavation and erection of fixed facilities. | Daily<br><br>Depends on of schedule interruption | Site inspection and investigation based on complaints received from affected population                         | Based on IMP                                                          | ESH Officer of the Contractor, DPWH, in close coordination with the concerned utility companies, community leaders of affected barangays in Silang, Cavite, and Santa Rosa and Biñan Cities, and concerned LGUS<br><br>Part of the construction costs |
| Compliance of Contractor to occupational health and safety rules and regulation | All construction areas, worker's camps, and temporary field offices                                                                                                                                           | Daily                                            | Site inspection of work areas including temporary sanitation facilities, to be recorded in Monitoring Checklist | Based on IMP                                                          | ESHO of the Contractor, DWPH, in close coordination with the Health Office of concerned LGUs<br><br>Part of the construction costs                                                                                                                    |
| Traffic Management                                                              | Along the entire stretch of the alignment, particularly major roads, bridge sites, residential areas and interchange locations                                                                                | Daily                                            | Site observation to be recorded in Monitoring Checklist                                                         | Based submitted TMP and Re-Routing Schemes approved by concerned LGUs | ESHO of the Contractor, DPWH in close coordination with the concerned LGUs<br><br>Part of the construction costs                                                                                                                                      |

| Table 6.1-1 Environmental Monitoring Plan (6/11)  |                                                                                                                                         |                         |                                                                                                                                        |               |                                                                                                                                                                                                                     |
|---------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Parameters to be Monitored                        | Stations to be Monitored                                                                                                                | Frequency of Monitoring | Methods of Analysis/Execution                                                                                                          | DENR Standard | Implementor/Cost                                                                                                                                                                                                    |
| <b>PRE-CONSTRUCTION AND CONSTRUCTION PHASES</b>   |                                                                                                                                         |                         |                                                                                                                                        |               |                                                                                                                                                                                                                     |
| <b>THE PEOPLE</b>                                 |                                                                                                                                         |                         |                                                                                                                                        |               |                                                                                                                                                                                                                     |
| Safety of motorists                               | Entire stretch of the alignment, particularly major roads and intersections, excavation areas bridge sites, and interchange locations   | Daily                   | Site observation to be recorded in the Monitoring Checklist<br><br>Investigation based on complaints received from affected population | Visual        | ESHO of the Contractor DPWH, in close coordination with the concerned LGUs<br><br>Part of the construction costs                                                                                                    |
| Safety of Pedestrians                             | Residential areas, school and hospital zones, pedestrian crossings along the industrial and commercial zones traversed by the alignment | Daily                   | Site observation to be recorded in the Monitoring Checklist<br><br>Investigation based on complaints received from affected population | Visual        | ESHO of the Contractor, DPWH, traffic aides/ flagmen to be assigned by the Contractor, and concerned LGUs<br><br>Part of the construction costs                                                                     |
| Solid and domestic wastes management and disposal | Areas where hauling of unusable excavated materials and construction spoils are necessary                                               | Daily                   | Site inspection using Monitoring Checklist                                                                                             | Visual        | ESHO of the Contractor, DPWH in close coordination with the Sanitation and Waste Management Disposal Office of the concerned LGUS and community leaders of affected barangays<br><br>Part of the construction costs |
|                                                   | Areas where temporary stockpiles are located                                                                                            | Daily                   | Site inspection using Monitoring Checklist                                                                                             |               |                                                                                                                                                                                                                     |
|                                                   | Work areas where temporary sanitation facilities are provided                                                                           | Daily                   | Site inspection using Monitoring Checklist<br><br>Investigation based on complaints received from affected                             |               |                                                                                                                                                                                                                     |

|                                                                     |                                                                                                                      |                                                                                                                             | population                                                                                                          |                      |                                                                                                                                             |
|---------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Table 6.1-1 Environmental Monitoring Plan (7/11)</b>             |                                                                                                                      |                                                                                                                             |                                                                                                                     |                      |                                                                                                                                             |
| <b>Parameters to be Monitored</b>                                   | <b>Stations to be Monitored</b>                                                                                      | <b>Frequency of Monitoring</b>                                                                                              | <b>Methods of Analysis/Execution</b>                                                                                | <b>DENR Standard</b> | <b>Implementor/Cost</b>                                                                                                                     |
| <b>PRE-CONSTRUCTION AND CONSTRUCTION PHASES</b>                     |                                                                                                                      |                                                                                                                             |                                                                                                                     |                      |                                                                                                                                             |
| <b>THE PEOPLE</b>                                                   |                                                                                                                      |                                                                                                                             |                                                                                                                     |                      |                                                                                                                                             |
| Liquid and solid hazardous wastes                                   | Motor pool area                                                                                                      | Daily                                                                                                                       | Site inspection to be recorded in the Monitoring Checklist<br><br>Weighing<br>Kg/day (solid)<br>Liters/day (liquid) | Visual<br><br>Visual | ESHO of the Contractor, DPWH, in close coordination with the DENR-EQD Region IV-A, and concerned LGUs<br><br>Part of the construction costs |
| <b>DEMOBILIZATION/DECOMMISSIONING PHASE</b>                         |                                                                                                                      |                                                                                                                             |                                                                                                                     |                      |                                                                                                                                             |
| <b>THE LAND</b>                                                     |                                                                                                                      |                                                                                                                             |                                                                                                                     |                      |                                                                                                                                             |
| Aesthetic Values                                                    | Areas stripped of vegetation cover<br><br>Tree planting along the shoulders of the newly constructed CALA Expressway | Monthly until landscaping activities are completed<br><br>Monthly until survival rate of the species planted is established | Joint site inspection using Monitoring Checklist<br><br>Site inspection using Monitoring Checklist                  | Visual               | ESHO of the Contractor, DPWH in close coordination with the concerned LGUs<br><br>To be determined during DED                               |
| Survival rate of the species introduced at the reforestation site/s | Reforestation site/s                                                                                                 | Monthly until survival rate of the species introduced is established                                                        | Joint site inspection using Monitoring Checklist                                                                    | Visual<br><br>Visual | ESHO of the Contractor, DPWH, in close coordination with the DENR-EQD Region IV-A, and concerned LGUs<br><br>To be determined during DED    |

| Table 6.1-1 Environmental Monitoring Plan (8/11) |                                                                                                                                |                                                          |                                                                                                                             |               |                                                                                                                                                                                                      |
|--------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Parameters to be Monitored                       | Stations to be Monitored                                                                                                       | Frequency of Monitoring                                  | Methods of Analysis/Execution                                                                                               | DENR Standard | Implementor/Cost                                                                                                                                                                                     |
| <b>DEMOBILIZATION/DECOMMISSIONING PHASE</b>      |                                                                                                                                |                                                          |                                                                                                                             |               |                                                                                                                                                                                                      |
| <b>THE WATER</b>                                 |                                                                                                                                |                                                          |                                                                                                                             |               |                                                                                                                                                                                                      |
| Water flow and siltation                         | All waterways crossed by the alignment, particularly Malaking Ilog River, Lumbia River, and Malindig River, and adjacent areas | Daily until all decommissioning activities are completed | Joint site inspection using Monitoring Checklist                                                                            | Visual        | ESHO of the Contractor, DPWH, in close coordination with the DENR-EQD Region IV-A, and concerned LGUs<br><br>Part of construction costs                                                              |
| Domestic and solid wastes disposal               | All construction sites provided with temporary sanitation facilities adjacent to the waterways                                 | Daily until all decommissioning activities are completed | Joint site inspection using Monitoring Checklist<br><br>Investigation based on complaints received from affected population | Visual        | ESHO of the Contractor, DPWH in close coordination with the Waste Management and Disposal Office of the concerned LGUS and community leaders of affected barangays<br><br>Part of construction costs |
| <b>THE PEOPLE</b>                                |                                                                                                                                |                                                          |                                                                                                                             |               |                                                                                                                                                                                                      |
| Complete dismantling of all temporary facilities | Workers' camp site and field offices                                                                                           | Daily until all decommissioning activities are completed | Joint site inspection<br><br>Investigation based on reports received from affected population                               | -             | ESHO of the Contractor, DPWH in close coordination with the concerned LGUs'<br><br>Part of construction costs                                                                                        |

| Table 6.1-1 Environmental Monitoring Plan (9/11)                                                                                                 |                                                                                                                                                                                     |                                                                         |                                                                                                                             |               |                                                                                                                                                                                                                                                   |
|--------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Parameters to be Monitored                                                                                                                       | Stations to be Monitored                                                                                                                                                            | Frequency of Monitoring                                                 | Methods of Analysis/Execution                                                                                               | DENR Standard | Implementor/Cost                                                                                                                                                                                                                                  |
| <b>THE PEOPLE</b>                                                                                                                                |                                                                                                                                                                                     |                                                                         |                                                                                                                             |               |                                                                                                                                                                                                                                                   |
| <b>DEMOBILIZATION/DECOMMISSIONING PHASE</b>                                                                                                      |                                                                                                                                                                                     |                                                                         |                                                                                                                             |               |                                                                                                                                                                                                                                                   |
| Complete dismantling of the temporary sanitation facilities and proper disposal of remaining solid and domestic wastes                           | All work sites where temporary sanitation facilities are provided, particularly those adjacent the residential areas and waterways, workers' camp site, and temporary field offices | Daily until all decommissioning activities are completed                | Joint site inspection using Monitoring Checklist<br><br>Investigation based on complaints received from affected population | Visual        | ESHO of the Contractor, DPWH in close coordination with the concerned LGUs' Sanitation and Waste Management Disposal Office, and community leaders of affected barangays<br><br>Part of construction costs                                        |
| Replacement and restoration of affected basic social service utilities such as deep wells, power and water supplies, and telecommunication lines | All areas where social service utilities were affected, particularly Brgy. Sabutan, Silang, Cavite where deep wells will be displaced                                               | Daily until operations of the affected utilities are returned to normal | Joint site inspection using Monitoring Checklist<br><br>Investigation based on complaints received from affected population | Visual        | ESH Officer of the Contractor, DPWH, in close coordination with the concerned utility companies, community leaders of affected barangays in Silang, Cavite, and Santa Rosa and Biñan Cities, and concerned LGUs<br><br>Part of construction costs |

| Table 6.1-1 Environmental Monitoring Plan (10/11)                                                                           |                                                                                                                                                    |                                                                 |                                                                                                                                |                                                                                                    |                                                                                                                                 |
|-----------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| Parameters to be Monitored                                                                                                  | Stations to be Monitored                                                                                                                           | Frequency of Monitoring                                         | Methods of Analysis/Execution                                                                                                  | DENR Standard                                                                                      | Implementor/Cost                                                                                                                |
| <b>OPERATIONAL PHASE</b>                                                                                                    |                                                                                                                                                    |                                                                 |                                                                                                                                |                                                                                                    |                                                                                                                                 |
| <b>THE LAND</b>                                                                                                             |                                                                                                                                                    |                                                                 |                                                                                                                                |                                                                                                    |                                                                                                                                 |
| Illegal conversion of agricultural areas adjacent to the newly constructed CALA Expressway (Laguna Section) into other uses | Agricultural areas adjacent to the newly constructed expressway                                                                                    | -                                                               | Investigation based on complaints of affected population                                                                       | -                                                                                                  | Municipality of Silang, and Cities of Santa Rosa and Biñan, Laguna                                                              |
| Aesthetic Values                                                                                                            | Landscaping areas and shoulders of the newly constructed expressway                                                                                | Quarterly until survival rate of species planted is established | Joint site inspection using Monitoring Checklist                                                                               | Visual                                                                                             | DPWH/ CALA Expressway Operator                                                                                                  |
| <b>THE AIR</b>                                                                                                              |                                                                                                                                                    |                                                                 |                                                                                                                                |                                                                                                    |                                                                                                                                 |
| Total Suspended Particulates (TSP)                                                                                          | Selected dust sensitive receptor areas adjacent to the newly constructed expressway such as residential, schools, and hospitals along the          | Twice a year (for 2 years)                                      | Air quality monitoring:<br><b>Gravimetric Method</b>                                                                           | TSP<br><b>300 µg/Ncm (1 hour)</b>                                                                  | DPWH/CALA Expressway Operator in close coordination with the DENR-EQD Region IV-A<br><br><b>P10,000.00</b> per sampling station |
| SO <sub>2</sub> and NO <sub>2</sub>                                                                                         | Selected air pollution sensitive receptor areas adjacent to the newly constructed expressway such as residential, schools, and hospitals along the | Twice a year (for 2 years)                                      | Air quality monitoring:<br><b>Pararosalinine Method for SO<sub>2</sub></b><br><b>Griess Saltzman Method for NO<sub>2</sub></b> | NO <sub>2</sub><br><b>260 µg/Ncm (1 hour)</b><br><br>SO <sub>2</sub><br><b>340 µg/Ncm (1 hour)</b> | DPWH/CALA Expressway Operator in close coordination with the DENR-EQD Region IV-A<br><br><b>P10,000.00</b> per sampling station |

| Table 6.1-1 Environmental Monitoring Plan (11/11)                                                    |                                                                                                                                                          |                         |                                                                |                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                |
|------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|----------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| Parameters to be Monitored                                                                           | Stations to be Monitored                                                                                                                                 | Frequency of Monitoring | Methods of Analysis/Execution                                  | DENR Standard                                                                                                                                                                                                                                                                                                                                                                                  | Implementor/Cost                                                                                                               |
| <b>OPERATIONAL PHASE</b>                                                                             |                                                                                                                                                          |                         |                                                                |                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                |
| <b>THE AIR</b>                                                                                       |                                                                                                                                                          |                         |                                                                |                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                |
| Noise Level                                                                                          | At selected noise sensitive receptor areas, adjacent to the newly constructed expressway such as residential, hospitals, places of worships, and schools | Quarterly               | Digital Noise Level Meter and Monitoring Checklist             | <b>Class B</b> “A section which is primarily use for commercial purposes”<br><b>60 dBA</b> (Daytime)<br><b>65 dBA</b> (Morning)<br><b>60 dBA</b> (Evening)<br><b>55 dBA</b> (Nighttime)<br><br><b>Class C</b> “A section which is primarily reserved as a light industrial area”<br><b>65 dBA</b> (Daytime)<br><b>70 dBA</b> (Morning)<br><b>55 dBA</b> (Evening)<br><b>60 dBA</b> (Nighttime) | DPWH/CALA Expressway Operator in close coordination with the DENR-EQD Region IV-A<br><br><b>P5,000.00</b> per sampling station |
| <b>THE PEOPLE</b>                                                                                    |                                                                                                                                                          |                         |                                                                |                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                |
| Road signs, lane markings and lighting, particularly at bridge sites, interchanges, and toll barrier | Entire stretch of the newly constructed CALA Expressway (Laguna Section)                                                                                 | Periodically            | Based on DPWH Standard Roads and Bridges Maintenance Procedure | -                                                                                                                                                                                                                                                                                                                                                                                              | DPWH/CALA Expressway Operator<br><br>Based on DPWH Standard Roads and Bridges Maintenance Procedure                            |

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**Chapter 7**

**Emergency Response Policy  
and  
Generic Guidelines**

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## 7 EMERGENCY RESPONSE POLICY AND GENERIC GUIDELINES

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Presented in **Figure 7.1** is the organizational set up of the Emergency Preparedness and Rescue Team (EPRT) of the main Contractor. As shown in the chart, **three (3)** Team Leaders are assigned to each type of emergency situation, namely earthquakes, situations requiring clean up procedures (e.g., accidental spill of hazardous materials), and **one (1)** to head a medical team who will be available to the other **two (2)** teams.

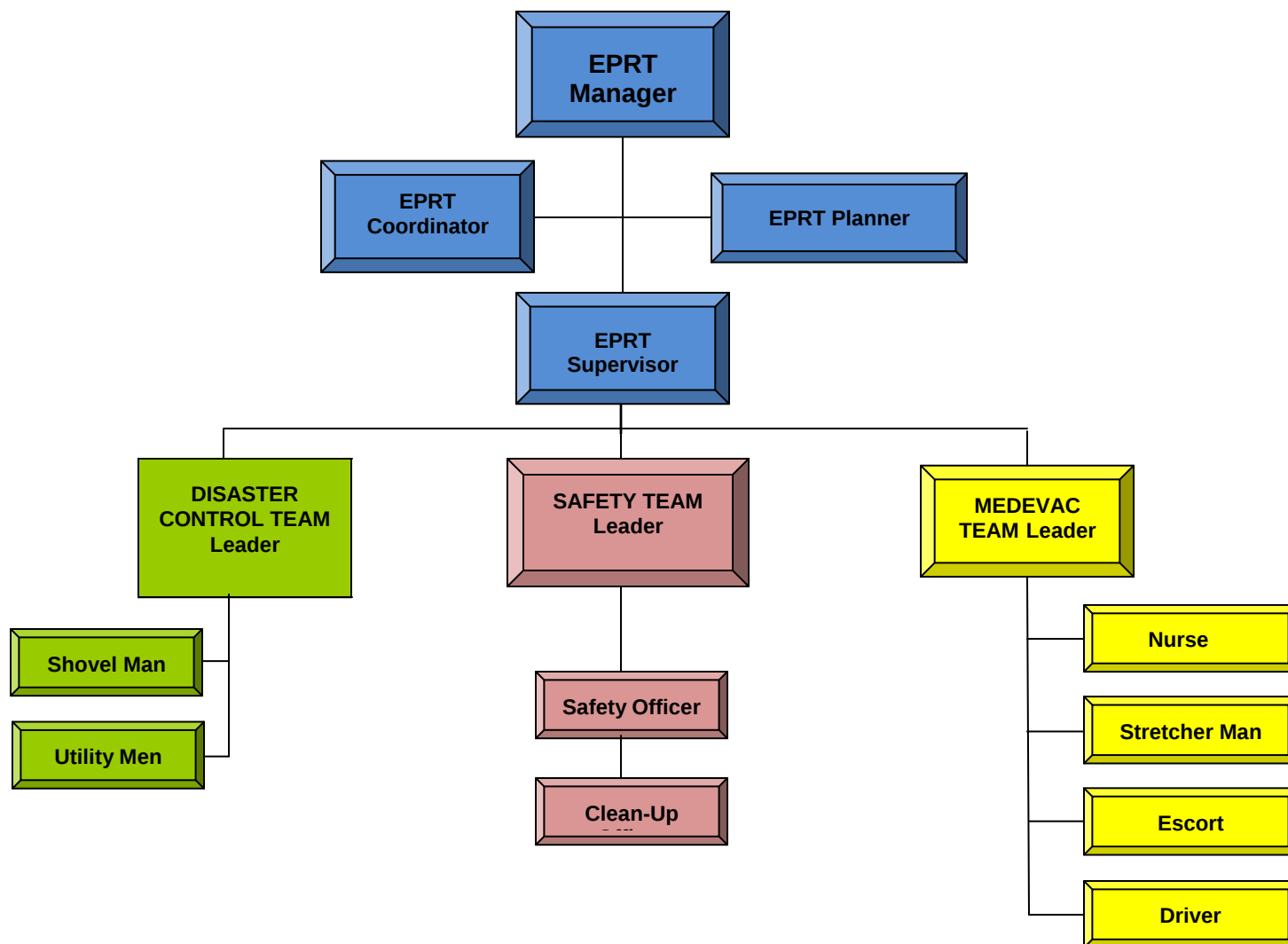


Figure 7.1 Emergency Preparedness and Response Team (EPRT) Organization Setup

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**Chapter 8**

**Institutional Plan for  
Implementation**

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## 8 INSTITUTIONAL PLAN FOR IMP IMPLEMENTATION

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### 8.1 INSTITUTIONAL PLAN

Presented in **Figure 8.1-1** is the institutional setup that will be implemented during project implementation. As shown in the said figure, DPWH shall be the Implementing Agency for the CALA Expressway Project. The PMO-BOT Director shall supervise all technical aspects of the project.

PMO-BOT will be responsible for directing and supervising the (i) detailed engineering design of civil engineering works; (ii) preparation of tender documents and tender assistance; and (iii) construction activities. Included in Item (ii) is the updating of the Impact Management Plan (IMP) to reflect changes in configuration as well as construction methodologies based on developments brought about during Detailed Engineering Design. A **Senior Environmental Specialist** shall be assigned and be mainly responsible for: (1) monitoring the overall operation and effectiveness of the IMP during the construction and operational phases; (ii) updating of the IMP as the need arises; and (iii) preparing the Compliance Monitoring Report to be submitted to DENR-EMB;.

An **Environment Safety and Health (ESH) Officer** shall be assigned by the main **Contractor** during the construction phase. In coordination with the **Senior Environmental Specialist** of Construction Supervision Consultant, he shall be responsible for implementing the Impacts Management Plan (IMP) and the Environmental Monitoring Plan (EMP) presented in **Tables 4.1-1** and **6.1-1**, respectively of this report. Aside from the above-mentioned tasks, the main duties of the **ESH Officer** shall be to:

- (i) Ensure that all other concerned supervisors and staff understand and properly undertake their responsibilities;
- (ii) Ensure that environmental monitoring activities are being done promptly and in an accurate manner;

- (iii) Implement an effective preventive and corrective control system, particularly in terms of environmental emergency preparedness and response procedures;
- (iv) Conduct or initiate training of contractors (and sub-contractors, if any) on environmental awareness; and
- (iv) Collate performance data and prepare reports, which include an assessment of performance in comparison with the IMP objectives and targets, for submittal to the Construction Supervision Consultant's Senior Environmental Specialist. To ensure effectiveness of the IEC, he shall also act as a liaison between PMO-BOT, and the primary stakeholders, particularly the LGUs concerned, other government agencies, and more importantly, the affected barangays. This task is particularly important in terms of receiving comments, views, complaints (if any), and other concerns from the stakeholders mentioned.

The main Contractor shall also engage a **Safety Officer** to review and recommend amendments and updates to LRTA's circulars and bulletins pertaining to environmental safety, with special attention to the protection of human lives and properties against fire, and natural disasters such as typhoons, earthquake, and other calamities. In coordination with the ESH Officer, he shall also be in charge of posting environmental information and internal/external communications that pertain to environmental quality and safety.

Aside from these **two (2)** key staff, each Sub-Contractor shall be required to assign **Environmental Coordinators** to undertake site supervision and inspection, during the implementation of the Environmental Monitoring Plan, as well as in maintaining cleanliness and aesthetic appeal, at construction areas. Each shall be responsible for liaising with other government agencies with regards to licensing and securing permits, as required.

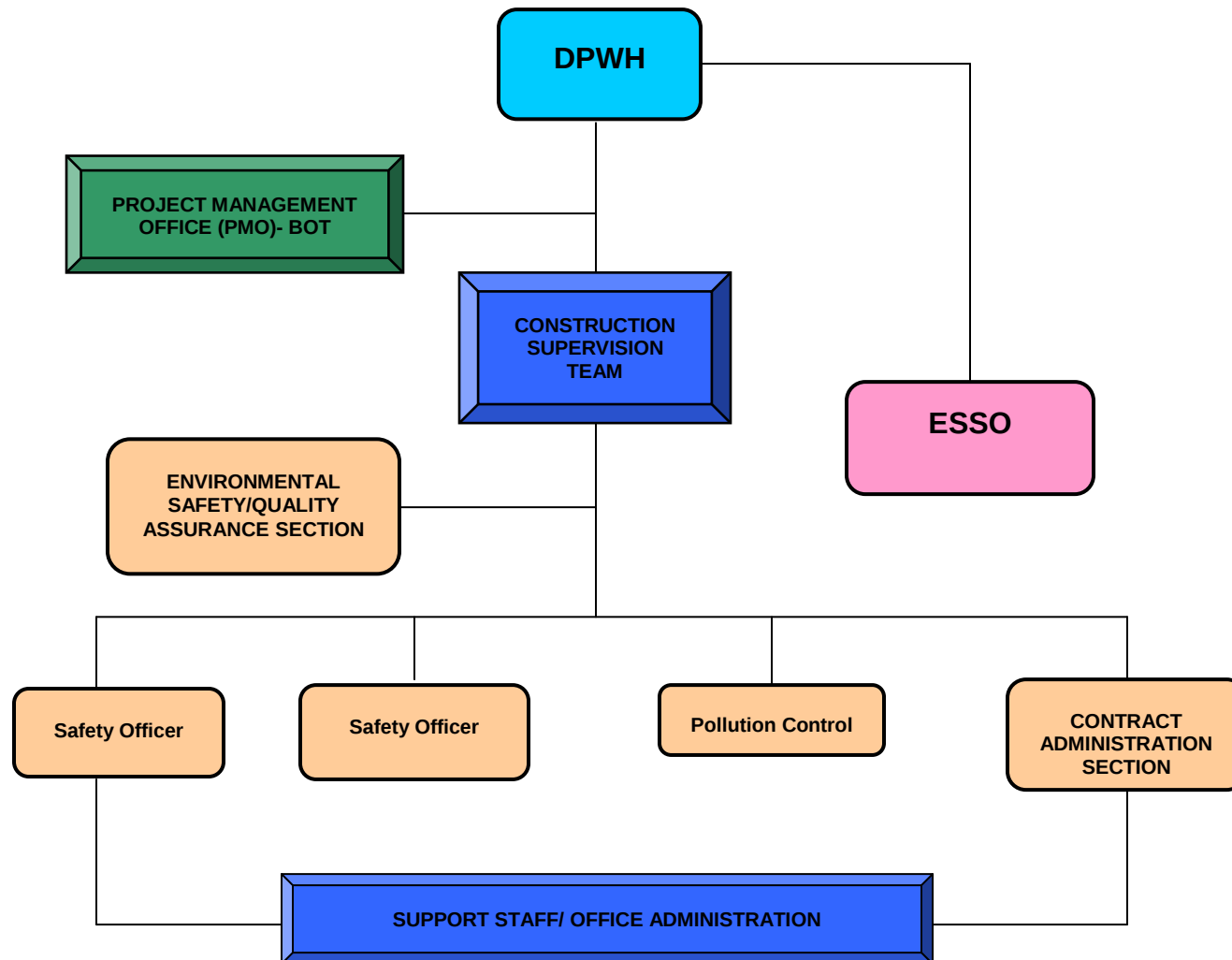


Figure 8.1-1 Institutional Plan - Organizational Structure of DPWH

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# Sworn Statements

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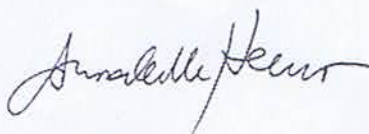
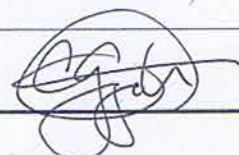
## SWORN STATEMENT OF ACCOUNTABILITY OF PREPARERS

This is to certify that all data or information in this Environmental Impact Statement (EIS) for the CAVITE-LAGUNA Expressway (CALAX) Project (Laguna Section) are accurate and complete to the best of our knowledge and information, and that an objective and thorough assessment of the Project was undertaken in accordance with the dictates of professional and reasonable judgment. Should we learn of any information which would make this Environmental Impact Statement (EIS) inaccurate, we shall immediately bring the said information to the attention of Department of Environmental and Natural Resources –Environmental Management Bureau (DENR-EMB).

We hereby certified that no DENR-EMB personnel was directly involve in the preparation of this CAVITE-LAGUNA Expressway (CALAX) Project other than to provide procedural and technical advice consistent with the guidelines in the DAO 03-30 Revised Procedural Manual.

We hereby bind ourselves jointly and solidarity to answer any penalty that may be imposed arising from any misrepresentation or failure to state material information in this Environmental Impact Statement (EIS).

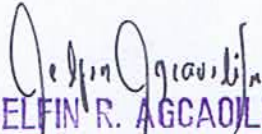
In witness whereof, we hereby set our hands this 11 JUN 2012 day of \_\_\_\_\_ at QUEZON CITY.

|   | Name                 | Field of Expertise     | Signature                                                                            |
|---|----------------------|------------------------|--------------------------------------------------------------------------------------|
| 1 | Annabelle N. Herrera | Team Leader, EIA Team  |  |
| 2 | Charlon Gonzales     | Air Quality Specialist |  |

SUBSCRIBED AND SWORN TO before me this 11 JUN 2012 day of \_\_\_\_\_  
20\_\_\_\_, at QUEZON CITY \_\_\_\_\_affiant exhibiting his/her  
Community Tax Certificate information, as follows:

|   | Name                 | Community Tax Certificate/Passport Information |                           |                   |
|---|----------------------|------------------------------------------------|---------------------------|-------------------|
|   |                      | CTC No./<br>Passport No.                       | Place of Issue            | Date of Issue     |
| 1 | Annabelle N. Herrera | CTC No. 00021354                               | Quezon City<br>City       | January 20, 2012  |
| 2 | Charlon Gonzales     | CTC No. 35294408                               | Valencia City<br>Bukidnon | February 22, 2012 |

Doc. No. 179  
Page No. 26  
Book No. VI  
Series of 2012

  
**ATTY. DELFIN R. AGCAOILI JR.**  
NOTARY PUBLIC  
PTR 0285334 JAN. 4, 2012  
UNTIL DEC. 31, 2012  
IBP: 797299-JAN. 10, 2012 MCA  
ROLL # 24655-TIN # 44519966  
MCLE: # 0013521