ENVIRONMENTAL IMPACT STATEMENT (EIS)

Proposed 3.0 MMTPY
Cement Plant Complex Project with Quarry

Barangay Baha and Barangay Talibayog

Calatagan, Batangas

Submitted by:

Asturias Industries Inc.

Submitted to:

Environmental Management Bureau – Central Office

An Environmental Report By:

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List of Acronyms

AERMIC	-	American Meteorological Society/EPA Regulatory Model Improvement Committee
BACT	-	Best and Available Control Technology
BFAR	-	Bureau of Fisheries and Aquatic Resources
BMB	-	Biodiversity Management Bureau
BLGU	-	Barangay Local Government Unit
CAA	-	Clean Air Act
CARP	-	Comprehensive Agrarian Reform Program
CENRO	-	Community Environment and Natural Resources Office
CMR	-	Compliance Monitoring Report
DENT	-	Department of Environment and Natural Resources
DIA	-	Direct Impact Area
DIV		Dutch Intervention Values
DOLE	-	Department of Labor and Employment
DPT	-	Digit Photo-Transect
ECC	-	Environmental Compliance Certificate
EGF	-	Environmental Guarantee Fund
EIA	-	Environmental Impact Assessment
EIS	-	Environmental Impact Statement
EMB	-	Environmental Management Bureau
EMP	-	Environmental Monitoring Fund
EMoP	-	Environmental Monitoring Plan
FVC	-	Fish Visual Census
GHG	-	Greenhouse Gas
GLC	-	Ground-Level Concentration
GPS	-	Global Positioning System
IEC	-	Information, Education and Communication
IFMA	-	Integrated Forest Management Agreement
IIA	-	Indirect Impact Area
IRR	-	Implementing Rules and Regulations
KBA	-	Key Biodiversity Area
kW	-	Kilowatts
kWh	-	Kilowatt hour
LCI	-	LCI Envi Corporation
MASL	-	Meters above sea level
MENRO	-	Municipal Environment and Natural Resources Office
MGB	-	Mines and Geoscience Bureau
MHO	-	Municipal Health Officer
MMTPY	-	Million Metric per Year
NAAQS	-	National Ambient Air Quality Standards
NAAQGV	-	National Ambient Air Quality Guideline Values
NESSAP	-	National Emission Standard for Source Specific Air Pollutants
NGOs	-	Non-Government Organizations
NIPAS	-	National Protected Areas System
nm	-	Nanometer
NPCC	-	National Pollution Control Commission
NSCB	-	National Statistical Coordination Board
NWRB	-	National Water Resources Board
PAGASA	-	Philippine Atmospheric, Geophysical, and Astronomical Services Administration
PAR	-	Philippine Area of Responsibility
PBL	-	Planetary Boundary Layer
PCG		Philippine Coast Guard
PDR	-	Project Description Report

PEISS	-	Philippine Environmental Impact Statement System
PENRO	-	Provincial Environment and Natural Resources Office
PHILVOCS	-	Philippine Institute of Volcanology and Seismology
PM	-	Particle Matter
PNSDW	-	Philippine National Standards for Drinking Water
PPE	-	Personal Protective Equipment
PSA	-	Philippine Statistics Authority
PSR	-	Public Scoping Report
PQ	-	Pliocene-Quaternary
RHU	-	Rural Health Unit
SB	-	Sangguniang Bayan
SBCs	-	Sensitive Biological Communities
SDP	-	Social Development Program
SMR	-	Self-Monitoring Report
SRTM	-	Shuttle Radar Topography Mission
SWMP	-	Solid Waste Management Program
TSP	-	Total Suspended Particles

EXECUTIVE SUMMARY

Project Fact Sheet

<table>
<tr><td>Name of Project</td><td colspan="3">3.0 MMTPY Cement Plant Complex with Quarry</td></tr>
<tr><td>Project Location</td><td colspan="3">Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas</td></tr>
<tr><td>Nature of Project</td><td colspan="3">Cement Plant with Quarrying</td></tr>
<tr><td>Project Size</td><td>Line 1</td><td>Line 2</td><td>Total</td></tr>
<tr><td></td><td>1.5 Million Metric Tons per Year (MMTPY) Clinker</td><td>1.5 Million Metric Tons per Year (MMTPY) Clinker</td><td>3.0 Million Metric Tons per Year (MMTPY) Clinker</td></tr>
<tr><td>Summary of Major Project Components</td><td colspan="3">
<table>
<tr><th>PROJECT COMPONENT</th><th>DESCRIPTION/SPECIFICATIONS</th></tr>
<tr><td colspan="2">Quarry Operations</td></tr>
<tr><td>Limestone crushing system</td><td>1,500 tons per hour (tph) capacity with a double rotor hammer crusher</td></tr>
<tr><td>Stacker</td><td>Rectangular store with 1,500tph capacity</td></tr>
<tr><td>Clay Crusher</td><td>400tph with double-toothed roller crusher</td></tr>
<tr><td>Reclaimer</td><td>1 unit</td></tr>
<tr><td>Storage Bins</td><td>500 m^3 limestone; 250 m^3 shale, 250 m^3 silica and 100 m^3 pyrite</td></tr>
<tr><td colspan="2">Cement Plant Operations (per line)</td></tr>
<tr><td>Vertical Roller Mill</td><td>400tph or 2x 200tph roller press system</td></tr>
<tr><td>Homogenizing Silo</td><td>Raw meal silo 15,000mt</td></tr>
<tr><td>Clinker</td><td>5,000 TPD clinker</td></tr>
<tr><td>Clinker Silo</td><td>2 units with capacity of 25,000 mt each and 800mt for the off-spec clinker storage</td></tr>
<tr><td>Cement Proportioning Station</td><td>CPS with 4 bins use for clinker, limestone, pozzolan and gypsum/enhancer storage (400t, 250t, 250t and 200t for each material respectively)</td></tr>
<tr><td>Cement Grinder</td><td>2 unit Vertical Roller Mill with 260tph and >300tph capacity</td></tr>
<tr><td>Cement Silo</td><td>4 units x 10,000 MT capacity</td></tr>
<tr><td>Water Source</td><td>Deep well
Coastal Water</td></tr>
<tr><td colspan="2">Pollution Control Devices</td></tr>
<tr><td>Air Pollution Control</td><td>Bag house filters
Electrostatic Precipitator</td></tr>
<tr><td>Wastewater Pollution Control</td><td>Siltation ponds
Sewage Treatment Plant</td></tr>
<tr><td colspan="2">Support Facilities</td></tr>
<tr><td colspan="2">• Warehouses
• Administration Building and Staff House
• Parking and Truck Marshalling Area
• Clinic
• Fire Station
• Utility Building
• Pier Facility (covered by existing ECC No. R4A-1811-0320)</td></tr>
</table>
</td></tr>
<tr><td>Project Cost</td><td colspan="3">Php 12,000,000,000.00</td></tr>
<tr><td>Construction Period</td><td colspan="3">Phase 1 (Line 1-Cement Grinding Facility): 2019-2021
Phase 2 (Line 1- Completion of Full Cement Plant): 2022-2023
Phase 3 (Line 2): 2024-2026</td></tr>
<tr><td>Commercial Operation Date</td><td colspan="3">Line 1: 2022
Line 2: 2027</td></tr>
</table>

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Process Documentation

Terms of Reference for the EIA Study

1 The Philippine Environmental Impact Statement System (PEISS), under Presidential Decree No. 1586, is a key planning tool for any major project that needs the incorporation of sustainable development. The main purpose of sustainable development activities is to support the project's intended business interest while preventing or minimizing its negative effects to the surrounding environment and maintaining a good partnership with the host communities.

2 **Asturias Industries Inc.** intends to construct and operate a cement plant complex with quarry in Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas. The cement plant will have a total clinker production capacity of 3.0 MMTPY, composed of 2 lines with 1.5 MMTPY capacity each.

3 The proposed project will be constructed in 3 phases. **Phase 1** of the project is intended for the construction of the cement grinding facility of Line 1. In **Phase 2**, facilities for the clinker production of Line 1 will be constructed while Line 2 of the cement plant will be constructed in **Phase 3**.

4 This project has already been granted with an ECC in June 29, 1998 (9803-003-105) but did not proceed as planned due to economic reasons and some issues on land use classification. The present site was initially covered for distribution by the Comprehensive Agrarian Reform Program (CARP) even with previous mining and quarrying activities undertaken in the area. After a long and tedious legal battle, the same area was confirmed as a 'mineralized area' by the Supreme Court of the Philippines virtually declaring the mistake committed by the Department of Agrarian Reform. After the SC decision was declared, the Proponent decided to re-establish the plans for the proposed cement plant project. However, under the EIS procedural guidelines, the proposed project's ECC issued in 1998 has already lapsed its validity of five years.

5 The Proponent then re-applied for its ECC last 2011. An Environmental Impact Statement (EIS) was submitted and was reviewed by the EIARC. However, the Proponent was not able to provide the additional information requested by the EIARC during the final meeting last 2013. One of the members of the review committee requested for the final exploration report of the project. There was a status quo issued by the Mines and Geoscience Bureau (MGB) hence, the proponent was prevented from entering the site and was not able to conduct the exploration activities.

6 As mentioned, the MGB Regional Office IV-A (CALABARZON) suspended the mineral exploration activities of the MPSA 071-97-IV last April 17,2008. This was due to some issues with the local community involving the land dispute in the area. Asturias Industries, Inc. made necessary actions and were able to resolve the issues. With this, the MGB RIV-A lifted the suspension last July 13,2018 and granted 20 months of exploration activities under the mentioned MPSA.

7 With this, the Proponent is again updating the EIS prepared last 2011 to continue its ECC application. MPSA 071-97-IV will be utilized for the quarry operations of the proposed project. The Environmental Impact Assessment (EIA) Study used the EIS Scoping and Screening Form for Mining Projects as a guide in the impact analysis.

Scope of the EIA Study

8 This EIA Report documents the baseline environmental conditions in the proposed project area in relation to the various stages of development of the proposed project. This report also presents how **Asturias Industries Inc.** plans to manage the environmental impacts associated with the proposed Cement Plant Complex and Quarry operations through a comprehensive environmental management and monitoring plan. This document shall be submitted to the Environmental Management Bureau (EMB) Central Office for review and evaluation.

EIA Team

9 LCI Envi Corporation (LCI) was commissioned by **Asturias Industries Inc.** to conduct the EIA study for the proposed Cement Plant Complex with Quarry Project. LCI was tasked to prepare, document, and, on behalf of the Proponent, submit to the DENR-EMB all the necessary information related to the proposed Project. The following table presents the EIA Study Team composition.

CONSULTANT	EXPERTISE	REGISTRATION NO.
Engr. Jose Marie U. Lim, MSc	Team Leader/Environmental Specialist	IPCO-029
Ms. Carol Barrias	Terrestrial Ecology	-
Victor Ticzon, PhD	Marine Ecology	-
Joseph P. Lalo, MA	Sociology/Social Development Specialist	IPCO-149
Kevin Paolo G. Bartolome	Environmental Specialist	IPCO-353
Engr. Patricia Ann C. Go	Environmental Specialist	IPCO-352

EIA Study Schedule

10 The timetable for the EIA study is shown in the following table.

PROCESS	EIA STUDY MILESTONES	DATE
PRE-SCOPING	Information and Education Campaign (IEC) with Barangay Baha and Barangay Talibayog LGU	July 17, 2018
ENVIRONMENTAL IMPACT ASSESSMENT	Conduct of the EIA Study	June to December 2018

EIA Study Area

11 The proposed cement plant and quarry project is to be located in Brgy. Baha and Brgy. Talibayog in Calatagan, Batanags. The project will be inside the industrial park that will be developed in the same barangays also owned by Asturias Industries Inc. The project impact area generally consisted of the 272-hectare project footprints of the cement plant complex and quarry areas as the direct impact area (DIA) while the areas in the immediate vicinity of the project site in the host barangays as the indirect impact area (IIA). In accordance with the guidelines provided in DAO 2017-15, after the completion of the EIA study, the delineation of the direct and indirect impact areas was updated as follows:

- For the Land component, the direct impact area (DIA) pertains to the areas that will be cleared and developed for the construction and operation of the proposed project components and the areas that will be for quarry, which are identified in **Section 1.4.**

- For the Water component, the DIA refers to the water source in the project site that will be tapped to supply the service water requirement of the project and may be affected by the proposed project activities. It also includes the nearby coastal water where the pier facility that will be used during the operation of the cement plant will be located.

- For the Air component, the DIA covers the areas within the host barangays of Baha and Talibayog where the ground-level concentrations (GLC) of total suspended particles (TSP), the criteria pollutant of potential concern, were projected to exceed 40 µg/Ncm based on 1-hr averaging time. According to the dispersion modelling, the maximum GLC does not exceed the standards stated in DAO 2000-81.

- For the People component, the IIA encompasses the communities in the host Municipality of Calatagan, particularly Brgy. Baha and Brgy. Talibayog (host barangays), which are expected to benefit from the employment, business opportunities, taxes, and other potential socio-economic contributions of the project. It must be noted that there are no people in Barangay Baha as the whole barangay has been relocated.

EIA Methodologies

12 All design information presented in the EIS are those that are available at the time of preparation provided by the proponent. Changes in design elements or processes may be required during the detailed design, construction and operational phases of the project which will result in a deviation from what is presented in the EIS report. With this, the project will have a management of change process to manage and track any such amendments, and to:

- assess their potential consequences with respect to environmental and social impact; and,

- to inform and consult with relevant parties on the nature of the impact and on proposed mitigation measures (where a significant impact is likely to arise because of the amendment or change), where practical and appropriate.

13 The methods employed in each of the four modules of the EIA study are summarized as follows:

EIA MODULE	METHODS	PURPOSE
LAND	• Review of land use plan in the host municipality of Calatagan, Batangas • Soil sampling and quality analysis • Review of relevant geologic maps covering the study area • Assessment of terrestrial ecology in the study area	• To assess land use/zoning compatibility of the proposed project • To establish baseline information on soil quality in the proposed project site • To assess possible impacts of geological hazards on the proposed development • To establish baseline information on terrestrial flora and fauna in the proposed project site
AIR	• Review of climatological data from the Philippine Atmospheric, Geophysical, and Astronomical Services Administration (PAGASA)	• To assess possible impacts of meteorology on the proposed development

EIA MODULE	METHODS	PURPOSE
	• Ambient air quality and noise level monitoring and analysis • Air dispersion modeling	• To establish baseline information on ambient air quality and noise levels in the project area with considerations on relevant national standards • To assess possible impacts of proposed project activities on air quality in the impact area
WATER	• Coastal and groundwater sampling and quality analysis to establish the baseline • Conduct of marine ecology survey	• To establish baseline information on water quality in the project area with considerations on relevant national standards • To establish baseline information on the marine ecology within the project site that might be affected by the proposed project
PEOPLE	• Socio-economic and perception survey in the project impact areas • Review of socio-economic profile of the communities in the impact area (Barangays Baha and Talibayog), Stakeholder consultations (focused group discussion, key informant interview with various stakeholders	• To establish baseline information on the socio-economic conditions in the impact areas and general perception on the proposed project • To involve stakeholders in the EIA process and address issues and concerns on the proposed project

Scoping and Stakeholders' Engagement

Information and Education Campaign

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

15 For the proposed 3.0 MMTPY Cement Plant Complex with Quarry project, the invitation to conduct the IEC was coursed through the host community: the barangay local government unit (BLGU) of Baha and Talibayog in the Municipality of Calatagan, Batangas.

16 The IEC activity was conducted in Balayan, Batangas from 9:30 AM to 11:30 AM on July 17, 2018 (Tuesday). The participants were composed of representatives from the barangay LGUs of Baha and Talibayog and local organizations. The meeting was facilitated by LCI (EIA Consultant), together with the Proponent representatives.

17 The preliminary issues and concerns raised and addressed during the IEC activity for the proposed project covered a wide array of subject matter, including employment opportunities, safety of the community, livelihood opportunities for the communities and the improvement of the road access going to the project site.

18 The importance of constant open communication between the community and the project Proponent throughout the different phases of the project implementation was emphasized during the meeting.

Socio-Economic and Perception Survey

19 As part of the baseline characterization and impact assessment on People, a socio-economic and perception survey was conducted last Nov. 25, 2018. The survey covered the residents of Talibayog and those formerly residing in Brgy. Baha with a total of 100 respondents.

20 Each respondent was asked to fill out a two-page survey form, which was written in the local vernacular (Tagalog). The initial perception survey form had two parts. The first part contained 11 questions on the respondent's profile, while the second part had six questions that aimed to gauge the awareness and gather the opinion of the respondent regarding the proposed project.

Technical Scoping

21 The composition of the EIA Review Committee is presented below.

EIA REVIEW COMMITTEE MEMBER	AREAS/EXPERTISE	REGISTRATION NO.
Chester Cabalza, PhD	Anthropology	RCO-053
Dr. Maria Lourdes Moreno	Marine Biology	-
Engr. Jose Reynato Morente	Air Quality and Water Quality, ERA	RCO-002
Engr. Reynaldo Zabala	Mining Engineer	-
For. Raul Briz	Terrestrial Ecology	-

22 The EIS Scoping and Screening Form for Mining Projects was used during the technical scoping to define the coverage of the EIA Study for the proposed 3.0 MMTPY Cement Plant Complex with Quarry Project.

EIA Summary

Summary of Alternatives

Site Selection

23 In terms of siting, the project site in Brgy. Baha and Brgy. Talibayog was selected since it is already owned by **Asturias Industries Inc**. The proposed site is known to contain limestone and shale minerals, therefore it was not practical to select other sites. The zoning of the project site is also suitable for industrial purposes; the project footprint will not be built on agricultural areas.

Technology Selection/Operation Processes and Design of Selection for Storage

24 In terms of technology, **Asturias Industries Inc.** opts to implement a full cement plant instead of a stand-alone grinding facility since the raw materials for the cement production is already present in the proposed project site. However,Phase 1 of the project will only include the construction and operation of the cement grining facility of Line 1. The full cement plant for Line 1 will happen during the Phase 2 of the project. The process that will be used for the cement production is a dry-process thus, minimizing the water requirement. The technology proposed will also involve the recovery of heat from the furnace which will be used internally to save on power requirement.

25 There are two types of process involved in the cement production; the wet process and the dry process. Asturias will be using the dry process because of its minimal water requirement.

The savings in fuel cost by using the dry process vs the wet process is the compelling reason why modern cement plants use the dry process.

Resources and Alternative Fuels

26 The proponent is committed to improve the cement production in its project by seeking energy efficient processes and sustainable alternative energy sources. They are considering the use of alternative fuels, which is well proven and well established in most cement industries in Europe and Asia.

27 Possible alternative fuels that can be used for the proposed cement plant include industrial wastes such as: used tires, rubber, paper waste, waste oils, waste wood and paper sludge.

28 The proponent will submit its technical position on its use of alternative fuels to EMB and secure the necessary permits from appropriate agencies prior to implementation.

No Project Option

29 If the proposed project will not proceed, the existing biophysical, environmental and socio-economic conditions in the project site will remain the same. None of the potential effects of the project, positive or negative, will occur. There will be no increase in the economic activity in the host barangays and municipality and any adverse effect of the project on the existing environment would be avoided. However, the mineral resource present in the project site will not be developed and the resulting socio-economic benefits of Brgy. Baha and Brgy. Talibayog and the Municipality of Calatagan will not occur. .

30 Asturias is committed to contributing to local and national development including care for the environment and sustainable development, by promoting practices that minimize negative impacts on natural resources, and other community values, at the same time acknowledging that mining development and the establishment of the plant can significantly contribute to improvements in local and national quality of life and economic development needs and objectives. Proceeding with the Project is not expected to have significant negative effects on the biophysical and socio-economic environment due to the implementation of appropriate mitigation measures.

Key Findings of the Environmental Baseline Studies

31 The findings of the environmental baseline studies conducted for each of the four EIA modules are summarized in the following table.

MODULE	SUMMARY OF FINDINGS
LAND	
Land Use and Classification	• The proposed project site is situated in an area designated for industrial use. • The proposed project site does not fall within any declared ECA and is not covered by any tenurial instrument.
Pedology	• Based on the soil quality assessment, the detected levels of all parameters tested were way below the respective threshold limits/intervention values.
Terrestrial Ecology	• Out of the 121-species of flora identified from the project area, thirteen (13) species are included in the The IUCN Red List of Threatened Species version 2017-3. • There are no critically endangered fauna species observed within study area. However, there is 1 considered nearly threatened and 3 are considered vulnerable.

MODULE	SUMMARY OF FINDINGS
WATER	
Competition in Water Use	• The project will use 850 cu.m. of water per day for the cement plant operation and domestic warer. This will be sourced from two deep wells in the project site. • The Waste Heat Recovery will be utilizing 1,650 m^3/hr of water which will be sourced from the nearby coastal water. • Competition in water use is not expected during the operation of the project.
Oceanography	• Bathymetry will not be changed since there will be no reclamation.
Water Quality	• GW3 and GW4 exceeded the DENR limit for nitrate. • GW4 exceeded the DENR limit for TSS. • GW1, GW2 and GW4 have Fecal Coliform above the limit of PNSDW and DENR.
Marine Ecology	• Relative cover of hard corals and other fauna remain generally low across stations. • Fish assemblages were dominated by small non-commercial species, there was a scarcity of important target species, and biomass was relatively low. However, fish species richness was notably good. • Seagrass communities appeared to be in good condition with moderate estimates of diversity and canopy cover. • The reef benthic communities were in relatively poor condition as characterized by patchy distribution of coral communities and low live hard coral cover. • There are mangroves along a 4-km stretch of the shoreline.
AIR	
Meteorology	• The proposed project area mainly belongs to Type I climate under the modified Coronas classification (two pronounced seasons, dry from December to May and wet from June to November). • Temperature is highest in April and May and lowest in February. • The rainiest months are from June to October with mean monthly rainfall values ranging from 228.7 to 218.4mm. The driest month in the area is February with only 16.0 mm of rainfall and 3 rainy days. • The prevailing surface wind in the area is northeastern from October to April and southwestern from June to September • An average of 3 cyclones passes through the area every two years.
Ambient Air Quality and Noise	• All sampling stations showed acceptable ambient air and noise conditions, with the values way below the specified NAAQS and NPCC limits, respectively.
PEOPLE	
	• Based on the IEC conducted, the main concern raised by the residents is the prioritization of the hiring of workers from their barangays. The proponent will ensure that qualified local residents will be prioritized. • Based on the perception survey, (92%) of the 100 respondents have prior knowledge about the proposed project. A good portion (67%) of the respondents believed that the proposed project would be beneficial, while (5%) believed otherwise; 27% were undecided. The most cited potential positive impact of the project is employment generation (54%), followed by business opportunities (23%) and tax revenues (22%). Conversely, the most cited potential negative impact of the project is air pollution (39%), followed by noise pollution (19%) and impacts on the sea (Baayan Bay) (2%).

Integrated Summary of Impacts and Residual Effects After Mitigation

32 The main project impacts of the proposed Project for each environmental component and the corresponding mitigating measures are summarized in the following table.

POTENTIAL IMPACTS	PROJECT PHASES	FINDINGS/OBSERVATIONS	MITIGATING MEASURES	MONITORING PARAMETER
LAND				
Devaluation of land value as a result of improper solid waste management and other related impacts	Construction, Operation, Abandonment	Solid waste is expected to be produced.	Implementation of a solid waste management plan	Weight of waste generated
Vegetation removal and loss of habitat	Construction	Disturbance and/or displacement of flora and fauna	• Prepare management plans and protection/conservation strategies • Perform earth-balling for trees when necessary • Avoidance of unnecessary tree-cutting • Create reserve or protected areas to still produce and sustain biodiversity even with the implementation of the proposed Project • Establishment of plant nurseries • Retaining and managing viable habitat units within and surrounding the project's development block areas • Reforestation • Conduct trainings, seminars and field demonstrations on company personnel on how to identify, care, propagate these threatened native tree species	Important species existing in the area
WATER				
Degradation of ground water / coastal water quality	Construction, Operation	Accidental oil spills from heavy equipment Accidental oil spill from delivery trucks and operation of pier facility	• Use sawdust, rice hulls, or coir dusts to absorb the oil spills • Maintain canal in the maintenance and repair area of vehicles and equipment • Implementation of oil spill contingency plan	Oil and Grease (Coastal water)
	Construction, Operation	Ground and coastal water contamination from improper disposal	• Provision of sanitation facilities for workers (e.g. toilets, showers, etc.)	Fecal Coliform (Ground water & Coastal water)

POTENTIAL IMPACTS	PROJECT PHASES	FINDINGS/OBSERVATIONS	MITIGATING MEASURES	MONITORING PARAMETER
		of wastes, percolated wastewater, sludge and fecal matter	• Provision of sewage treatment plant	
Degradation of coastal water quality	Construction,	Possible siltation and surface runoff Increase in turbidity of coastal water	• Establishment of sediment traps and erosion barriers • Regular removal of silt and sediments.	Total Suspended Solid (Coastal water)
	Operation	Runoff from plant and quarry operations Possible spillage of raw materials from pier Accidental oil spill from ship	• Installation and maintenance of drainage system within the plant and quarry areas. • Provision and regular maintenance of siltation ponds in the quarry areas. • Coastal water monitoring • Oil spill contingency plan	Total Suspended Solids (Coastal water)
Threat to existence and/or loss of important local species and habitat	Construction	Possible siltation that may disturb nearby reefs	• Installation of silt curtain • Establishment of sediment traps and erosion barriers • Regular removal of silt and sediments.	Total Suspended Solids (Coastal water)
	Operation	Possible coral bleaching due to discharge of the cooling water	• Cooling down of secondary cooling water prior to discharge	Temperature (WHR water discharge)
AIR				
Impact on Air Quality	Construction	NO_x, SO_2, and CO emissions from heavy equipment that will be used during construction.	Proper maintenance on heavy equipment.	NO_x, SO_2, CO
	Operation	TSP and PM_{10} emissions from the cement manufacturing facility and quarry sites is of primary concern.	• Installation of bag filters that will control at least 90% of the emissions from the cement plant • Road watering within the plant site to control dust	TSP, PM_{10}
		Gaseous emissions are expected from the kiln and the coal mill.	• Proper maintenance of equipment to ensure efficiency • Use of Waste Heat Recovery to lessen the use of coal	NO_x, SO_2, CO

POTENTIAL IMPACTS	PROJECT PHASES	FINDINGS/OBSERVATIONS	MITIGATING MEASURES	MONITORING PARAMETER
Increase in Ambient Noise Level	Construction/ Operation	Noise will be generated by heavy equipment during construction and quarry operation. The cement plant will generate noise.	• Maintenance of engines and other mechanical parts of the equipment • Installation of exhaust mufflers • Constructing enclosures surrounding the project site • Maintenance of vegetation surrounding the area to serve as natural noise barriers • Quarry operations limited during daytime	Noise
PEOPLE				
Threat to Public Health and Safety	Construction Operation	Dust may cause negative health effects (i.e., respiratory) to the community and workers if not properly mitigated. Crime incidence may also increase in the local community.	• Conduct of medical missions and regular check-ups to workers and host barangay • Coordination with Municipal Health Officer (MHO) and barangay health units to address health-related needs of the community • Coordination with barangay officials to ensure peace and order among workers and community members	No. of work-related illnesses/ injuries, No. of safety man-hours
Generation of Local Benefits from the Project	Operation	Generation of additional source of income and livelihood Additional revenue for the local government Increased basic social services Addition and improvement of local residential dwelling	Implementation of social development programs that are responsive to local needs in the impact area	Implementation of SDMP

Risks and Uncertainties

33 The risks and uncertainties identified relating to the EIA findings of for each environmental component are summarized in the following table.

MODULE	RISKS AND UNCERTAINTIES	IMPLICATION ON DECISION MAKING
Water	Possible oil spills during operation of the cement plant (i.e., use of pier facility)	• Development of oil spill management plan • Coordination with appropriate government agencies for proper management control
Air/People	Failure of existing air pollution control devices	• Consider redundancy for emergency air pollution control
Land/People	Landslide associated to quarry operations	• Development and strict implementation of the quarry development plan approved by MGB • Coordination with MGB and local authorities for proper management control.

SECTION 1

PROJECT DESCRIPTION

1 **Asturias Industries Inc.** intends to construct and operate a cement plant complex with quarry in Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas. The proposed project will be located inside the 464.08-hectare industrial park that will be developed in the area. The park is also owned by Asturias Industries Inc.

2 The cement plant will have a total clinker production capacity of 3.0 MMTPY, composed of 2 lines with 1.5 MMTPY capacity each. The operation of the cement plant will also be using the pier facility that will be constructed as part of the operation of the industrial park. **Table 1-1** shows the details of the project, the Proponent, and the EIA Preparer.

3 The proposed project will be done in 3 phases. **Phase 1** of the project is intended for the construction and operation of the cement grinding facility of Line 1 that will have a clinker production capacity of 1.5 MMTPY. In **Phase 2**, facilities for the clinker production for Line 1 will be constructed and the full cement plant of Line 1 will be operated. Quarry operations will also start during this phase to supply the limestone and shale requirements for the cement production. Line 2 of the full cement plant will be constructed and operate in **Phase 3.** Additional limestone and shale requirements for the operation of Line 2 will also be supplied by the quarry.

4 This project was already granted an ECC in June 29, 1998 (9803-003-105) but did not proceed as planned due to economic reasons and some issues on land use classification. The present site was initially covered for distribution by the Comprehensive Agrarian Reform Program (CARP) even with previous mining and quarrying activities undertaken in the area. After a long and tedious legal battle, the same area was confirmed as a 'mineralized area' by the Supreme Court of the Philippines virtually declaring the mistake committed by the Department of Agrarian Reform. After the SC decision was declared, the Proponent decided to re-establish the plans for the proposed cement plant project. However, under the EIS procedural guidelines, the proposed project's ECC issued in 1998 has already lapsed its validity of five years.

5 The Proponent re-applied its ECC last 2011. An Environmental Impact Statement (EIS) was submitted and was reviewed by the EIARC. However, the Proponent was not able to provide the additional information requested by the EIARC during the final meeting last 2013. One of the members of the review committee requested for the final exploration report of the project however, there was a status quo issued by the Mines and Geoscience Bureau (MGB) hence, the proponent was prevented from entering the site and was not able to conduct exploration activities.

6 The Mines and Geosciences Bureau (MGB) Regional Office IV-A (CALABARZON) suspended the mineral exploration activities of the MPSA 071-97-IV last April 17,2008. This was due to some issues with the local community involving the land dispute in the area. Asturias Industries, Inc. made necessary actions and were able to resolve the issues. With this, the MGB RIV-A lifted the suspension last July 13,2018 and granted 20 months of exploration activities under the mentioned MPSA.

7 With this, the Proponent is again updating the EIS prepared last 2011 to continue its ECC application. MPSA 071-97-IV will be utilized for the quarry operations of the proposed project. The Environmental Impact Assessment (EIA) Study used the EIS Scoping and Screening Form for Mining Projects as a guide in the impact analysis.

Table 1-1: Basic Information on the Proposed Project, Proponent, and EIA Preparer

Name of Project	**3.0 MMTPY Cement Plant Complex with Quarry**		
Project Location	Sitio Punta, Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas		
Nature of Project	Cement Plant with Quarrying		
Project Size	**Line 1**	**Line 2**	**Total**
	1.5 Million Metric Tons per Year (MMTPY) Clinker	1.5 Million Metric Tons per Year (MMTPY) Clinker	3.0 Million Metric Tons per Year (MMTPY) Clinker
Proponent Name	**Asturias Industries Inc**		
Proponent Authorized Representatives	**Mr. Ricardo L. Yabut** General Manager **Atty. Micaela A. Rosales** Authorized Representative Office of the President		
Proponent Address and Contact Details	153 EDSA, Barangay Wack-Wack, Mandaluyong City Tel. Nos.: (+63-2) 7267016 / (+63-2)-7261969		
EIA Preparer (Consultant)	**LCI Envi Corporation**		
Preparer Contact Person	**Engr. Jose Marie U. Lim, MSc.** EIA Team Leader		
Preparer Address and Contact Details	Unit 8L-M Future Point Plaza 3 111 Panay Avenue, South Triangle Quezon City, Metro Manila, Philippines Tel. No.: (632) 442-2830 Fax No.: (632) 961-9226		

1.1 Project Location and Area

1.1.1 Project Area

8 The project site (quarry and cement plant complex) is located in Barangays Baha and Talibayog, Municipality of Calatagan, Batangas. The cement plant complex will occupy a total land area of 22 hectares while the quarry covers an area of about 250 hectares. MPSA 071-97-IV has a total area of 2,337 hectares.

9 The proposed project will be located inside the 464.08-hectare Industrial Park owned by Asturias Industries Inc. in Brgy. Baha and Brgy. Talibayog. The industrial park was granted with an ECC (ECC-R4A-1811-0320) in 2018. The industrial park will cater to different types of industrial locators including the proposed cement plant complex.

1.1.1.1 Project Location

10 The general location map of the proposed project is shown in **Figure 1-1**. The geographic coordinates defining the boundary of the proposed cement plant complex are provided in the table below.

Table 1-2: Coordinates of the Proposed Cement Plant Complex

POINT	LATITUDE (N)	LONGITUDE (E)
1	13°52'28.24"N	120°42'20.86"E
2	13°52'33.43"N	120°42'27.13"E
3	13°52'6.00"N	120°42'40.46"E
4	13°52'12.42"N	120°42'46.17"E

11 **Figure 1-1** also shows the area covered by the MPSA of the project the areas that will be used for the quarry operations. The geographic coordinates of the quarry areas are shown in **Table 1-3.**

Table 1-3: Geographic Coordinates of the Proposed Quarry Areas

POINT	LATITUDE (N)	LONGITUDE (E)
Shale Quarry 1		
1	13°53'12.28"N	120°41'9.89"E
2	13°52'58.74"N	120°41'8.86"E
3	13°52'35.66"N	120°41'25.96"E
4	13°52'36.80"N	120°41'41.99"E
5	13°53'11.06"N	120°41'40.62"E
Shale Quarry 2		
1	13°51'32.11"N	120°42'45.45"E
2	13°51'14.35"N	120°43'8.83"E
3	13°51'33.57"N	120°43'14.44"E
4	13°51'44.19"N	120°42'54.90"E
Limestone Quarry		
1	13°52'14.60"N	120°41'28.73"E
2	13°52'27.70"N	120°41'38.69"E
3	13°51'15.35"N	120°43'8.26"E
4	13°50'56.94"N	120°43'6.67"E
5	13°51'4.97"N	120°42'43.94"E
6	13°51'29.34"N	120°42'10.75"E
7	13°51'46.60"N	120°42'8.45"E
8	13°51'57.93"N	120°41'52.06"E
9	13°51'57.32"N	120°41'42.80"E
10	13°52'6.43"N	120°41'33.96"E

1.1.2 Project Impact Areas

12 Initially, the project impact area generally consisted of the 272-hectare project footprints of the cement plant complex and quarry areas as the direct impact area (DIA) while the areas in the immediate vicinity of the project site in the host barangays as the indirect impact area (IIA). In accordance with the guidelines provided in DAO 2017-15, after the completion of the EIA study, the delineation of the direct and indirect impact areas was updated as follows:

- For the Land component, the direct impact area (DIA) pertains to the areas that will be cleared and developed for the construction and operation of the proposed project components, which are identified in **Section 1.4.**

- For the Water component, the DIA refers to the water source in the project site that will be tapped to supply the service water requirement of the project and may be affected by the proposed project activities. It also includes the nearby coastal water where the pier facility that will be used during the operation of the cement plant will be located.

- For the Air component, the DIA covers the areas within the host barangays of Baha and Talibayog where the ground-level concentrations (GLC) of particulate and gaseous emissions, may increase due to the project.

- For the People component, the IIA encompasses the communities in the host Municipality of Calatagan, particularly Brgy. Talibayog which are expected to benefit from the employment, business opportunities, taxes, and other potential socio-economic contributions of the project. It must be noted that all residents of Barangay Baha are already relocated to other barangays in Calatagan.

13 The impact area delineation for the proposed project is graphically presented in **Figure 1-2**.

1.1.3 Accessibility of the Project Site

14 Since the project is more proximate to the Municipality of Balayan, with aerial distance of 12 kilometers from the site, compared to the Poblacion of Calatagan, the site is more conveniently reached via 0.5-hour drive from Balayan passing through the barangay road connecting Dali and Talibayog. Balayan, on the other hand, is approximately 118 kilometers from Manila, which takes around 3 to 4 hours of land travel.

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

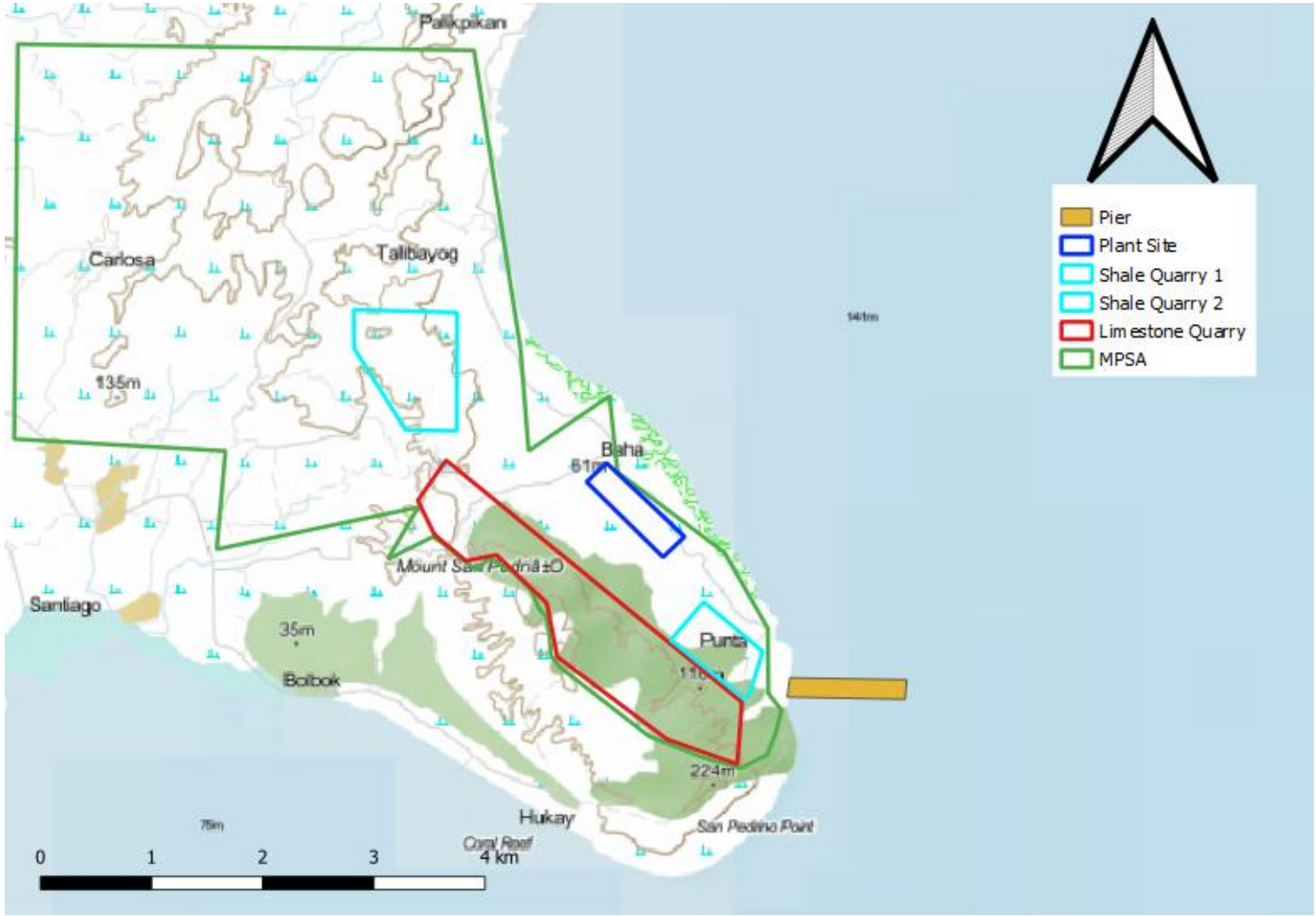

FIGURE NO.:	FIGURE TITLE:
1-1	**GENERAL LOCATION MAP OF THE PROPOSED PROJECT**

PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
ASTURIAS INDUSTRIES INC	**3.0 MMTPY CEMENT PLANT COMPLEX WITH QUARRY** Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas	**LCI ENVI CORPORATION**

Figure 1-2: Primary and Secondary Impact Areas

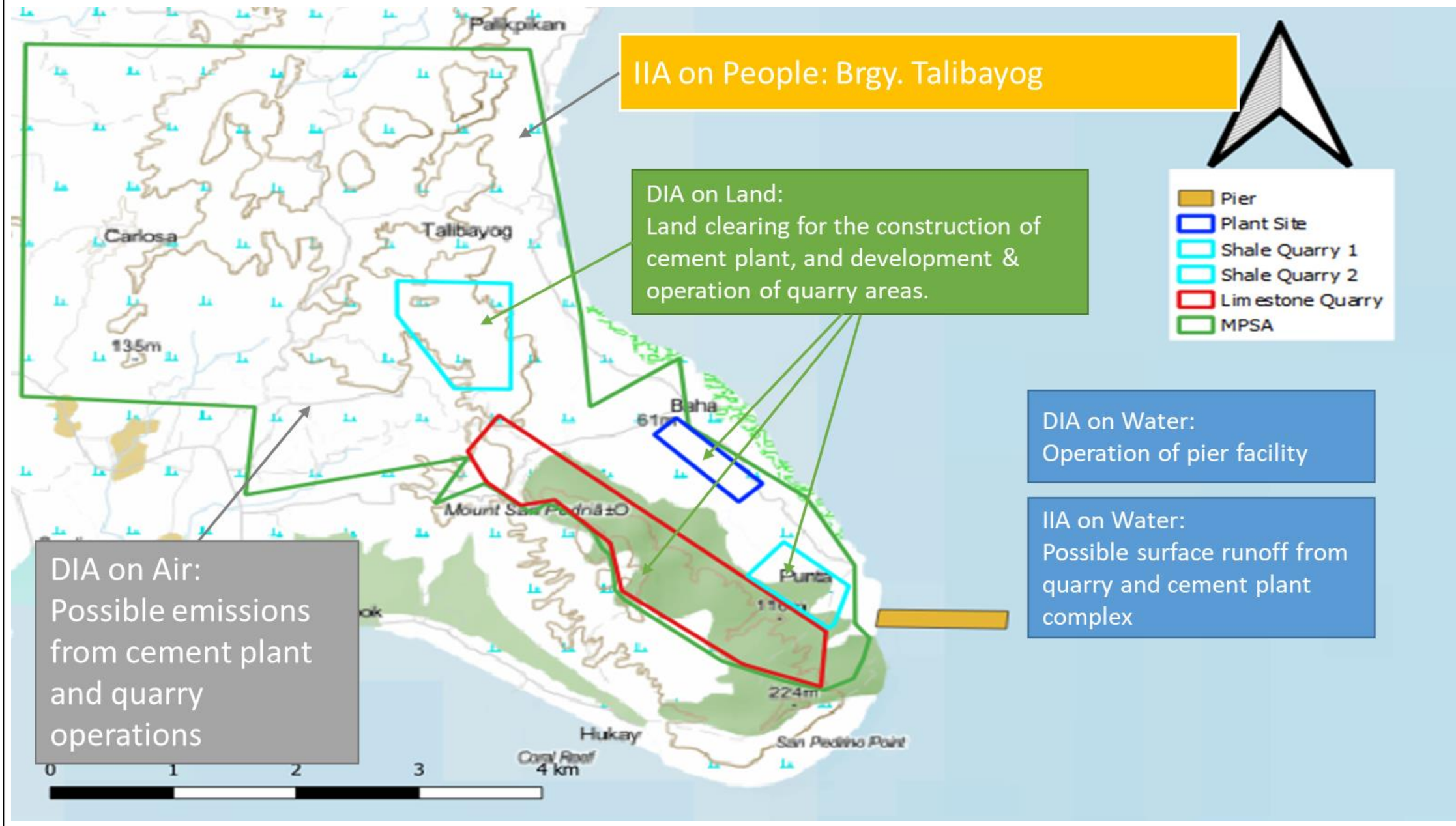

FIGURE NO.:	FIGURE TITLE:
1-2	**PRIMARY AND SECONDARY IMPACT AREAS**

PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
ASTURIAS INDUSTRIES INC	**3.0 MMTPY CEMENT PLANT COMPLEX WITH QUARRY** Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas	**LCI ENVI CORPORATION**

Figure 1-3: Accessibility Map of the Proposed Project Site

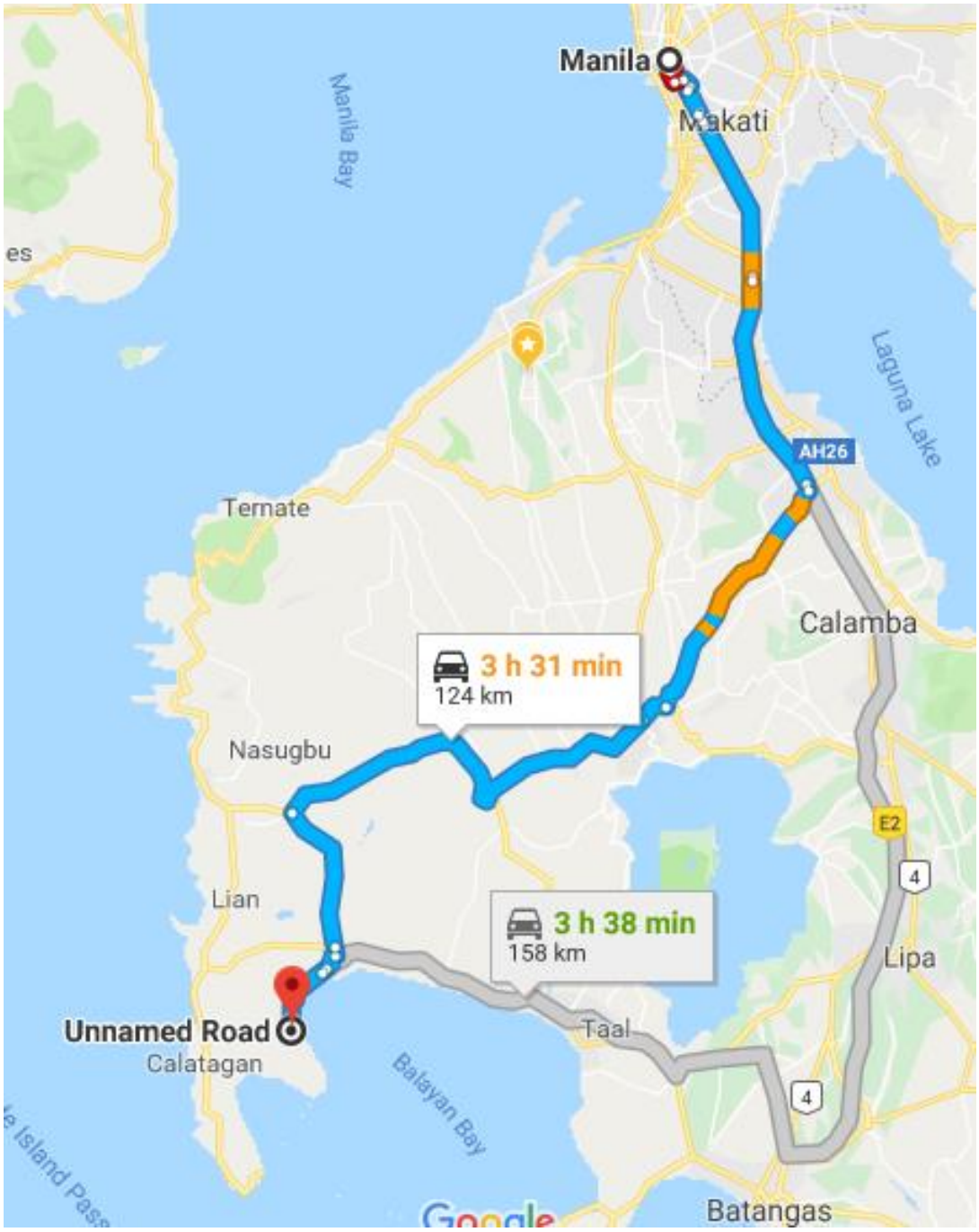

FIGURE NO.:	FIGURE TITLE:
1-3	**ACCESSIBILITY MAP OF THE PROPOSED PROJECT SITE**

PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
ASTURIAS INDUSTRIES INC	**3.0 MMTPY CEMENT PLANT COMPLEX WITH QUARRY** Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas	**LCI ENVI CORPORATION**

1.2 Project Rationale

15 The cement manufacturing industry is an essential component in the infrastructure sector of the Philippines. Being an important construction material in infrastructure projects, it is therefore necessary to guarantee its supply while maintaining competitive prices. Cement is almost universal in terms of building applications, both from the public and the private sectors. It has produced many projects in the country, such as low-cost socialized housing, public schools & hospitals, highways, bridges and privately-funded endeavors, such as condominiums and other residential and commercial structures.

16 The supply and demand of cement is often used as an indicator of the country's overall economic situation. When supply of cement is low, prices increase, and importation becomes necessary. In worst case scenarios, this leads to development projects being be delayed, downsized or even cancelled. This would impede the construction of basic social services infrastructures and would result to slowing down of the economy and the local cement industry. Hence, to be able to increase the Philippines' cement supply, lower the need for its importation, and guarantee its competitive price; there should be additional establishment of cement production facilities.

17 This proposed project will not only provide Asturias Industries, Inc. a viable business, but will also contribute to the economic development of Calatagan, specifically Barangay Baha and Talibayog, its neighboring municipality of Balayan, and even improve the economic growth of the entire province of Batangas. The proposed project will contribute to the development of these municipalities by means of job creation, taxes, increased commercial trading, and could perhaps even bring additional investments. Asturias Industries, Inc. shall maintain a socially-acceptable and environmentally-responsible operation, so as to make the Asturias Cement Plant Complex Project important to the lives of the local population and industry.

1.3 Project Alternatives

1.3.1 Site Selection

18 Mining and quarry projects are site specific as dictated by the location of the resources. Unlike other natural resources, there are no alternative sites in developing mineralized areas. The location of ancillary facilities (i.e. processing plants) were determined based on economic, technical, and environmental factors.

19 Upon selecting the potential sites for the proposed cement plant complex and quarry sites, the following factors persuaded the proponent to choose the site in Barangays Baha and Talibayog as the final project site. The proposed site was chosen for the following reasons:

- Good quality limestone is present in the area;
- The area is accessible from the provincial highways;
- It is approximately 5 kilometers from the national highway;
- The coastal water is deep which is ideal for building a wharf;
- The land owners are reasonable to deal with; and
- There are no immediate volcanic hazards in the area.

20 The proposed project site is already owned by **Asturias Industries Inc**. . The proposed site is known to contain limestone and shale minerals, therefore it was not practical to select other sites. The zoning of the project site is also suitable for industrial purposes; the project footprint will not be built on agricultural areas.

1.3.2 Technology Selection

21 Development design factored in the provisions for human health and safety, including 1) the provisions for mining operations as provided by the Mines and Geosciences Bureau for set-backs, and 2) the guidelines to protect people and their sources of livelihood. For example, the provisions are: a) safety factors of equipment to ensure minimizing environmental impact during operations, b) benching method to be employed in limestone quarrying, and c) optimized blasting frequency vs. magnitude of blast.

22 In terms of technology, **Asturias Industries Inc.** opts to implement a full cement plant instead of a stand-alone grinding facility since the raw materials for the cement production is already present in the proposed project site. However,Phase 1 of the project will only include the construction and operation of the cement grining facility of Line 1. The full cement plant for Line 1 will happen during the Phase 2 of the project.

23 There are two types of process involved in the cement production; the wet process and the dry process. Asturias will be using the dry process because of its minimal water requirement. The savings in fuel cost by using the dry process vs the wet process is the compelling reason why modern cement plants use the dry process.

24 The technology proposed will also involve the recovery of heat from the furnace which will be used internally to save on power requirement.

1.3.3 Resources and Alternative Fuels

25 The proponent is committed to improve the cement production in its project by seeking energy efficient processes and sustainable alternative energy sources. They are considering the use of alternative fuels, which is well proven and well established in most cement industries in Europe and Asia.

26 Possible alternative fuels that can be used for the proposed cement plant include industrial wastes such as: used tires, rubber, paper waste, waste oils, waste wood and paper sludge. The use of alternative fuels is subject to its availability and to limits on handling. Alternative fuels that are commonly used in the cement industry are used rubber tires. For the production of 1.5 MMTPY of clinker, about 10 to 20 MT of tires per day can reduce 1.8 to 3.6% of the coal usage.

27 The proponent will submit its technical position on its use of alternative fuels to EMB and secure the necessary permits from appropriate agencies prior to implementation.

28 The use of waste as alternative fuel in cement production has numerous environmental benefits such as:

- The use of waste will reduce the use of non-renewable fossil fuels, such as coal, and reduce the environmental impacts associated with coal mining. The use of waste as alternative fuel will contribute towards lowering of greenhouse gases emissions by reducing waste materials to be incinerated in municipal waste incinerators.
- The use of waste as alternative fuel is technically sound, since the process basically destroys the organic components and retains the inorganics, such as insoluble residues, ashes and silicates, and integrates these to the product. Cement kilns have a number of characteristics which make them ideal installations for alternative fuels to be vaporized

and burnt safely. The following characteristics are: high operating temperature, long residence time, presence of oxidizing atmosphere and alkaline environment, high thermal inertia, retention of ash in clinker and the continuous supply of fuel.

- Concrete made from cement manufactured using alternative fuels will have the same properties as concrete made from cement manufactured using fossil fuel as the heavy metal concentrations in concrete are not significantly changed by the use of alternative fuels. It is expected that quantities of leached metals will be immeasurable and significantly below levels allowed for drinking water.

1.3.4 No Project Option

29 If the proposed project will not procees, the existing biophysical, environmental and socio-economic conditions in the project site will remain the same. None of the potential effects of the project, positive or negative, will occur. There will be no increase in the economic activity in the host barangays and municipality and any adverse effect of the project on the existing environment would be avoided. However, the mineral resource present in the project site will not be developed and the resulting socio-economic benefits of Brgy. Baha and Brgy. Talibayog and the Municipality of Calatagan will not occur. .

30 Asturias is committed to contributing to local and national development including care for the environment and sustainable development, by promoting practices that minimize negative impacts on natural resources, and other community values, at the same time acknowledging that mining development and the establishment of the plant can significantly contribute to improvements in local and national quality of life and economic development needs and objectives. Proceeding with the Project is not expected to have significant negative effects on the biophysical and socio-economic environment due to the implementation of appropriate mitigation measures.

1.4 Project Components

31 The proposed project will include major components for quarry operations and cement production. The project will also include the improvement of existing dirt roads leading to the proposed site. The operation of the cement plant complex will involve the use of the pier facility that will be constructed within the area. This port facility has a separate ECC (ECC-R4A-1811-0320) provided. The proposed cement plant layout is presented in **Figure 1-4**.

32 Since explosives will be used for the quarry operation, an explosives storage facility will be constructed based on the guidelines set by the Bureau of Fire Protection (BFP), the Philippine National Police-Firearms and Explosives Division (PNP-FED) and by the DENR AO No. 2000-98 or known as the “Mine Safety and Health Standards”. The project shall also include support facilities and pollution control facilities. The proposed support facilities for the quarry operations is shown in **Figure 1-5.**

33 The project components for the quarry operation and cement plant complex are summarized in **Table 1-4.**

Table 1-4: Project Components of the Proposed Cement Plant Complex and Quarry

Component	Line 1 (1.5 MMTPY)	Line 2 (additional 1.5 MMTPY)
Quarry Operations		
Limestone crushing system	1,500 tons per hour (tph) capacity with a double rotor hammer crusher	1,500 tons per hour (tph) capacity with a double rotor hammer crusher

Component	Line 1 (1.5 MMTPY)	Line 2 (additional 1.5 MMTPY)
Stacker	Rectangular store with 1,500tph capacity	Rectangular store with 1,500tph capacity
Clay Crusher	400tph with double-toothed roller crusher	400tph with double-toothed roller crusher
Reclaimer	1 unit	1 unit
Storage Bins	500 m^3 limestone; 250 m^3 shale, 250 m^3 silica and 100 m^3 pyrite	500 m^3 limestone; 250 m^3 shale, 250 m^3 silica and 100 m^3 pyrite
Water Source	Deep well Coastal water	Deep well Coastal water
Wastewater Pollution Control	Siltation ponds	Siltation ponds
Support Facility	Explosive Storage	
Cement Plant Complex		
Vertical Roller Mill	400tph or 2x 200tph roller press system	400tph or 2x 200tph roller press system
Homogenizing Silo	Raw meal silo 15,000mt	Raw meal silo 15,000mt
Clinker	5,000 TPD clinker	5,000 TPD clinker
Clinker Silo	2 units with capacity of 25,000 mt each and 800mt for the off-spec clinker storage	2 units with capacity of 25,000 mt each and 800mt for the off-spec clinker storage
Cement Proportioning Station	CPS with 4 bins use for clinker, limestone, pozzolan and gypsum/enhancer storage (400t, 250t, 250t and 200t for each material respectively)	CPS with 4 bins use for clinker, limestone, pozzolan and gypsum/enhancer storage (400t, 250t, 250t and 200t for each material respectively)
Cement Grinder	2 unit Vertical Roller Mill with 260tph and >300tph capacity	2 unit Vertical Roller Mill with 260tph and >300tph capacity
Cement Silo	4 units x 10,000 MT capacity	4 units x 10,000 MT capacity
Water Source	Deep well Coastal water	Deep well Coastal water
Air Pollution Control	Bag house filters Electrostatic Precipitator	Bag house filters Electrostatic Precipitator
Wastewater Pollution Control	Siltation ponds Sewerage Treatment Plant	Siltation ponds Sewerage Treatment Plant
Waste Heat Recovery	7.5 MW Waste Heat Recovery System	7.5 MW Waste Heat Recovery System
Support Facilities	• Water Treatment Plant • Warehouses • Administration Building and Staff House • Pier Facility (ECC-R4A-1811-0320) • Parking and Truck Marshalling Area • Clinic and Fire Stations • Utility Building	

1.4.1 Support Facilities

34 Warehouses, administration building and staff house, utility building and parking and truck marshalling area will be constructed to support the operation of the cement plant. Clinic, fire station and power substation will also be constructed as support facilities.

35 The pier facility that will be constructed as part of the industrial park, where the project will be located, will also be used during the operation of the cement plant as means of transportation of the materials and products of the project. This pier facility shall also be used by other locators of the industrial park.

36 A waste heat recovery system will also be used in the cement plant. Waste Heat Recovery System is a scheme to utilize the valuable heat exhausted from the pyro-processing plant and convert it to electrical energy using the thermodynamic principle of a Rankine Cycle. This system employs four major components: the Boiler, Steam Turbine, Condenser, and Feed Water Pump. These components are used for energy conversion and power generation. For a 5,000 tpd kiln line, the maximum electricity that may be generated is 7.5 MW. The generation of electricity varies depending on the actual clinker production, initial moisture, raw materials, etc.

37 The plant shall build an Explosives Magazine (warehouse/storage facility) to specifically store explosives that will be used in the blasting activities. This facility will be constructed based on the guidelines set by the Bureau of Fire Protection (BFP), the Philippine National Police-Firearms and Explosives Division (PNP-FED) and DAO 2000-98 to primarily decrease the risk of accidental explosion to people and property. The explosive storage facility will have a maximum capacity to store for one month's usage. Physically, the storage room may only be about 10 x 10 meters well-ventilated, locked and secured with a fence all around the room about 5 meters from the walls of the room. The Explosives Magazine shall feature the following items:

- Designed to be fire, blast, and even bullet-resistant;
- The facility will be situated in an isolated zone, away from nearby residents and the main production facility;
- Installed security fences and gates, warning signs, and closed-circuit television;
- No other openings except for the entrance/exit and ventilations;
- All ventilations will be provided with metal screens to prevent unauthorized access;
- The doors will have multiple security locks, which will be kept by a representative of PNP-FED, plant's security officer, and the master blaster;
- Equipped with lightning arrester, wooden matting, anti-static devices, fire extinguishers, and vapor-proof lighting fixtures;
- The immediate surrounding will be cleared with any combustible material; and
- Has separate chambers to contain the stocks of dynamite, blasting caps, fuses, and ammonium nitrate.

1.4.2 Access Roads

38 Two main access roads will be developed for easier access to the project site. One is the existing route from Zobel highway in Calatagan wherein the provincial road will be connected to the barangay road within the project site. This road will be widened and concreted. The second one will the construction of a new road that will connect the Balayan highway to the project site.

39 These access roads, after full completion, will provide Asturias a faster and safer means of land travel to the proposed Project's facilities.

40 The construction of the access roads has an ECC granted by EMB Region IVA (ECC-R4A-1811-0320) as part of the site development project of the industrial park.

1.4.3 Temporary Facilities during Construction

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

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

1.4.4 Pollution Control Devices

1.4.4.1 Air Pollution Control

42 The priority is to minimize the increase in ambient particulate levels by reducing the mass load emitted from fugitive emissions and from other sources. Collection and recycling of dust is required to improve the efficiency of the operation and to reduce atmospheric emissions. It was estimated that the annual emission rate of the cement plant in terms of particulate matter is about 1,640 MT/yr.

43 For control of fugitive particulate emissions, ventilation systems shall be used in conjunction with hoods and enclosures covering transfer points and conveyors. Drop distances shall be minimized using adjustable conveyors. The operations of the air pollution control system are described in the following sections:

- Bag filters are installed at various points in the plant to collect the solid particulates escaping from the system. The bag filters have guaranteed efficiency of 99.99% in eliminating the dust. The bag filters are provided with a fan, driven by an electric motor, to regulate volumetric flow, gas temperature, and static pressure.
- Electrostatic precipitators will also be installed to handle fugitive emissions that were not captured by the bag filters.
- Operating areas which could be dusty, such as the pack house and the additives storage hall will be fully enclosed and provided with dust collectors. Fugitive dusts on the roads will be suppressed with water sprays.
- A green area about 10 meters wide will be constructed along the sides of the plant premises where residential houses are located nearby. The green area will be planted with trees of various heights and “thicknesses” to act as dust barrier or dust curtain.

Table 1-5: Air Pollution Sources and Corresponding Air Pollution Control Facility

Air Pollution Control Facility	Air Pollution Source
Bag Filters	• Primary Crusher • Vibrating Screen • Secondary Crusher • Additive Crusher • Transport conveyors • Homosilo discharge • Kiln Feeding Bin • Clinker Silo • Clinker Silo discharge

Air Pollution Control Facility	Air Pollution Source
	• Feed bins • Roller Press • Finish Mill • Top of clinker bin • Cement Silo • Air slide transport • Finish Mill • Bulk Silo • Pack House • Transport Bag Filter
Electrostatic Precipitator	• Waste Heat Recovery • Clinker Cooler Discharge

1.4.4.2 Water Pollution Control

44 Portable toilet facilities will be installed on-site to cater the domestic wastewater that will be generated by the workers. These facilities will be regularly siphoned by DENR-accredited haulers. It is estimated that the domestic wastewater that will be generated during the construction phase is ~40 m^3/day (14,600 m^3/yr).

45 Wastewater that will be generated during the operation of the project will be limited to domestic wastewater and surface run—off. A sewage treatment plant will be constructed in the cement plant complex to treat the domestic wastewater generated by the workers. The STP will have a capacity of 145 m^3/day (52,925 m^3/yr).

46 Siltation ponds will also be constructed on strategic areas within the project site to collect and pre-treat the run-offs that will come from the quarry areas prior to discharging to the drainage. This is to allow the settling and decrease the suspended solids of run-off.

47 Wastewater from ground surface (from rain and from cleaning) will pass thru a sediment and oil trap before release to existing waterways in the site.

48 The sewer and drainage layout plans for the proposed cement plant complex are shown in **Figure 1-6** and **Figure 1-7**, respectively.

1.4.4.3 Solid Waste Control

49 A temporary solid waste storage area will be provided in the site during construction. All solid wastes will be properly segregated and disposed. Designated spoil disposal area will also be provided. All of these will be located inside the project site

50 Solid wastes from the office, dormitory/kitchen and other facilities will be segregated as to bio-degradable or not and will be disposed of accordingly with the help of the municipal government. Domestic solid wastes that will be generated during the operation of the cement plant is estimated to be ~120 kg/day (~43.8 MT/year).

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Figure 1-4: Plant Layout for the Proposed Cement Plant Complex

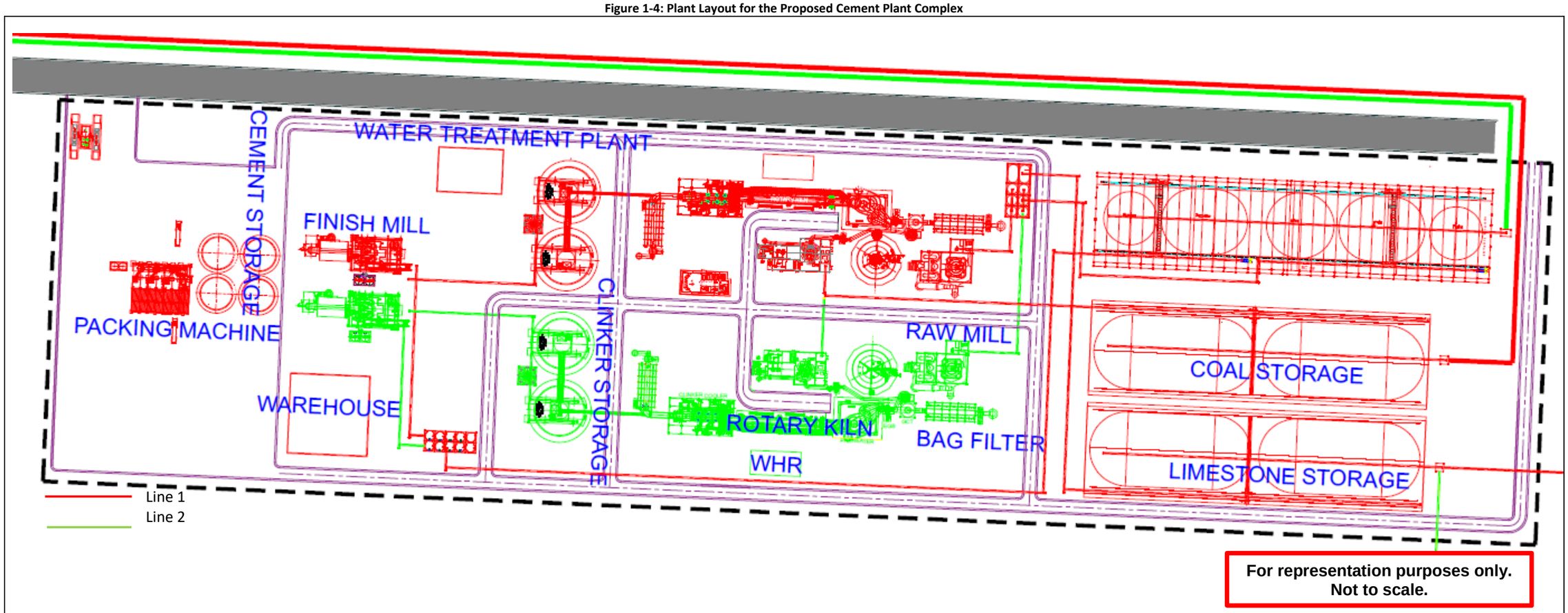


FIGURE NO.:	FIGURE TITLE:
1-4	**PLANT LAYOUT FOR THE PROPOSED Cement Plant Complex**

PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
ASTURIAS INDUSTRIES INC	**3.0 MMTPY CEMENT PLANT COMPLEX WITH QUARRY** Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas	**LCI ENVI CORPORATION**

Figure 1-5: Location of the Support Facilities for the Quarry Operation

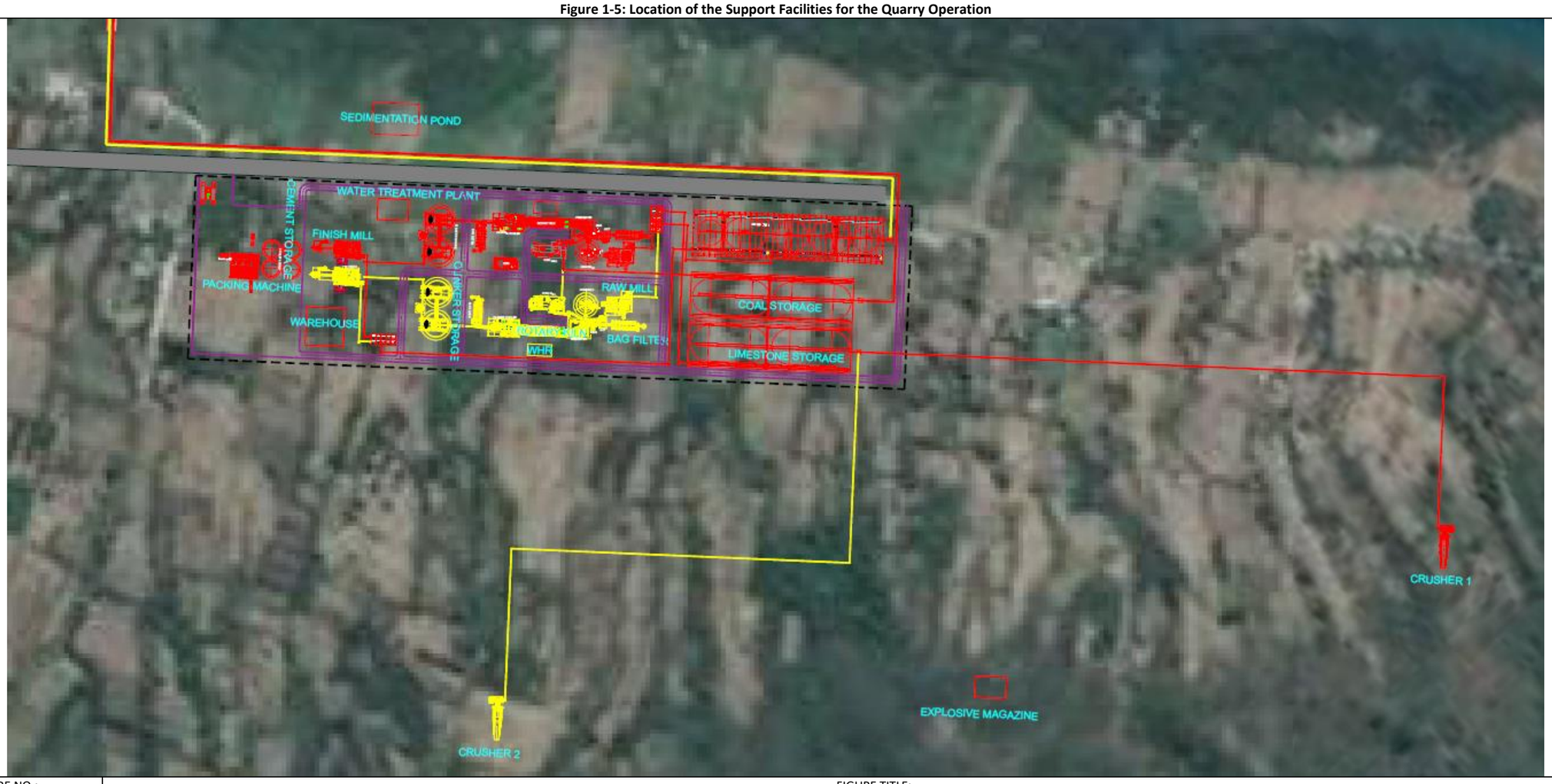


FIGURE NO.:	FIGURE TITLE:
1-5	**LOCATION OF SUPPORT FACILITIES FOR THE QUARRY OPERATION**

PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
ASTURIAS INDUSTRIES INC	**3.0 MMTPY CEMENT PLANT COMPLEX WITH QUARRY** Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas	**LCI ENVI CORPORATION**

Figure 1-6: Proposed Sewer Layout

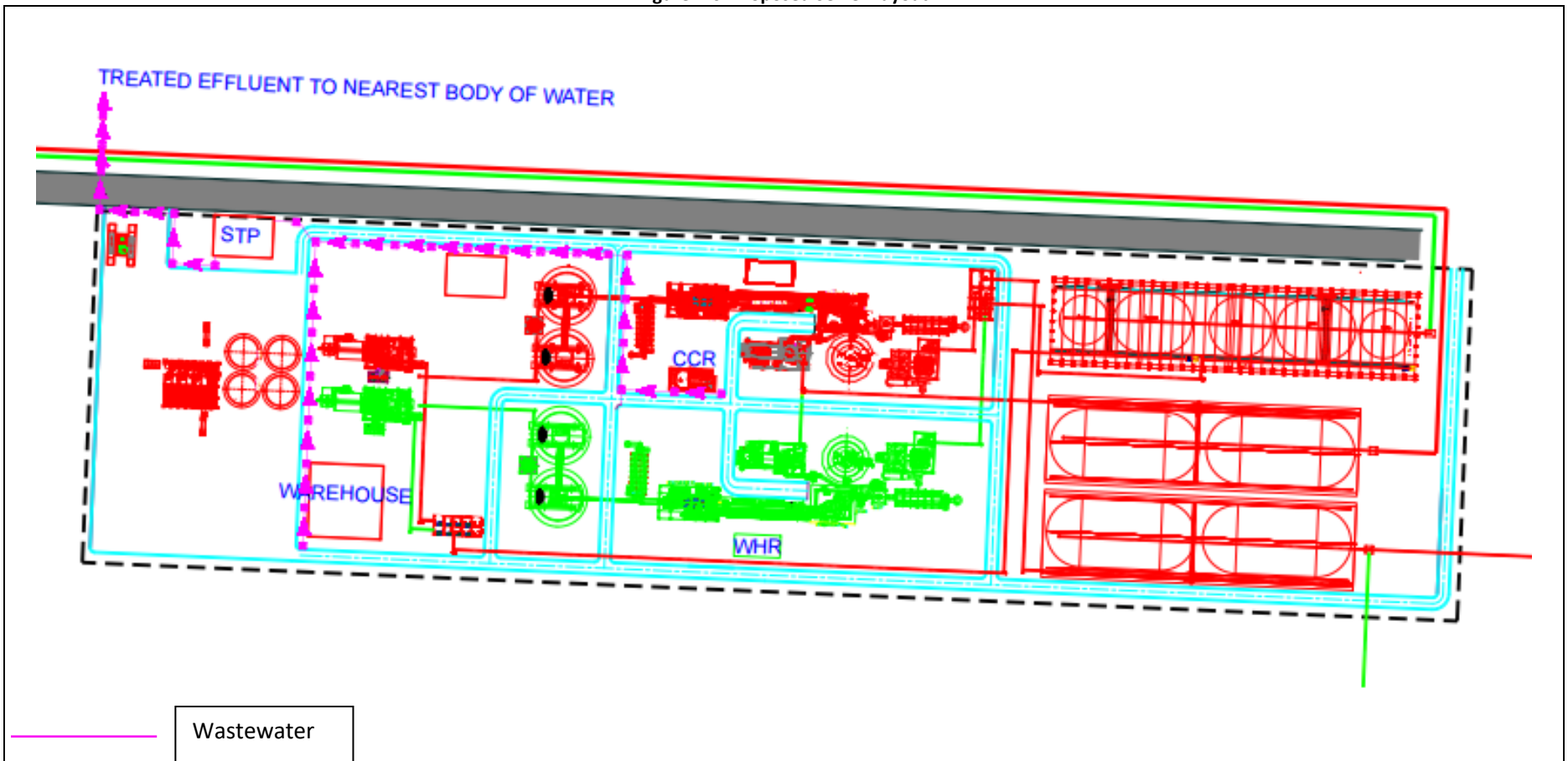


FIGURE NO.:	FIGURE TITLE:
1-7	**PROPOSED SEWER LAYOUT**

PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
ASTURIAS INDUSTRIES INC	**3.0 MMTPY CEMENT PLANT COMPLEX WITH QUARRY** Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas	**LCI ENVI CORPORATION**

Figure 1-7: Proposed Stormwater Drainage Plan

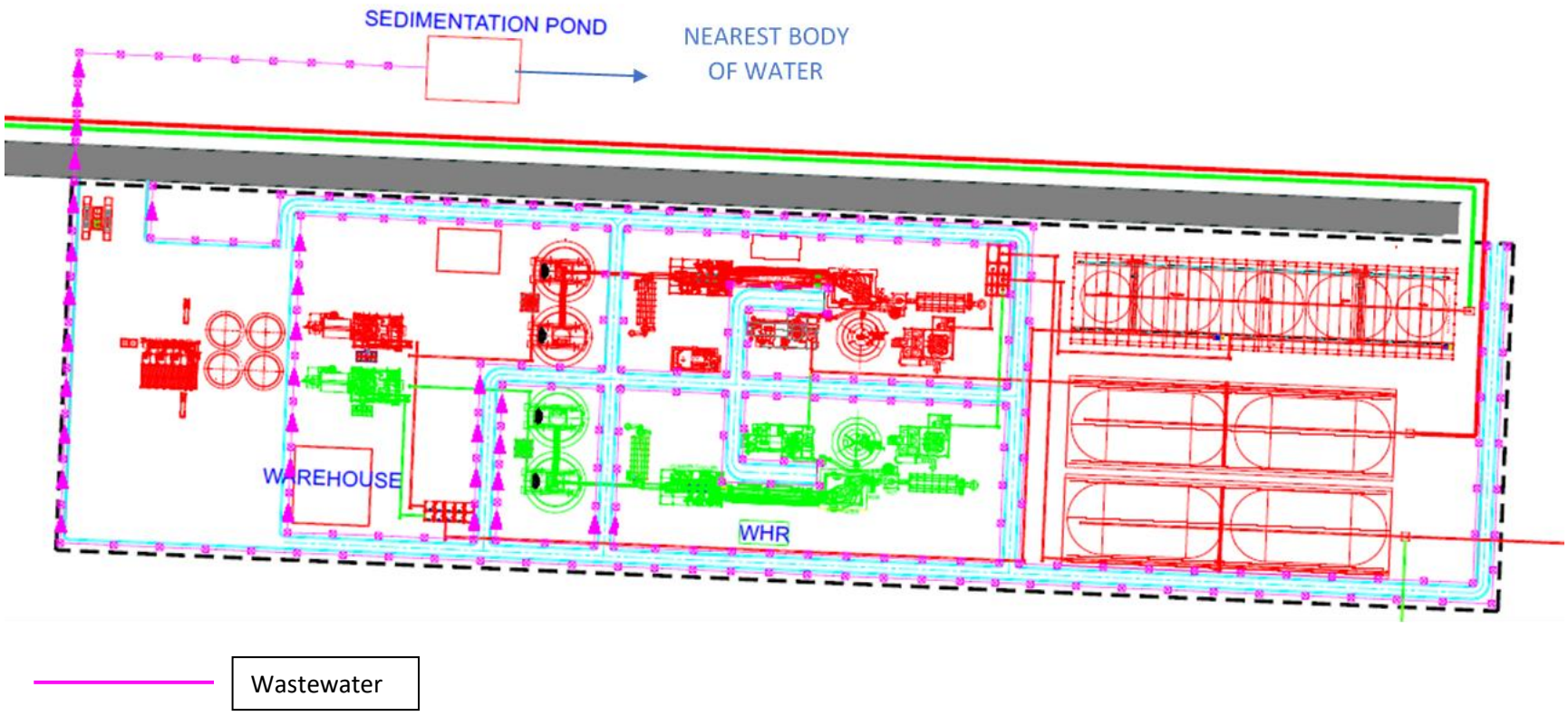


FIGURE NO.:	FIGURE TITLE:
1-8	**PROPOSED STORMWATE DRAINAGE LAYOUT**

PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
ASTURIAS INDUSTRIES INC	**3.0 MMTPY CEMENT PLANT COMPLEX WITH QUARRY** Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas	**LCI ENVI CORPORATION**

1.5 Process/Technology

51 The amount of raw materials that the cement plant will be utilizing to produce 1.5 MMTPY of clinker is summarized in **Table 1-6.** The process flow sheet for the cement plant production showing the material balance is presented on **Figure 1-8.**

Table 1-6: Raw Material Requirements of the Cement Plant

Minerals	Mineral Requirement (MTPY)
Limestone	2,333,192
Silica	267,646
Shale	399,162
Gypsum	101,250
Pozzolan	101,250

1.5.1 Quarry Operation

1.5.1.1 Shale and Limestone Excavation

52 The excavation of shale and limestone will be done using Air Trac Drill to a desired depth and applying the mining technique called 'benching'. With this method, the overburden, the soil and rocks that are covering the limestone and shale deposits, will be removed by creating a series of step levels or 'staircases', one top of each other. After the quarry has progressed, the mine site will resemble a terraced surface. This procedure reduces the risks of sudden landslides and uncontrolled erosions. The overburden shall be stored in Plant's holding facility, which then will be returned to the mined surfaces after the deposits have been gathered.

53 The excavated limestones will be transferred to the loading area by a bulldozer. Using a shovel or backhoe, these boulders will be loaded to dump trucks and hauled to the crushers.

54 The diagram of the benching method is shown in **Figure 1-9**.

1.5.1.2 Explosives Blasting

55 Explosives blasting will be carried out for ore sites that are too difficult to extract by conventional drilling and excavation methods. The explosive force breaks large boulders into smaller and more manageable sizes that can be transported by trucks. This method hastens the ore extraction process, and also decreases the wear and tear on major quarrying equipment.

56 However, this method of ore extraction will be done in an exceptionally calculated, secured, and carefully-handled procedure. To prepare a mine site for blasting, holes will be drilled in the soil, evenly-spaced, where the explosives will be placed in. After the explosives are settled, electrical detonators will be placed, and wired to the main control switch. Prior to the blasting, all systems shall be double-checked. When an alarm is already ensued, all personnel near the blast zone must already be evacuated. A duly-trained blasting operator, with direct supervision, shall induce an electrical current to detonate the explosives. The explosion will take place in a brief moment. The exposed overburden and ore will be hauled into the main production facility.

1.5.1.3 Limestone Crushing and Conveying

57 From the quarry site, the extracted limestone will be transported to the crushing system of the plant. The mined limestone is dumped in the receiving hoppers through open trucks; one for low grade limestone and a one for high grade limestone. Using apron feeders, limestone will be fed to the crushers. The limestone will undergo two stages of crushing. Both of the crushing stages will be using single rotor hammer crushers.

Figure 1-8: Material Balance of Cement Plant (1.5 MMTPY Clinker)

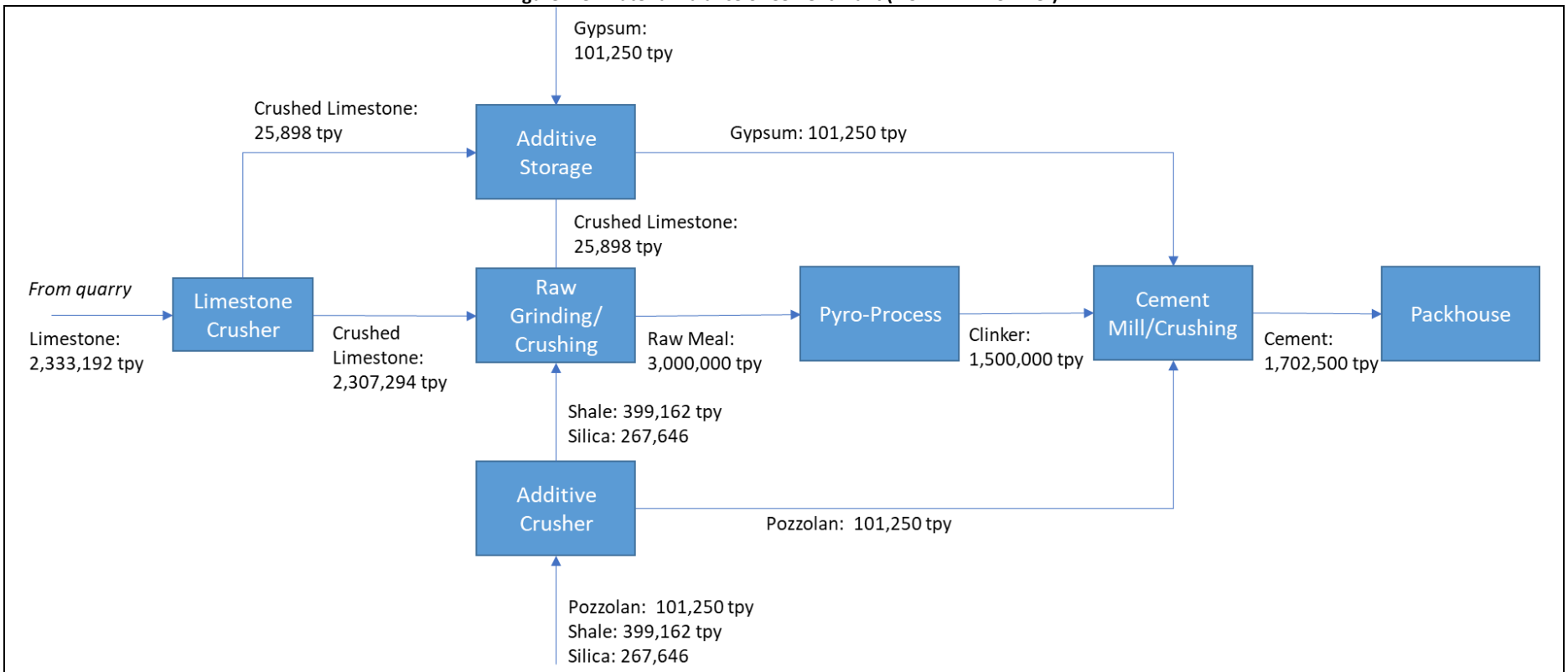


FIGURE NO.:	FIGURE TITLE:
1-8	**MATERIAL BALANCE OF CEMENT PLANT (1.5 MMTPY CLINKER)**

PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
ASTURIAS INDUSTRIES INC	**3.0 MMTPY CEMENT PLANT COMPLEX WITH QUARRY** Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas	**LCI ENVI CORPORATION**

Figure 1-9: Diagram of Benching Method in Quarrying

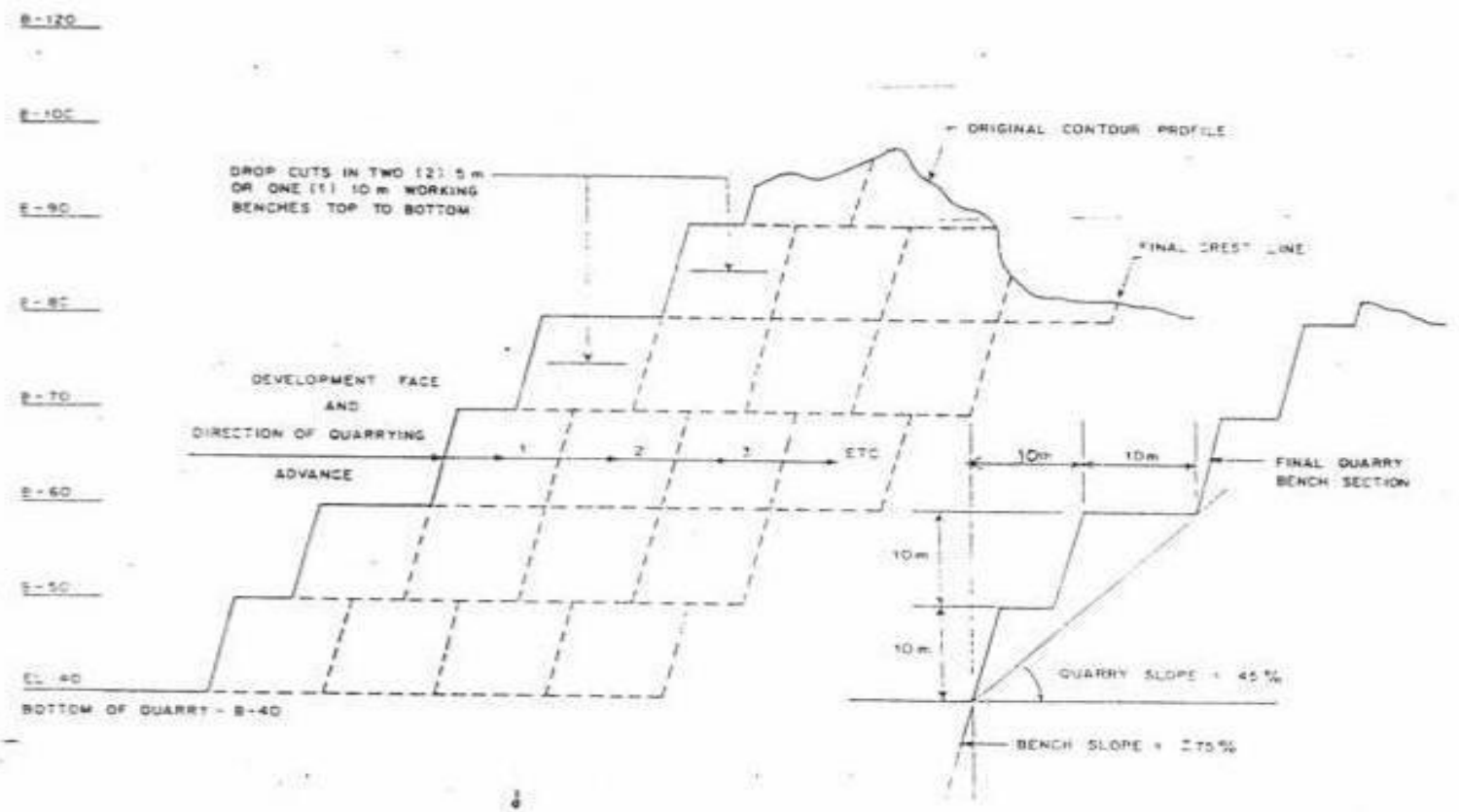


FIGURE NO.:	FIGURE TITLE:	
1-9	**Diagram of Benching Method in Quarrying**	
PROJECT PROPONENT: **ASTURIAS INDUSTRIES, INC.**	NAME OF PROJECT: **Asturias Industries 3.0 MMTPY Cement Plant Complex Project with Quarry and Pier Facility** *Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas*	EIA PREPARER: **LCI ENVI CORPORATION**

1.5.2 Cement Plant Operation

1.5.2.1 Raw Meal Grinding

58 Limestone and other raw materials will be reduced in size (25 mm sieve size 90%) to approximately less than 10% residue on 88-micron sieve. Vertical roller mill will be used for the raw meal grinding. The mill feed belt conveyor transfers the material into a pneumatic actuated diverter chute, which passes the material either to a collector bin for the removal of tramp metals or to the mill via an appropriate heavy-duty airlock valve.

59 The raw meal product is transported by means of air slides and bucket elevator to the raw meal homogenizing silo. On the raw mill output, before the raw meal elevator, a continuous sampling device is installed to allow checking of the product quality in the laboratory.

1.5.2.2 Raw Meal Homogenization

60 The raw materials will pass through a series of conveyors and reclaimers that will proportion the materials through speed regulation. Once the desired material proportion had been attained, the raw materials are ground to produce raw material mix. In the raw mill, kiln gases will be used to dry the raw mix. The raw mix is then pneumatically conveyed into a large concrete homogenizing silo for thorough blending. The capacity of the homogenizing silo is about 22,000 tons.

1.5.2.3 Pre-heat Exhaust Gas Treatment

61 Kiln gas from pre-heater top stage is sucked through down comer by kiln pre-heater fan. After it passes the pre-heater fan, the gas is passes through the raw mill or mill bypass. It then passes to the main bag filter, filter fan, and to main stack. Portion of the kiln gases passes from pre-heater fan to coal mill. The pre-heater fan is equipped with hydrodynamic coupling as variable speed device in order to save power energy. Kiln vent gas is used during compound operation (when raw mill is turned on) for drying of raw material in the raw mill. Depending on the required drying conditions for the raw material, the hot gases flowing to mill will be controlled while portion of the gases are bypassed.

1.5.2.4 Kiln Feeding System and Pre-heater Tower

62 The kiln feeding system consists of a string of five staged pre-heater cyclones fitted with a pre-calciner which is fired with ground coal. Co-processing of alternative fuels such as used oil or sludge on the kiln is being planned.

63 The raw meal is fed into the pre-heater via a bucket elevator. The gas entering the pre-heater passes thru the gas inlet of cyclone 1# or cyclone 2#, which is controlled by an air slide and rotary valve. Under each rotary valve, slide gates are installed in order to protect them against overheating. Material ducts between the pre-heater stages are equipped with pendulum flaps and splash box. The raw meal enters into the pre-calciner from stage 4. Tertiary air is fed into the sides of the pre-calciner. The pre-calciner ensures a complete combustion of the pulverized coal. The tertiary air comes from the kiln hood. The air quantity is adjusted by the damper installed in the TAD (Tertiary Air Duct). A staircase and a service/good lift for passengers and maintenance (handling of bricks and spare part) are included in the pre-heater structure.

1.5.2.5 Kiln & Clinker Cooling

64 The raw mix is then fed to the rotary kiln which is 87 meters in length and 5.8 meters in diameter. Inside the kiln, the raw mix is calcined to produce clinker. The clinker is cooled by air quenching in the grate cooler and is then stored before final grinding.

1.5.2.6 Clinker Transport & Storage

65 An inclined deep pan conveyor will be installed under the clinker cooler crusher discharge, for transporting of the clinker to the clinker silo.

66 This deep pan conveyor will feed a distribution box, which feeds the clinker either to the clinker silo or to off-spec clinker bin via another pan conveyor. The off-spec bin will discharge onto trucks for clinker bulk discharging, or transport to cement feed bin.

Longitudinal storage with 50,000 MT capacity and with mechanical reclaimer
Photo Source: supplier brochure

67 The clinker silo will have three extraction galleries underneath which will transfer the clinker thru a belt conveyor system to the cement mill clinker bin. All transfer points at this area will still be properly de-dusted by strategically designed bag filters.

1.5.2.7 Cement Proportioning Station

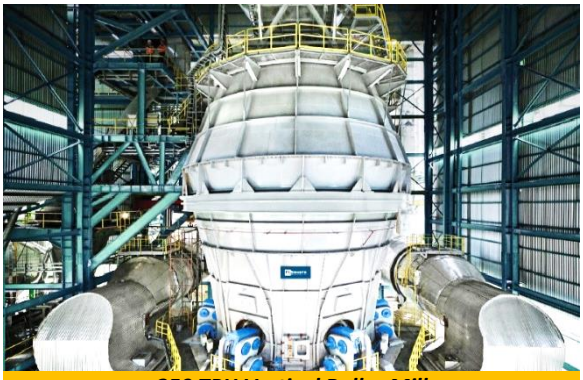
68 Four bins will be installed to be used as storages for the following: clinker, limestone, pozzolan, and gypsum. Each bin will have a weight belt feeder to measure quantities of materials being fed to the cement grinding system. Materials shall be discharged by proportion and conveyed to the cement grinding system by a belt conveyor.

Typical cement weigh feeder
(Photo source: supplier brochure)

69 The new bins will be mounted on load cells for exact determination of the filling level. Dust filter will de-dust the top area of the bins and the discharge area. A self-cleaning metal separator (belt magnet) and Metal detector will be installed over the collecting belt.

1.5.2.8 Cement Grinding

70 The materials will be ground in a vertical roller mill. They will be pulverized as they are crushed in between the four rollers pressing on a rotating table. Hot air is injected from underneath the nozzle ring outside the periphery of the rotating table. This jet of hot air dries the materials and the fine particles are entrained by the gases exiting thru a rotating classifier at the upper portion of the mill body. There is internal recirculation of the particles that could not pass thru the internal classifier. The coarse particles are rejected out of the mill and are re-circulated into the mill for re-grinding. The finer particles pass thru the classifier and are carried by the exit gases that will pass thru a bag filter where the finished cement will be separated by the bags and collected at the bottom of the bag filter and subsequently conveyed into the cement silos. There is internal recirculation of the particles that could not pass thru the internal classifier.



250 TPH Vertical Roller Mill
Photo source: supplier brochure

1.5.2.9 Cement Storage and Dispatch

71 Cement in the four cement silos are extracted at the bottom by sets of air slides and is conveyed to the bins of the rotary packing machines. Each of the three roto-packers has eight spouts which fill the bags as the machine rotates. The filled bags containing 40 kilograms of cement are conveyed to trucks on where they will be loaded manually.

72 Cement may also be dispatched in bulk to bulk carriers from a separate bulk cement bin thru expandable bellows. Cement may also be dispatched in jumbo bags with 1,000 kilograms net content. The jumbo bag loading facility will be located under the cement silo. Loading of cement into bulk carriers is controlled by the weight of cement already loaded into the bulk carrier.

90 TPH Roto packers
Photo source: supplier brochure

Figure 1-10: Process Diagram of Cement Production

FIGURE NO.:	FIGURE TITLE:	
1-10	**PROCESS DIAGRAM OF CEMENT PRODUCTION**	
PROJECT PROPONENT: **ASTURIAS INDUSTRIES INC**	PROJECT TITLE & LOCATION: **3.0 MMTPY CEMENT PLANT COMPLEX WITH QUARRY** Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas	REPORT PREPARER: **LCI ENVI CORPORATION**

1.6 Project Utilities

1.6.1 Water Supply and Demand

73 The construction of the cement plant complex will require about 400 m^3/day of water. Water for domestic usage of the workers is estimated to be 50 m^3/day which will be sourced from deep wells. The water needed for construction activities i.e., for concrete mixing and cleaning of equipment is approximately 50 m^3/day and will also be supplied by deep wells. To suppress the dust generation during the construction, regular water spraying will be done on-site. This will require at most 300 m^3 of water day, considering the area of the project site, and will be sourced from the coastal water.

Table 1-7: Water Requirement for the Construction of the Proposed Project

Water Use	Water Requirement (m^3/day)	Water Source	Wastewater Generation (m^3/day)
Domestic	50	Deep Well	~ 40
Concrete mixing and cleaning of equipment	50	Deep Well	-
Dust Suppression	300	Coastal Water	-
Total	400		40

74 The operation of the proposed project will be sourcing its water requirement from deepwells and the coastal water. The water balance of the operation of proposed project is presented in **Figure 1-11.** The water from the deep wells will undego water treatment prior to the usage.

75 The cement production will require 200 m^3/day of water and 145 m^3/day for the domestic water which will be supplied by the deep wells. Water for the cement production will be for the dust suppression in the crusher and spray water for the pre-heater gases conditioning tower. Domestic wastewater will be treated in a sewerage treatment plant prior to discharge to the nearby coastal water.

76 For the quarry operation, water is needed for the constant watering of the quarry road to lessen the dust emissions. During dry months, 3 watering sessions will be conducted per month which is equivalent to at least 60 m^3 per day while wet season will only require about 20 m^3/day. This will be sourced from the nearby coastal water.

77 Surface run-off from the quarry and the cement plant will be directed into siltation ponds to allow suspended solids to settle. The desilted water from these ponds will be re-used for road cleaning and watering of plants. In case of overflow (i.e, during heavy rainfall), the siltation ponds will discharge to the nearby coastal water.

78 The operation of the waste heat recovery system will initially require about 1,650 m^3/hr of recirculating cooling water for each unit. A make-up water of estimated 25 m^3/day, sourced from the deep wells, will be used to replace the water used during the boiler blowdown.

79 The steam-water cycle of the WHR is a closed-loop system however, a secondary cooling of the condenser cooling water will be observed using sea water thru a one pass shell & tube heat exchanger. The estimated volume of the secondary cooling water is 100 m^3/min for each unit. The secondary cooling water used will be discharged in an open concreted canal with ripples to cool down its temperature and meet the required standard prior to discharge to the nearby coastal water. The proposed location of the water intake and outfall for the secondary cooling in the WHR are shown in **Figure 1-12**.

80 The volume of sea water to be used for secondary cooling is estimated using a 5 degree Celsius rise in temperature as it absorbs heat from the condenser. The ripples in the long open canal discharge (returning the sea water to the coast) have been proven to reduce the temperature of water as it flows through the open canal. Expected temperature reduction can be as large as 5 degrees, depending on ambient temperature and relative humidity. In a worse-case scenario that the ripples would still be inadequate to reduce returning sea water temperature, fountains can be installed along the canal to spray water into the air and thereby create cooling effect.

1.6.2 Power Supply and Demand

81 The power of the proposed project will be sourced from the Batangas Electric Cooperative (BATELCO). The estimated power requirement of the project is about 35 MW per line.

Table 1-8: Estimated Power Consumption of Equipment per Line

Department	Power (kW)
Raw Mill	5,101.40
Raw Mill 2 Dept.	5,101.40
Raw Meal Blending and Kiln Feed Dept.	724.72

Department	Power (kW)
Spray Tower & Bag Filter Dept.	1,907.56
Coal Mill Dept.	2,337.49
Coal Dosing Dept.	533.20
Kiln Dept.	4,027.00
Clinker Cooler Dept.	3,902.00
Finish Mill 4	8,383.66
Silo 4 (Loading and Unloading)	652.80
Compressor	750.00
Water Pump	372.00
Packhouse Dept.	525.48
Total Power	**34,318.71**

Figure 1-11: Water Balance of the Operation of the Proposed Project

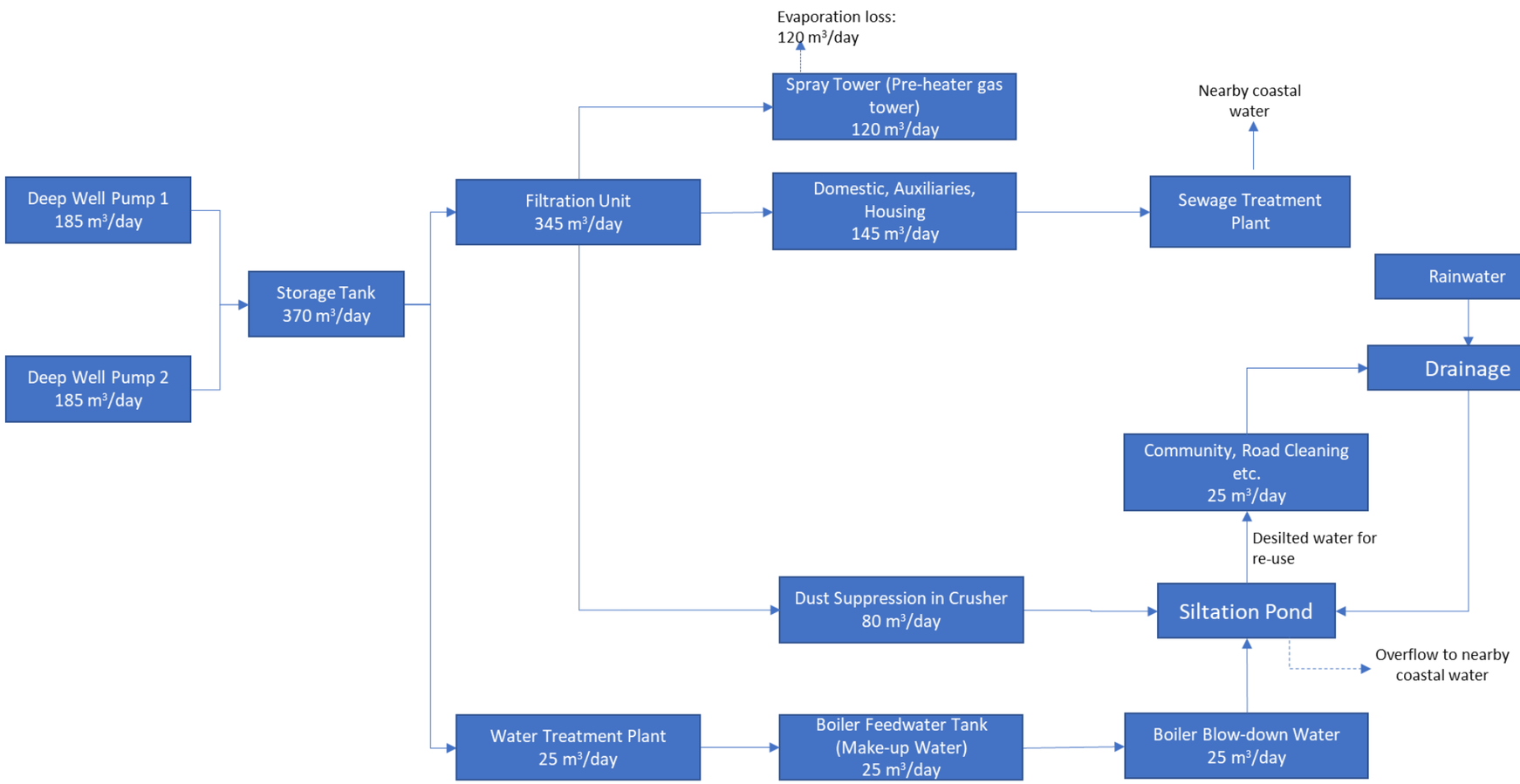


FIGURE NO.:	FIGURE TITLE:
1-11	**WATER BALANCE OF THE OPERATION OF THE PROPOSED PROJECT**

PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
ASTURIAS INDUSTRIES INC	**3.0 MMTPY CEMENT PLANT COMPLEX WITH QUARRY** Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas	**LCI ENVI CORPORATION**

Figure 1-11: Water Balance of the Operation of the Proposed Project (Continuation)

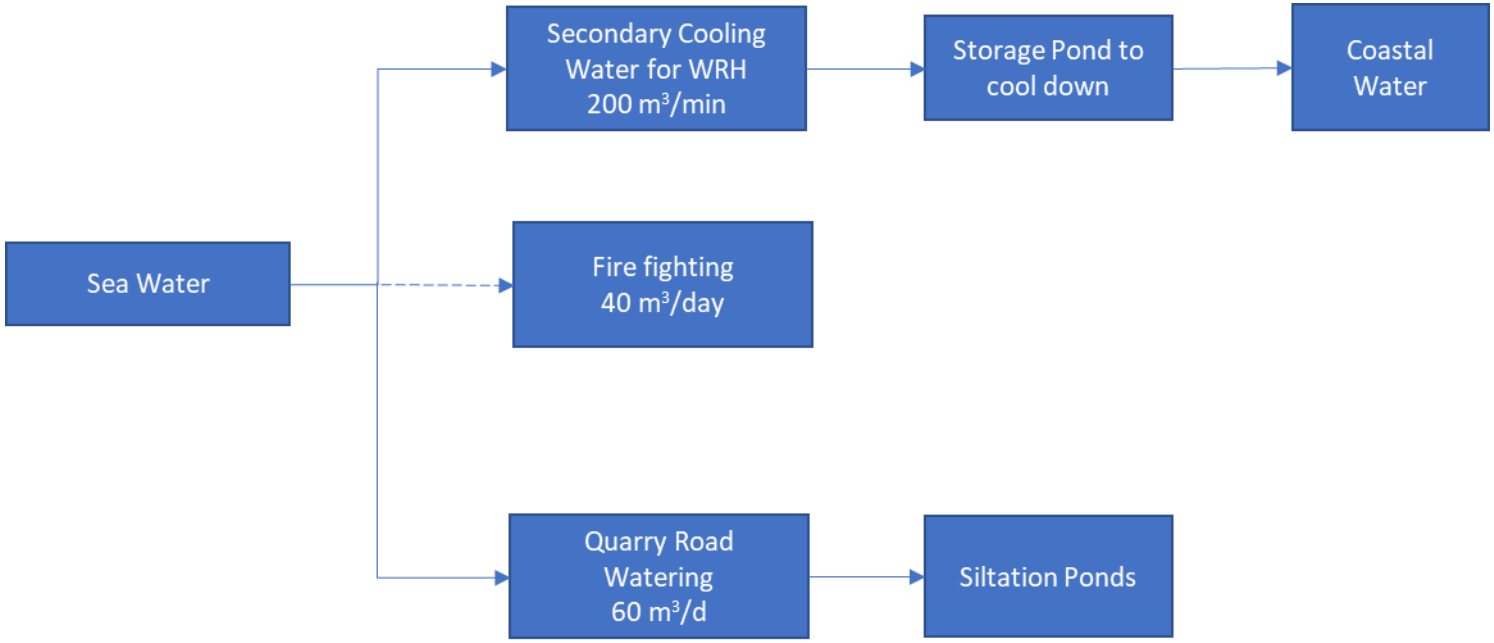
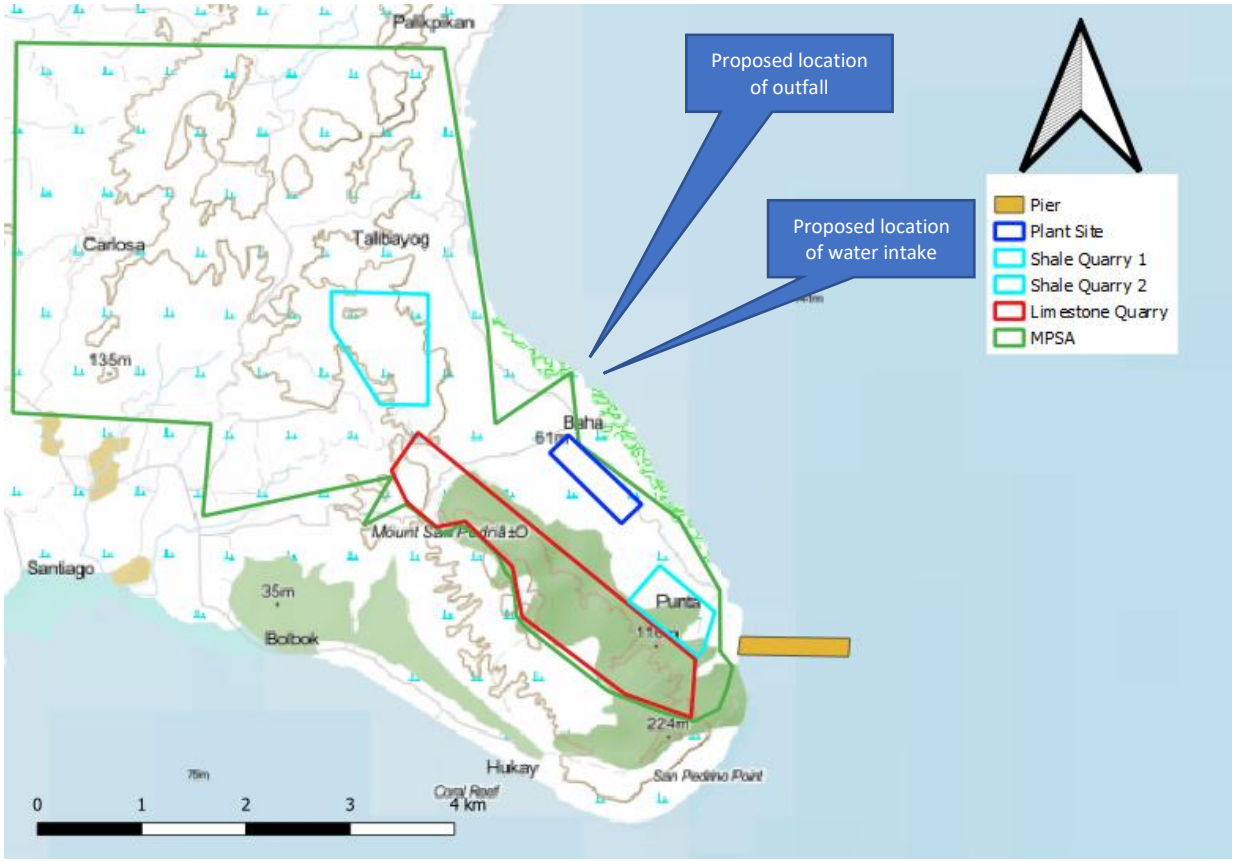


FIGURE NO.:	FIGURE TITLE:
1-11	**WATER BALANCE OF THE OPERATION OF THE PROPOSED PROJECT**

PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
ASTURIAS INDUSTRIES INC	**3.0 MMTPY CEMENT PLANT COMPLEX WITH QUARRY** Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas	**LCI ENVI CORPORATION**

Figure 1-12: Proposed Location of the Water Intake and Outfall for the WHR



Note: Actual distance between outfall and intake points to be determined later depending on the depths and wave directions usually prevailing in site

FIGURE NO.:	FIGURE TITLE:
1-12	**PROPOSED LOCATION OF THE WATER INTAKE AND OUTFALL FOR THE WHR**

PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
ASTURIAS INDUSTRIES INC	**3.0 MMTPY CEMENT PLANT COMPLEX WITH QUARRY** Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas	**LCI ENVI CORPORATION**

1.7 Project Size

1.7.1 Cement Production

82 The proposed Asturias Cement Plant Complex will have a total capacity of 3.0 MMTPY of clinker. The proposed facility will be constructed inside the 22-hectare property in Barangays Baha and Talibayog, Municipality of Calatagan, Batangas.

1.7.2 Allowable Quarry Area

83 The quarry of the project is within the property with Mineral Production Sharing Agreement (MPSA) No. of 071-97-IV with aggregate area of 2,337 hectares. However, only about 272 hectares will be used for the cement production.

84 The primary minerals that will be extracted from the quarry area are limestone and shale. A total of ~864 million MT of limestone and ~544 million MT of shale are available in the area based on the exploration conducted within the MPSA.

85 No quarrying activities will be done during the Phase 1(2022-2024) of the project since only cement grinding facility will be operated during this phase. Starting Phase 2 (2024-2027), full cement plant Line 1 with 1.5 MMTPY clinker capacity will be operated.

86 For the production of 1.5 MMTPY of clinker, about ~2.3 million MT and ~0.4 million MT of limestone and shale will be extracted per year, respectively. Starting 2027, another cement production line with the same capacity will be operated making the total annual production capacity of the proposed project to 3.0 MMTPY. The amount of limestone and shale that will be extracted for the overall capacity of the proposed project will be increased to ~4.8 MT/yr and ~0.88 MT/yr, respectively.

87 **Table 1-9** shows the amount of minerals to be extracted per year. Sample mining plan is presented in **Figure 1-13.**

Table 1-9: Total Available and Extracted Mineral Reserves for the Proposed Project

Mineral	Total Amount of Reserves Available (MT)	Total Amount of Reserves to be Extracted (MT/yr)	
		Year 1 to 3	Year 4 to Year 15
Limestone	863,905,700	2,333,192	4,800,000
Shale	543,863,600	399,162	880,000

Figure 1-13: Final Mining Plan (Year 1 to Year 15)

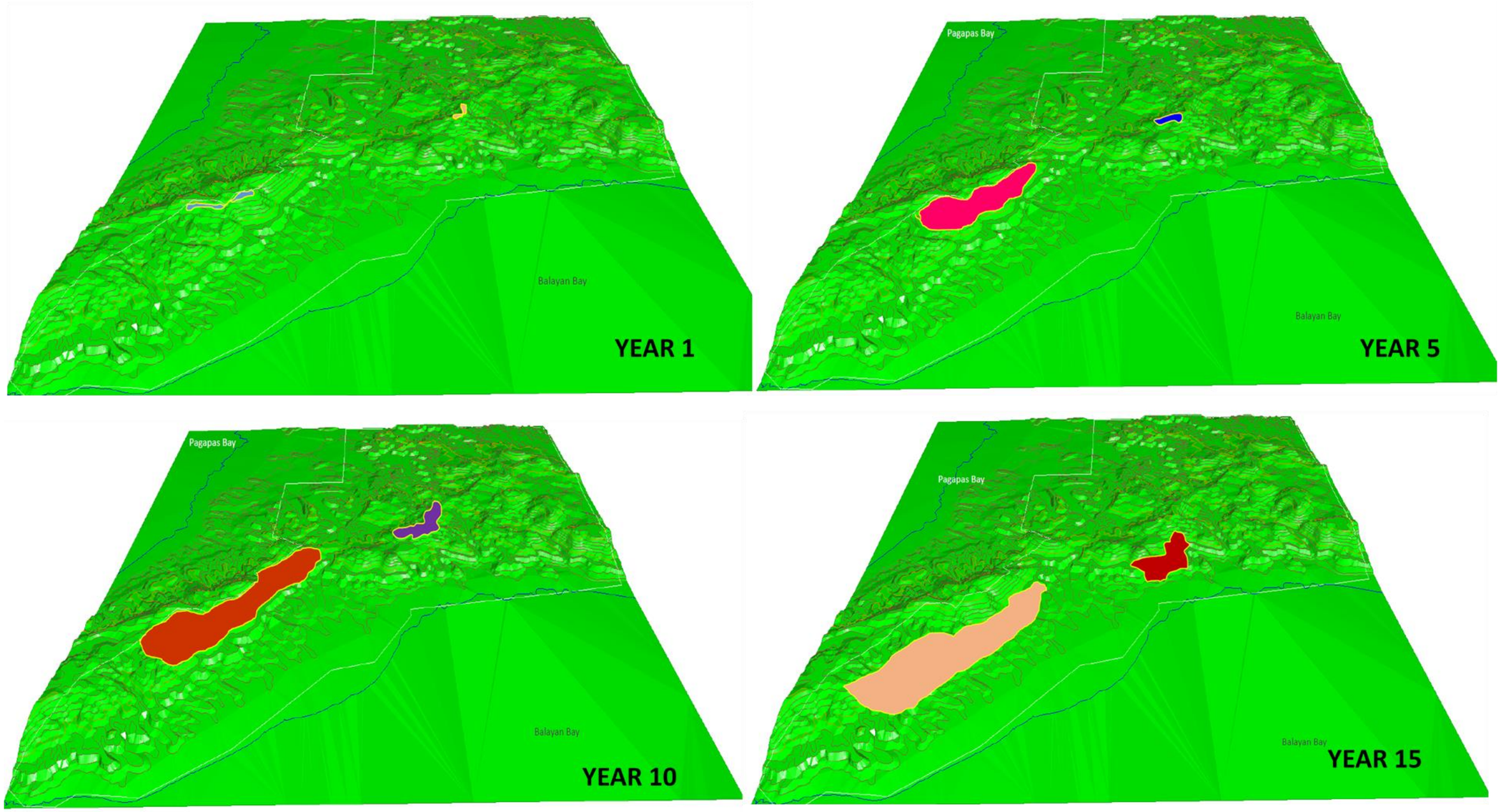


FIGURE NO.:	FIGURE TITLE:
1-13	**FINAL MINING PLAN (YEAR 1 TO YEAR 15)**

PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
ASTURIAS INDUSTRIES INC	**3.0 MMTPY CEMENT PLANT COMPLEX WITH QUARRY** Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas	**LCI ENVI CORPORATION**

1.8 Development Plan, Description of Project Phases and Corresponding Timeframes

1.8.1 Pre-Construction

88 Site preparation and clearing will be done prior to the construction phase. Initial development of the area includes the enhancement of road networks for increased accessibility and easier transport of materials and supplies. This phase of the proposed project will also involve the acquisition of the necessary documents before actual construction, such as Environmental Compliance Certificate (ECC), Building Permits, and Permit-to-Operate (PTO) Application. Exploration activities and mining plans will also be done bythe proponent.

89 Asturias targets to accomplish the pre-construction activities by the end of the 3rd quarter of the 2019.

1.8.2 Construction

90 Immediately thereafter, the development of the area shall follow. This involves construction/installation of the cement plant facilities and other support facilities. The equipment to be used would be purchased and assembled on site. Proper occupational safety and health procedures would be implemented to ensure the welfare of the workers.

91 The construction of the cement plant will be done in three phases.

- Phase 1 which includes the construction of Line 1 cement grinding facility, including the support facilities is expected to be completed by the end of the 2nd quarter of 2021.
- Phase 2, the construction of the 1.5 MMTPY Line 1 clinker production plant facility is to be completed by 4th quarter of 2023.
- Phase 3, the construction of the 1.5 MMTPY Line 2 cement production plant facility will end by 3rd quarter of 2026.

92 **Table 1-10** discusses the environmental impacts related to the construction of the cement plant complex. It also includes the corresponding mitigating measures/controls of each identified environmental impact. These are reflected and further detailed in **Section 3**.

Table 1-10: Aspects of Construction with corresponding Environmental Aspects, Impacts, and Mitigating Measures

Aspects of Construction	Environmental Aspect	Environmental Impact	Mitigating Measures/Controls
Civil and Structural Works - Laying of foundation for equipment and building - Concreting - Installation of steel members of building (e.g. columns,	Generation of solid wastes during construction	Accumulation of construction debris and other solid waste	• Implementation of the solid waste management program by the contractor • Regular transport of construction debris and other solid waste in the approved designated area by the DENR
	Generation of hazardous wastes during construction	Accumulation of hazardous wastes on-site	• Collect, store and dispose hazardous wastes in accordance to RA 6969 • Treatment and dispose of hazardous wastes through DENR-accredited waste treaters

Aspects of Construction	Environmental Aspect	Environmental Impact	Mitigating Measures/Controls
beams, platforms)	Generation of liquid waste	Ground and coastal water contamination from improper disposal of wastes, percolated wastewater, sludge and fecal matter.	• Provision of sanitation facilities for workers (e.g. toilets, showers, etc.)
		Possible siltation and surface runoff	• Establishment of sediment traps, erosion barriers, and silt curtains • Regular removal of silt and sediments
	Use of heavy equipment	Coastal and groundwater contamination due to accidental oil spills/leaks	• Use sawdust, rice hulls, or coir dusts to absorb the oil spills • Maintain canal in the maintenance and repair area of vehicles and equipment
		Water shortage since considerable amount of water is required for concrete mixing and watering of areas. Clean water is also needed for the daily consumption of the construction workers.	• Water shortage is not expected in the area.
		Generation of air emissions and noise due to operation of vehicles, machines and equipment	• Regular maintenance of heavy equipment • Perform noisy activities during daytime • Establish and maintain green zone to serve as natural noise barrier.
		Ground vibration due to operation of heavy equipment and vehicles	• Apply non-vibration techniques during construction, if possible • Notify nearby residents about use of heavy equipment • For hauling trucks, comply with road weight limit standards to avoid ground vibration
		Occupational health and safety	• Proper training on construction safety • Provision of PPE • Proper supervision by trained professionals during construction activities • Implementation of Occupational Health and Safety Policy • First-aid stations, safety equipment and signage shall be made available on working areas
	Generation of traffic	Delivery trucks may cause traffic congestion in the area.	• Provide early warning devices/road signs • Provide parking spaces within project site

Aspects of Construction	Environmental Aspect	Environmental Impact	Mitigating Measures/Controls
	In-migration	Employment opportunities	Priority in hiring should be given to residents of host communities
		Increased crime rate	Coordination with the barangay regarding imposition of laws and apprehension of erring individuals/groups of people
Mechanical Works - Installation of equipment		Occupational health and safety	• Proper training on construction safety • Provision of PPE • Proper supervision by trained professionals during construction activities • Implementation of Occupational Health and Safety Policy • First-aid stations, safety equipment and signage shall be made available on working areas
Electrical Works - Cabling - Installation of power supply for the plant facilities		Occupational health and safety	• Proper training on construction safety • Provision of PPE • Proper supervision by trained professionals during construction activities • Implementation of Occupational Health and Safety Policy • First-aid stations, safety equipment and signage shall be made available on working areas
Commissioning Works - initial operation of plant for equipment testing (mechanical, electrical and process)		Occupational health and safety	• Proper training on construction safety • Provision of PPE • Proper supervision by trained professionals during construction activities • Implementation of Occupational Health and Safety Policy • First-aid stations, safety equipment and signage shall be made available on working areas

93 After the construction phase, all the temporary facilities will be decommissioned properly. The proponent will ensure that all wastes generated during the construction will be properly disposed.

1.8.3 Operations

94 The normal plant operation is 24 hours a day, seven (7) days a week for 300 days a year. The operation involves the following major activities: cement production and quarrying of raw materials.

- Commercial operation of Phase 1 is targeted to start by 1st quarter of 2022. This will include the operation of Line 1 cement grinding facility only with capacity to process 1.5 MMTPY of clinker to produce cement;

- Phase 2 will start its operation by 3rd quarter of 2024. At this phase, Line 1 of the full cement plant will operate. Operation of the quarry will also commence. Limestone and shale requirement for the 1.5 MMTPY clinker production will be quarried in the area;

- Phase 3, which consists of the Line 2 of full cement plant, will start its operation during the 2nd quarter of 2027. By then, the production capacity of the cement plant will be 3.0 MMTPY of clinker. Again, limestone and shale requirements for the production will be quarried within the MPSA.

95 The same strict observation of occupational health and safety during construction will be followed.

1.8.4 Abandonment

96 The proposed project is not expected to be abandoned within the next 10 to 13 years of its planned operations, based on the existing MPSA. However, according to past and present geological surveys, the site and its contingent areas have limestone reserves that could last to 100 years based on normal production capacities. However, abandonment of the Plant may be necessary, due to the following potential scenarios:

- Depletion of limestone reserves in the approved MPSA (most unlikely);
- Unsustainable business operations due to economic downturns;
- Changes in zoning and other related ordinances of the Municipality of Calatagan, Batangas;
- Transfer of operations to other sites;
- Accidents and emergencies, either natural or man-made, that resulted to severe facility damage and loss of human life; and
- Closure order from government agencies.

97 As such, if the abovementioned scenarios happen and result to the partial or total closure of the proposed Project, an Abandonment Plan (which will be submitted to the Mines and Geosciences Bureau as a Final Mine Rehabilitation/Decommissioning Plan) will be initiated by the Asturias.

Table 1-11: Indicative Timeline of Activities

Item	2018		2019				2020				2021				2022				2023				2024				2025				2026				2027	
	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q
1. Pre-feasibility study																																				
2. Acquisition of ECC and other necessary permits																																				
3. Detailed Engineering																																				
4. Construction (Civil Works)																																				
Phase 1																																				
Phase 2																																				
Phase 3																																				
5. Installation of equipment including pollution control devices																																				
Phase 1																																				
Phase 2																																				
Phase 3																																				
6. Mine Development Planning																																				
Phase 2																																				
Phase 3																																				
7. Start-up and Commissioning																																				
Phase 1																																				
Phase 2																																				
Phase 3																																				
8. Commercial Operation																																				
Phase 1																																				
Phase 2																																				
Phase 3																																				

Note: *Phase 1: Line 1 Cement Grinding Facility*
Phase 2: Line 1 Full Cement Plant and Quarry
Phase 3: Line 2 Full Cement Plant and Quarry

1.9 Manpower

98 **Table 1-12** summarizes the manpower requirements throughout the development phases of the proposed project. As shown, around 500 to 750 workers will be employed for the construction of all necessary project components and facilities, and an estimate of 250 to 300 personnel, inclusive of engineers and skilled workers, will be hired to run the cement plant and the quarry operation on a 24/7 operation.

Table 1-12: Manpower Requirement

PROJECT PHASE	ESTIMATED MANPOWER REQUIREMENTS	TASKS TO BE PERFORMED	SKILLS REQUIREMENTS
Pre-construction	10 to 20	• Complete the feasibility study, detailed engineering design, detailed drawings, permit requirement and tender documents	• Specialized technical skills/expertise on various engineering and scientific skills.
Construction (Phases 1 to 3)	500 to 750	• Civil works, architectural, and electro-mechanical works.	• Engineers • Project managers • Skilled and non-skilled laborers
Operation (Phases 1 to 3)	250 to 300	• Oversee the entire operations of the proposed Project, including emergency situations; Ensuring the safety and welfare of its personnel • Maintain conformity of the proposed Project to relevant government regulations, including tax payments, ECC compliance, etc. • Promote and uphold a harmonious relationship with the host community • Operation of the plant • Quarry operations • Technical expertise on essential departments of the plant • Administrative works • Health / medical staff • Security force	• Management and administrative skills • Overall knowledge on the operation including key environmental, labor, and local ordinances
Abandonment	25 to 50	• Implementation of the Abandonment plan	• As required

99 **Asturias Industries Inc** will prioritize hiring of locals whose skills and experience match the specific needs of the project. Adequate public information for jobs available to local residents in the affected areas shall be provided. The proponent will also provide the necessary training of locals for possible hiring as the need arises.

1.10 Project Cost

100 Indicative cost for the proposed project is estimated to be **P 12,000,000,000.00 (12 Billion Pesos)**. These will include the following:

- Detailed engineering studies and designs, including the feasibility study (FS) and acquisition of necessary government permits and licenses;
- Site preparation;
- Construction of project components and facilities;
- Procurement of necessary equipment and materials;
- Environmental management and protection, air pollution devices, and water treatment facilities; and
- Environmental monitoring activities.

SECTION 2

ASSESSMENT OF ENVIRONMENTAL IMPACTS

2.1 The Land

101 For the Land component of the EIA study, coverage includes the proposed site for the cement plant and the quarry areas as the direct impact area. The relevant baseline characterization and impact assessment are presented in the succeeding sub-sections: land use and classification; geology/geomorphology; pedology; and terrestrial ecology.

2.1.1 Land Use and Classification

102 As indicated in **Section 1.1**, the proposed project site lies within the political jurisdiction of Brgy. Baha and Brgy. Talibayog and the Municipal Government of Calatagan in the Province of Batangas in Region IVA (CALABARZON). The Municipality of Calatagan is divided into 4 urban and 21 rural barangays, as shown in **Figure 2-1**. The respective land area of region, province, municipality, and barangay that cover the proposed project site are presented in **Table 2-1**.

Table 2-1: Land Area of Region IVA, Province of Batangas, Calatagan, and Brgys. Baha and Talibayog

JURISDICTION	LAND AREA (HAS.)
Region IVA (CALABARZON)	**1,622,861**
Province of Batangas	**316,581**
Municipality of Calatagan	**10,757.99**
Barangay Baha	**519.88**
Barangay Talibayog	**395.86**
Sources: Municipality of Calatagan National Economic and Development Agency Region IVA	

103 The Municipality of Calatagan is located in the southwestern most part of the Province of Batangas. It is bounded by the municipalities of Balayan and Lian from the north, the Verde Island Passage from the south, on the east by Pagaspas bay and Balayan bay and on the west is the South China Sea.

104 The municipality is composed of 25 barangays. The Project Site is bounded by Barangay Luksuhin in the West, Balayan Bay in the East, Mt. Pintong Itim in Barangay Palikpikan in the North, and Barangay Hukay and Pagaspas Bay in the South.

2.1.1.1 Impact in terms of compatibility with existing land use

105 Majority of the land area in Calatagan is classified as Agricultural (63.23%) followed by as planned unit development (12.19%) and as industrial (8.57%). The current land use of Calatagan is presented in **Table 2-2.**

106 According to the latest general land use map of the Municipality of Calatagan (2017), the proposed project site is classified as an industrial area and as planned unit development (PUD). **Figure 2-2** shows the general land use map of the Municipality of Calatagan.

Table 2-2: Current Land Use of Calatagan (2017)

Land Uses	Area Coverage (has)	Percent
Residential	560.83	5.21%
Commercial	39.20	0.36%
Institutional	23.07	0.21%
Parks and Recreation	2.58	0.02%
Cemetery	9.17	0.09%
Socialized Housing	0.82	0.01%
Agricultural	6,802.41	63.23%
Tourism	308.77	2.87%
Infrastructure and Utilities	134.50	1.25%
Ecology Center (MRF)	0.54	0.01%
Sanitary Landfill	-	
Planned Unit Development (PUD)	1,311.46	12.19%
Industrial	922.09	8.57%
Mining/Quarry	70.04	0.65%
Mangrove Area	323.19	3.00%
Protected Mangrove Area	-	
Fishponds	249.32	2.32%
Buffer Area	-	
Easement	-	
Total	**10,757.99**	**100.00**

Source: Comprehensive Land Use Plan of Calatagan

2.1.1.2 Impact on compatibility with classification as an Environmentally Critical Area (ECA)

107 The proposed project site does not fall within any declared environmentally critical area (ECA), defined in the DENR Administrative Order No. (DAO) 2017-15 as *"an area that is environmentally sensitive and is so listed under Presidential Proclamation No. 2146, Series of 1981, as well as other areas which the President of the Philippines may proclaim as environmentally critical in accordance with Section 4 of Presidential Decree No. 1586."*

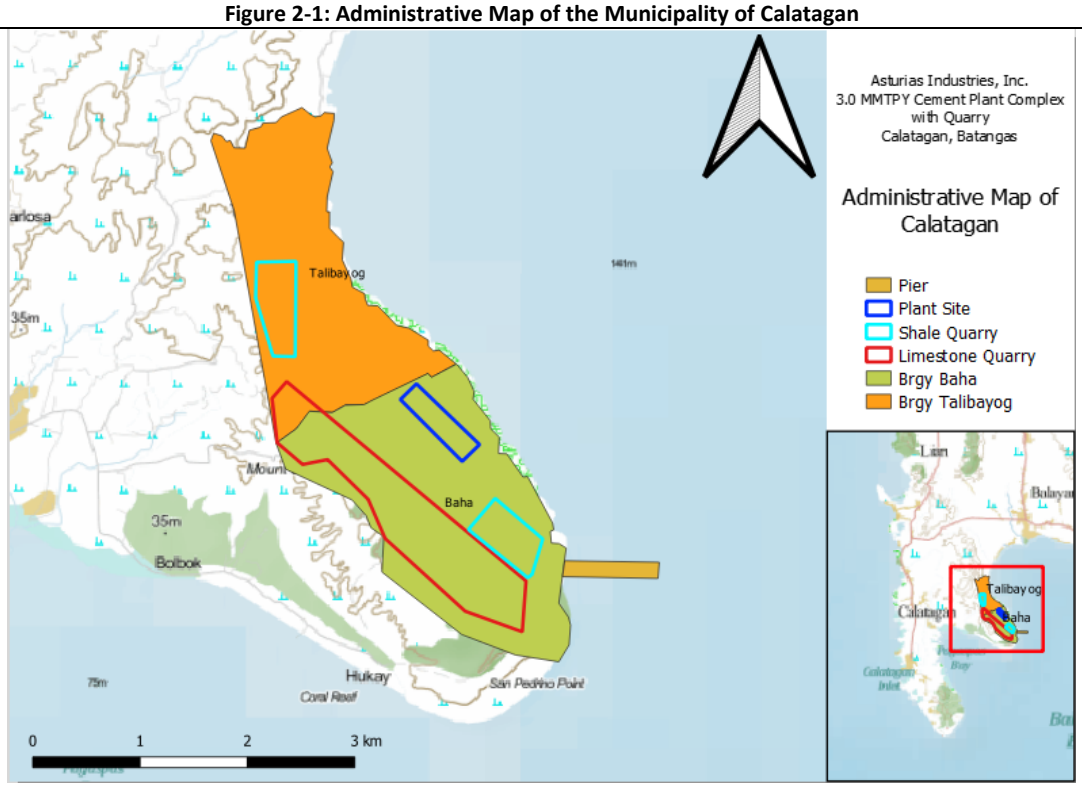
2.1.1.3 Impact in existing land tenure issue/s

108 The proposed project site is not covered by the Comprehensive Agrarian Reform Program (CARP). It is also not subject to a Certificate of Ancestral Domain Claim (CADC), Certificate of Ancestral Domain Title (CADT), Certificate of Ancestral Land Claim (CALC), Certificate of Ancestral Land Title (CALT), Integrated Forest Management Agreement (IFMA), Community-Based Forest Management Agreement (CBFMA), or any other tenurial instrument.

109 The present site was initially covered for distribution by the Comprehensive Agrarian Reform Program (CARP). However, it was later confirmed as 'mineralized area' by the Supreme Court of the Philippines virtually declaring the mistake committed by the Department of Agrarian Reform.

110 On July 28, 2005, the Supreme Court declared that Asturias Industries, Inc. is the true owner of the property. This decision became final and executory on November 8, 2005. The residents inside the project site were relocated with the financial assistance from Asturias. . The relocation started on the 6th of May 2016 and was completed last December 2017.

Figure 2-1: Administrative Map of the Municipality of Calatagan

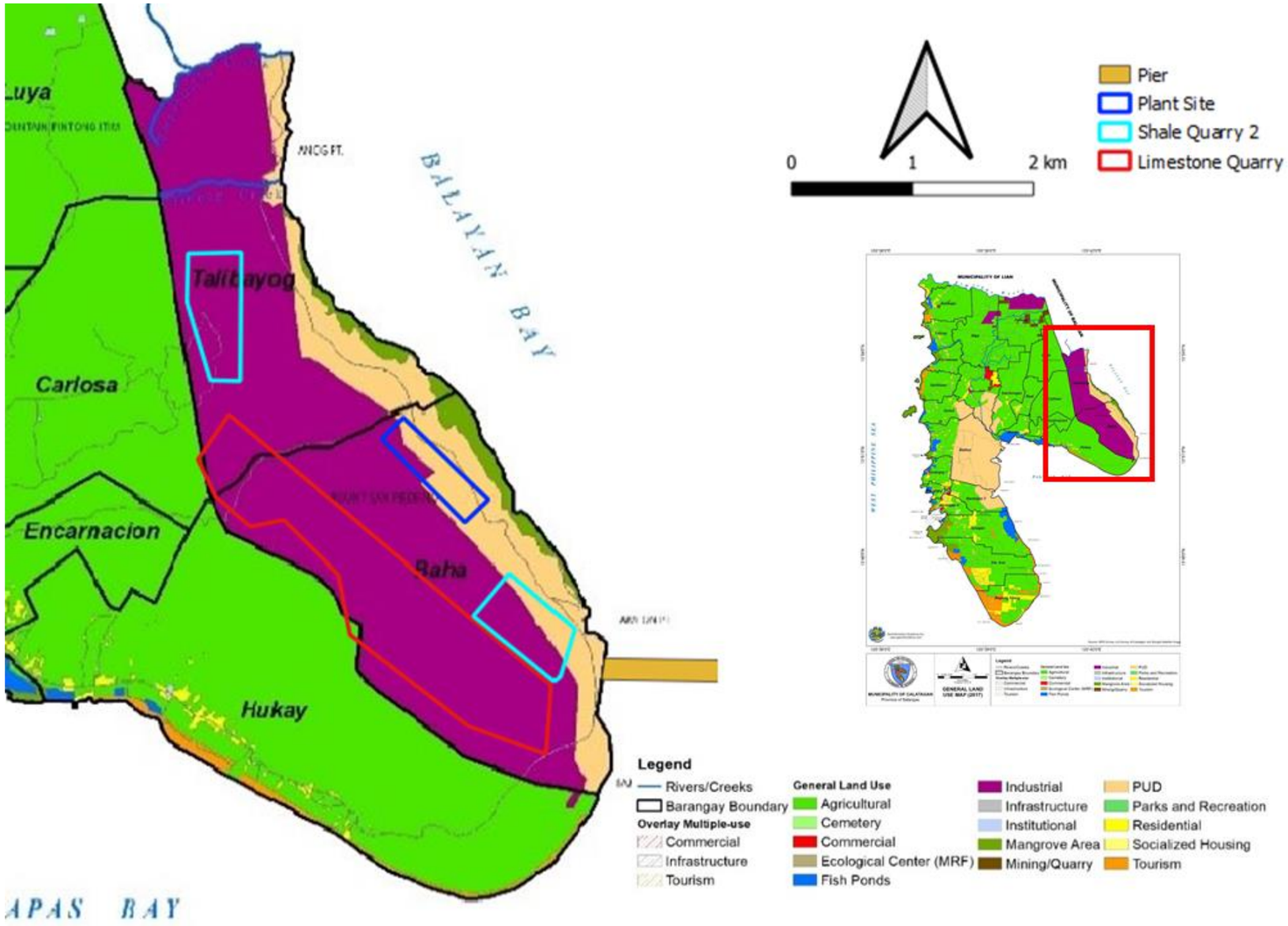


Source: Municipality of Calatagan

FIGURE NO.:	FIGURE TITLE:
2-1	**ADMINISTRATIVE MAP OF THE MUNICIPALITY OF CALATAGAN**

PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
ASTURIAS INDUSTRIES INC	**3.0 MMTPY CEMENT PLANT COMPLEX WITH QUARRY** Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas	**LCI ENVI CORPORATION**

Figure 2-2: Existing Land Use Map of the Municipality of Calatagan



Source: Comprehensive Land Use Plan of Calatagan (2017)

FIGURE NO.:	FIGURE TITLE:
2-2	**EXISTING LAND USE MAP OF THE MUNICIPALITY OF CALATAGAN**

PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
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2.1.1.4 Impairment of visual aesthetics

111 The slopes and landscape in the quarry areas are expected to be modified during the operation due to the extraction of soil. This modification will create an unaesthetic view of the natural surroundings. Considerations are made in the proposed project design to preserve and enhance the visual aesthetics in the project area.

2.1.1.5 Devaluation of land value as a result of improper solid waste management and other related impacts

112 Solid waste generation will be limited to construction debris during the construction phase and domestic wastes during the operational phase. Improper management of solid wastes may cause land pollution in the project site.

113 As a mitigation measure, a Solid Waste Management Plan will be strictly implemented based on the local disposal regulations and consistent with the Ecological Solid Waste Management Act of 2000 (Republic Act 9003). The proposed plan is discussed in Section 3 (Environmental Management Plan) of this document. Asturias will coordinate with the local government for the regular collection and disposal of the solid wastes.

2.1.2 Geology/Geomorphology

114 The general geologic setting shows the area to be composed of fine, marine tuffaceous silt and medium to well-indurated and medium to thickly bedded coralline limestone belonging to the Late Pliocene Calatagan Marl, also known as Calatagan Formation, as shown in **Figure 2-3**. It is equivalent to the Mapulo Limestone of Avila (1980). The formation may also be found in the peninsulas and islands south and east of Mabini, Batangas, as well as other areas of the province such as Taysan, Conde, Mataas and Mt. Banoy. The lithology varies from soft tuffaceous marine siltstone to medium to thickly bedded coralline limestone. It is massive, white to buff, soft and porous with abundant coral fingers. Corby and others (1951) assign it an age of Late Miocene to Early Pliocene. This marl conformably overlies the Early Pliocene Pinamucan Formation to the northwest. The Pinamucan Formation consists of interbedded sequence of well sorted but poorly indurated conglomerate, tuffaceous sandstone and shale.

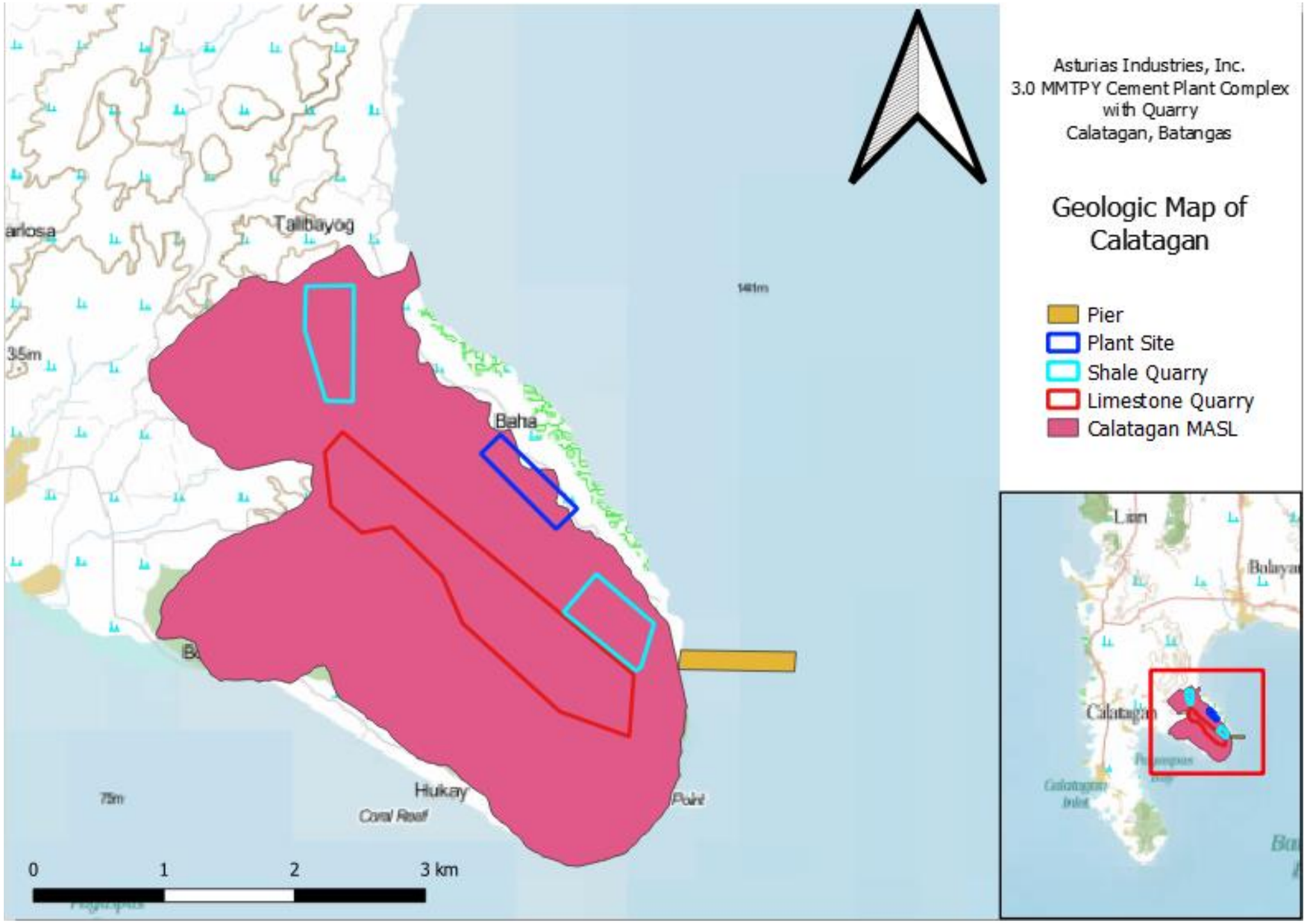
115 At Talibayog, the Lobo afflomerate and Taal Tuff, both of Pleistocene age, uncomformably overlie the Calatagan Marl, (BMG, 1987). The Lobo Agglomerate is characterized as massive agglomerates and volcanic breccias consisting of well cemented andesite and decite clasts in a fine matrix of the same composition. The Taal Tuff consists of thin to medium bedded, fine-grained vitric tuffs, welded volcanic breccia with conglomerate, tuffaceous sandstone and shale (BMG, 1987).

116 The area of Barangay Baha and nearby areas within the project site is within a slightly to gently sloping terrain and has very hilly and mountainous topography in the west **(Figure 2-4)**. The said barangays have an elevation that ranges from 5 meters and reaching up to 237 meters above mean sea level and elevation of up to 213 meters could be observed in the northwestern most portions and elevation of 237 meters could be observed along the southwestern portion of the proposed project site.

117 The elevation of the proposed site for the cement plant complex ranges from 10 meters above sea level (MASL) to approximately 90 MASL while the MPSA areas have elevation ranging from sea level to almost 280 MASL.

118 The slope of the project site and vicinities includes very steep, rolling and undulating lands between 15 to 25% and above. The coastal portion of the area is mainly 0 to 3 degrees in slope gradient. **Figure 2-4** shows the slope map of the proposed project site.

Figure 2-3: Geologic Map of the Proposed Site

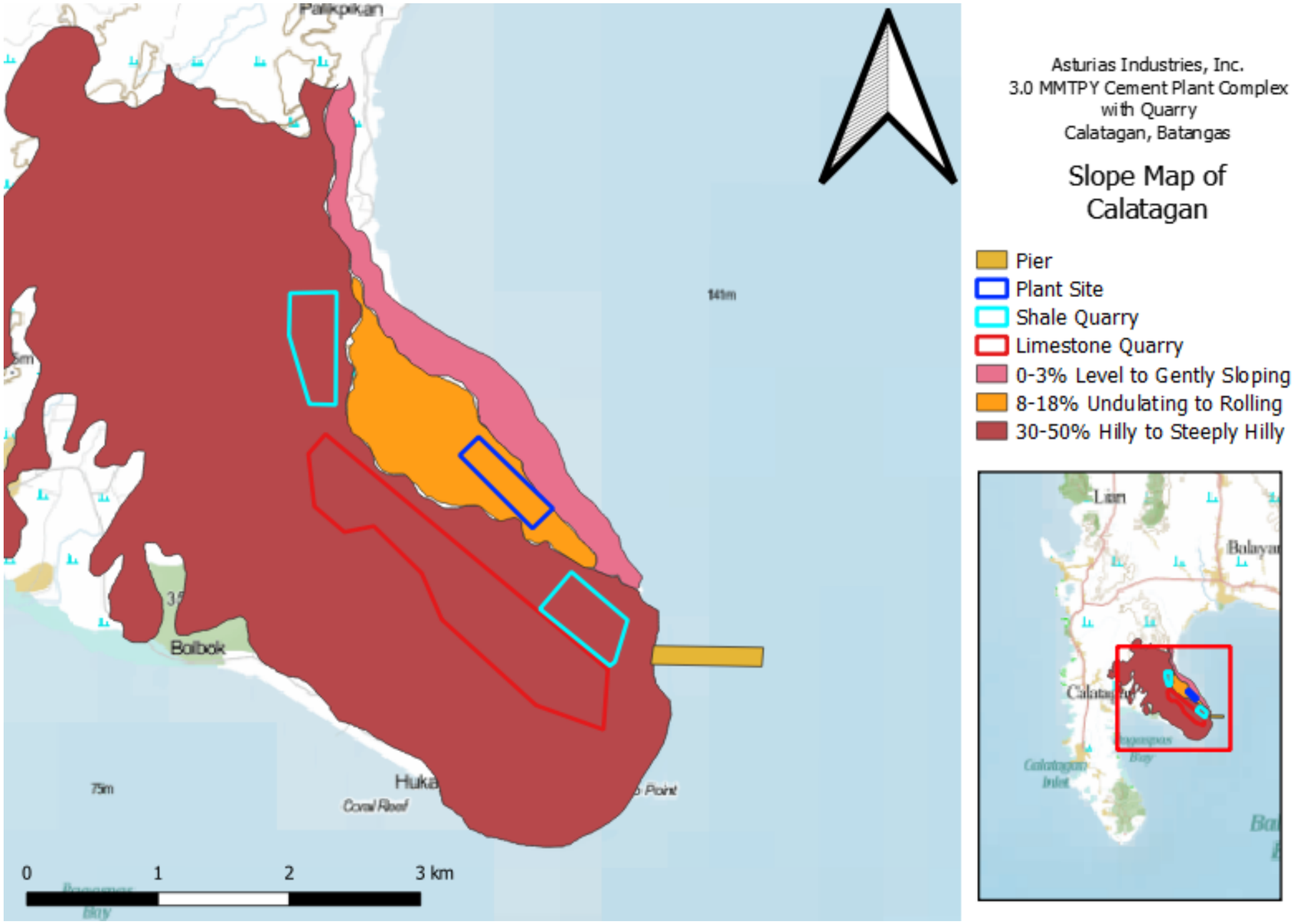


Source: Municipality of Calatagan

FIGURE NO.:	FIGURE TITLE:
2-3	**GEOLOGIC MAP OF THE PROPOSED PROJECT SITE**

PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
ASTURIAS INDUSTRIES INC	**3.0 MMTPY CEMENT PLANT COMPLEX WITH QUARRY** Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas	**LCI ENVI CORPORATION**

Figure 2-4: Slope Map of Calatagan



Source: Municipality of Calatagan

FIGURE NO.:	FIGURE TITLE:
2-4	**SLOPE MAP OF CALATAGAN**

PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
ASTURIAS INDUSTRIES INC	**3.0 MMTPY CEMENT PLANT COMPLEX WITH QUARRY** Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas	**LCI ENVI CORPORATION**

Flooding

119 Flooding in the country is often caused by prolonged rain. As such, majority of the flood occurrences are then associated with tropical cyclones or monsoon rains. In addition to this, anthropogenic activities such as accumulation of improperly disposed solid wastes, poor flood dynamics in public facilities and infrastructures, illegal or extreme logging without reforestation and inadequate preparedness for natural calamities may also cause or even worsen flooding events. According to the Flood Susceptibility Map of Calatagan **(Figure 2-5),** the coastal area of the project site is highly susceptible to flooding. This may occur due to local run-off and storm-surge.

120 The proposed project site has experienced localized flooding in the past due to heavy and continuous rainfall. The proponent should see to it the appropriate drainage system should be designed and constructed to minimize and/or mitigate flooding within the proposed project site during the rainy season. The proponent should take into consideration the effects of localized flooding events in the proposed project site.

Earthquake

121 The passage of seismic waves from the earthquake source to the ground surface causes most damages and mainly results to strong ground shaking. The intensity of the ground shaking is influenced by the magnitude of the earthquake, distance of the epicenter and the modifying effects of subsoil conditions. **Figure 2-6** shows the active faults in the Philippines.

122 The project site has low vulnerability to ground shaking, which is associated with earthquake. Based on the soil condition, bedrock and the proximity of the project site from major earthquake generators, the proposed project site and its immediate vicinity have low potential for ground shaking.

Liquefaction

123 The typical soil that is susceptible to liquefaction is loose sand located near the surface and with shallow groundwater table. During an earthquake, ground shaking causes loosely-consolidated sand deposits to contract resulting to increase in pore water pressure and reduced grain to grain effective stress (Seed, 1970). This causes loss of soil bearing capacity and makes the soil behave like fluid. In the process, there is an upward flow of water to the ground surface where it emerges in the form of mud spouts or sand boils. Liquefaction is usually accompanied by differential settlement and lateral spreading because of withdrawal of materials beneath the ground surface. Areas where liquefaction is likely to occur include river beds, old or abandoned river beds and meanders, swamps and back swamps. Alluvial plains, pyroclastic plains and coastal plains with shallow groundwater and with silty to sandy soils are also possible sites for liquefaction.

124 As shown in **Figure 2-6,** the project area is free from the hazards caused by liquefaction. However, the moderately thick soil layers present near the coastline could be affected by liquefaction hazards. A more detailed soil sampling and analysis and geotechnical assessment should be undertaken by the proponent prior to development and construction of structures especially near the coastline.

Landslides

125 Landslide is the general term for readily perceptible mass movements, slow or rapid. It includes, rock slide, rock fall, mudflow, slump, debris avalanche and many others. Areas with high risk to landslide are those with steep slopes, high precipitation, highly fractured rocks (sheared zone), scarce vegetation and location close to active faults.

126 Slopes within the project site differ. Areas farthest from the shore have slopes of 18-30%. As shown on **Figure 2-7,** these areas have low to medium susceptibility to landslides. Areas near the shore are nearly flat and are not susceptible to landslides.

127 Although the area is susceptible to landslides, it must be noted that there will be no structures constructed in areas with critical slopes; the proposed cement plant complex will be located in a flat terrain. The operation of the quarry area will also be limited to areas that are not located in critical slopes.

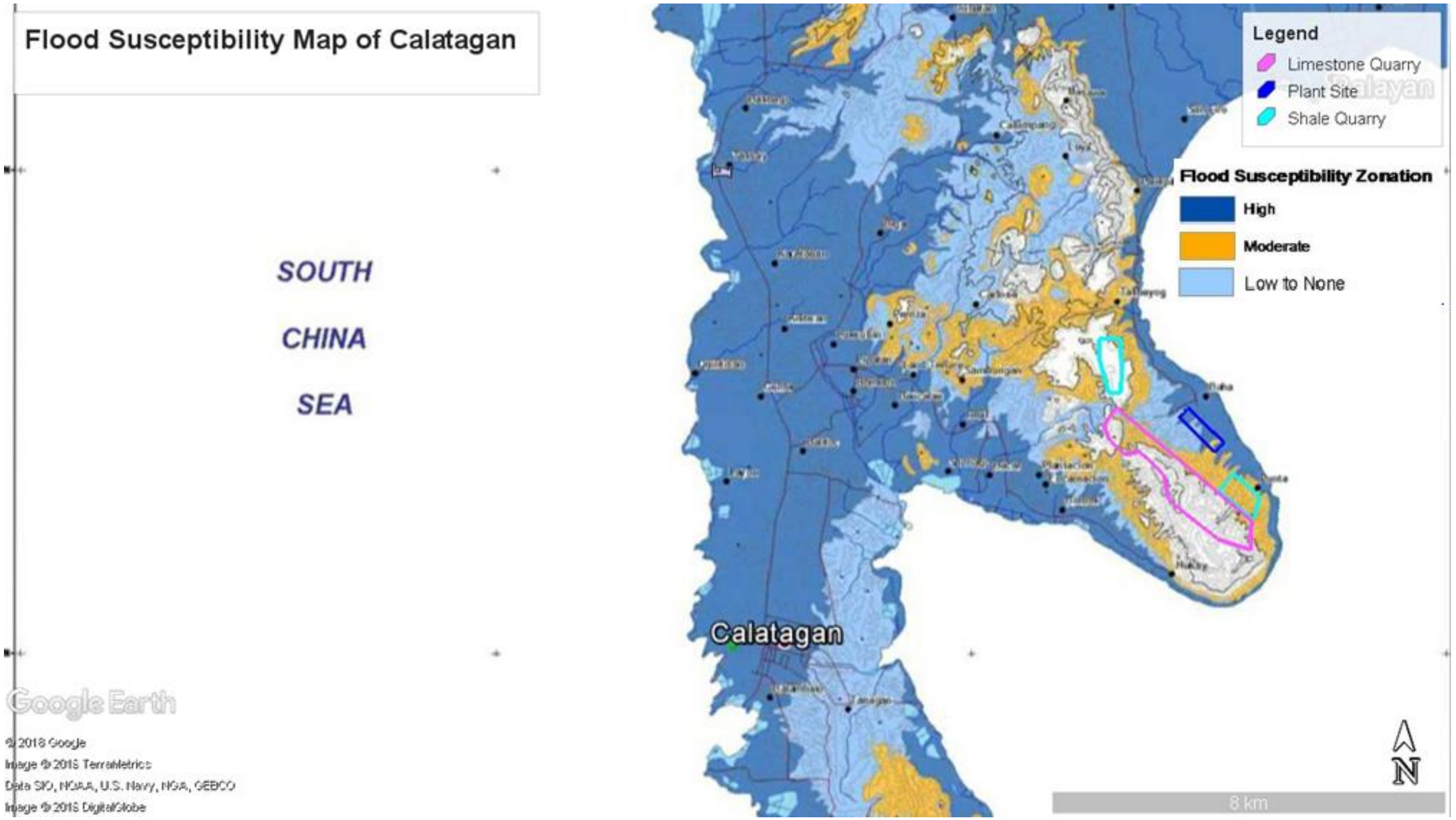
Tsunamis

128 According to the tsunami susceptibility map prepared by PHIVOLCS **Figure 2-8**, the project site is susceptible to tsunamis. The maximum wave height that may be experienced in the event of a tsunami is greater than 6m.

Volcanic Events

129 Another geologic hazard is from volcanic events. The Philippine has about 220 volcanoes (PHIVOLCS). Of these, 22 have been recorded in history to have erupted, and five are considered to be the most active namely: Taal, Mayon, Bulusan, Canlaon and Hibok-Hibok. Volcanic hazards from volcanic activity and eruption include lava flow, debris flow, pyroclastic flow, debris avalanche, lahar, bombs and ballistics projectiles, ash fall, volcanic gases emission, flooding and volcanic quakes. This may cause health problems since ash fall may contaminate water sources and also cause respiratory illnesses. As shown in **Figure 2-9,** the Province of Batangas medium risk to volcanic eruptions due to the presence of Taal Volcano.

Figure 2-5: Flood Susceptibility Map of Calatagan

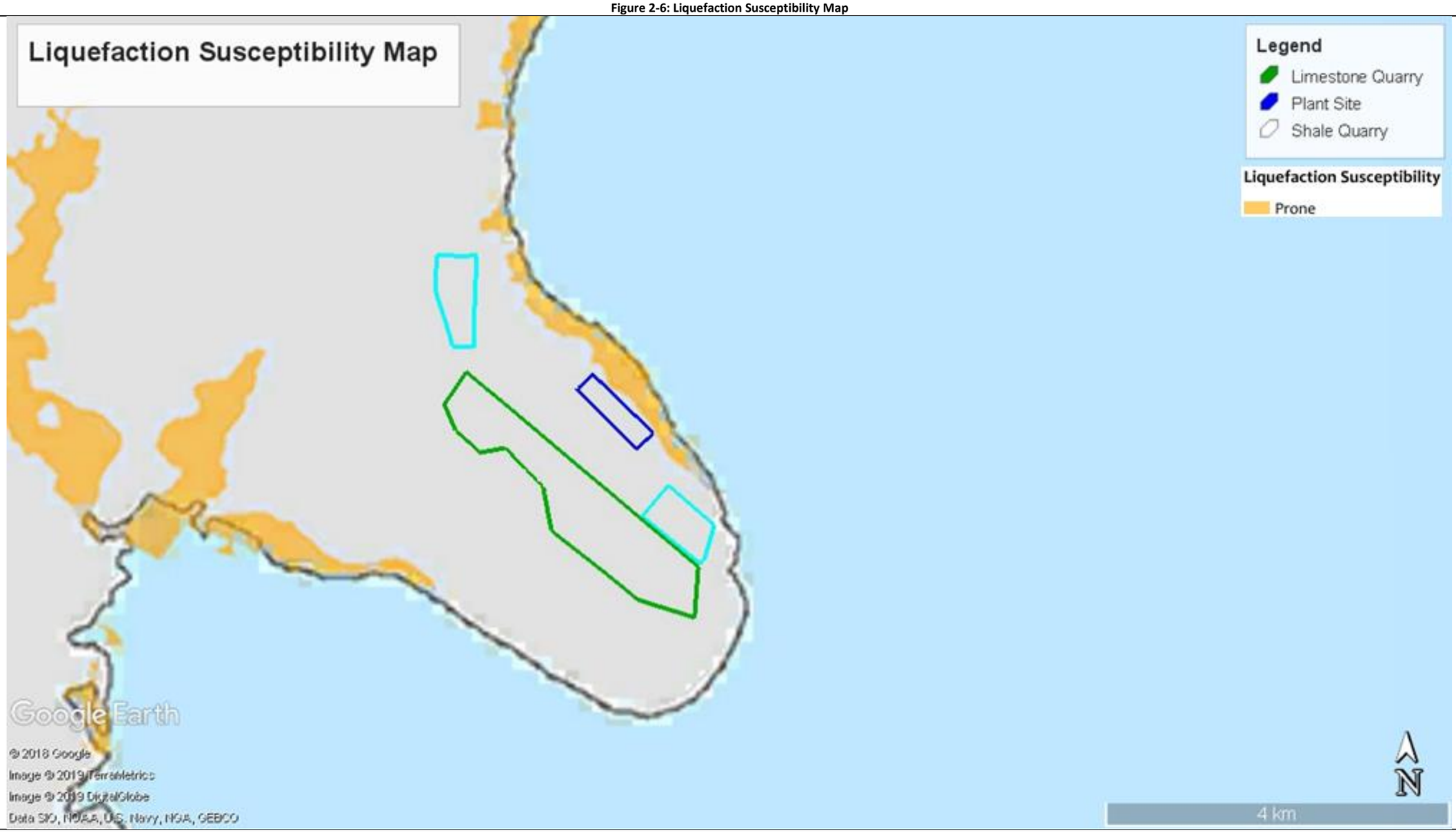


Source: MGB

FIGURE NO.:	FIGURE TITLE:
2-5	**FLOOD SUSCEPTIBILITY MAP OF CALATAGAN**

PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
ASTURIAS INDUSTRIES INC	**3.0 MMTPY CEMENT PLANT COMPLEX WITH QUARRY** Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas	**LCI ENVI CORPORATION**

Figure 2-6: Liquefaction Susceptibility Map

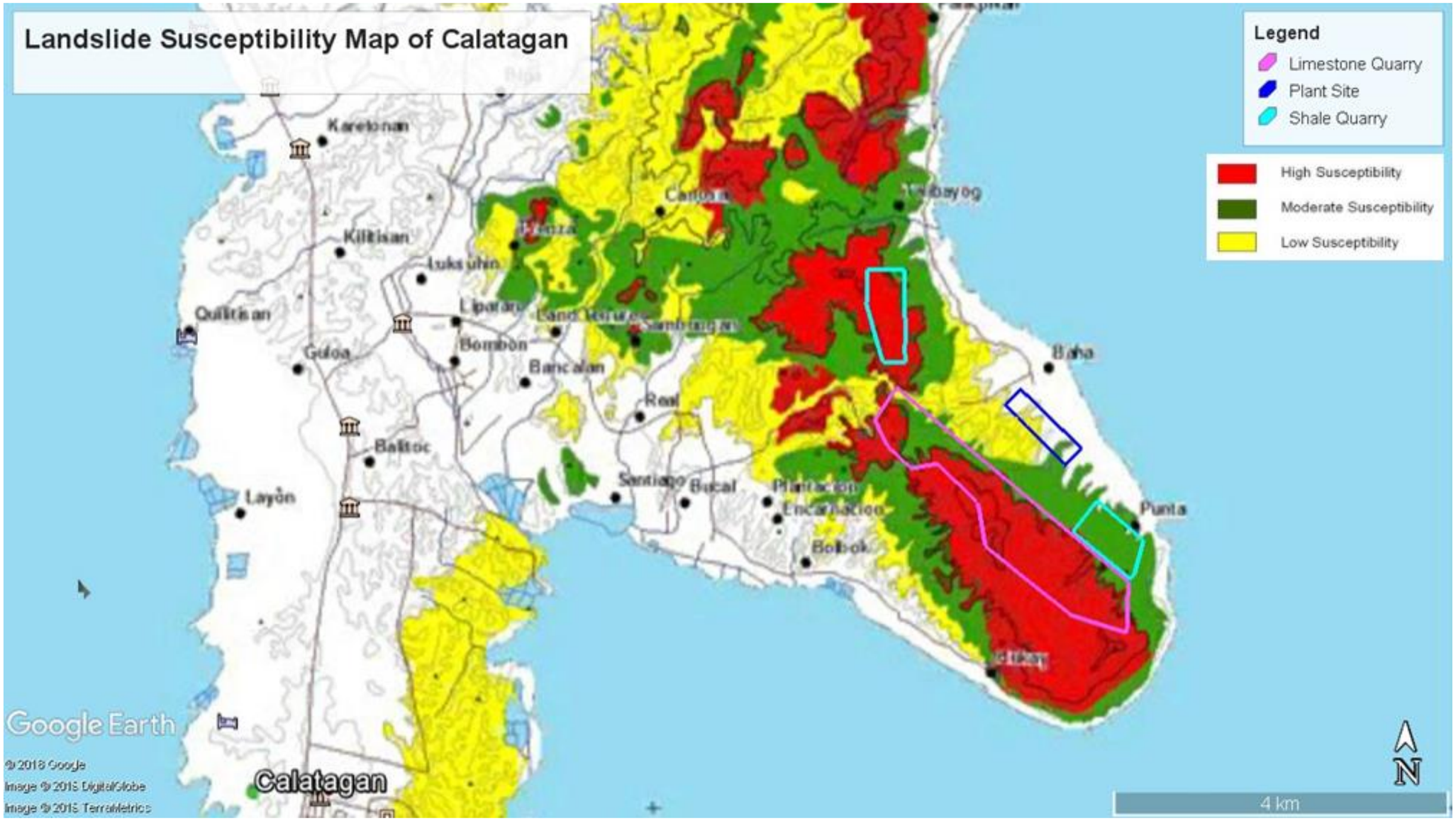


Source: PHIVOLCS

FIGURE NO.:	FIGURE TITLE:
2-6	**LIQUEFACTION SUSCEPTIBILITY MAP**

PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
ASTURIAS INDUSTRIES INC	**3.0 MMTPY CEMENT PLANT COMPLEX WITH QUARRY** Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas	**LCI ENVI CORPORATION**

Figure 2-7: Landslide Susceptibility Map of Calatagan

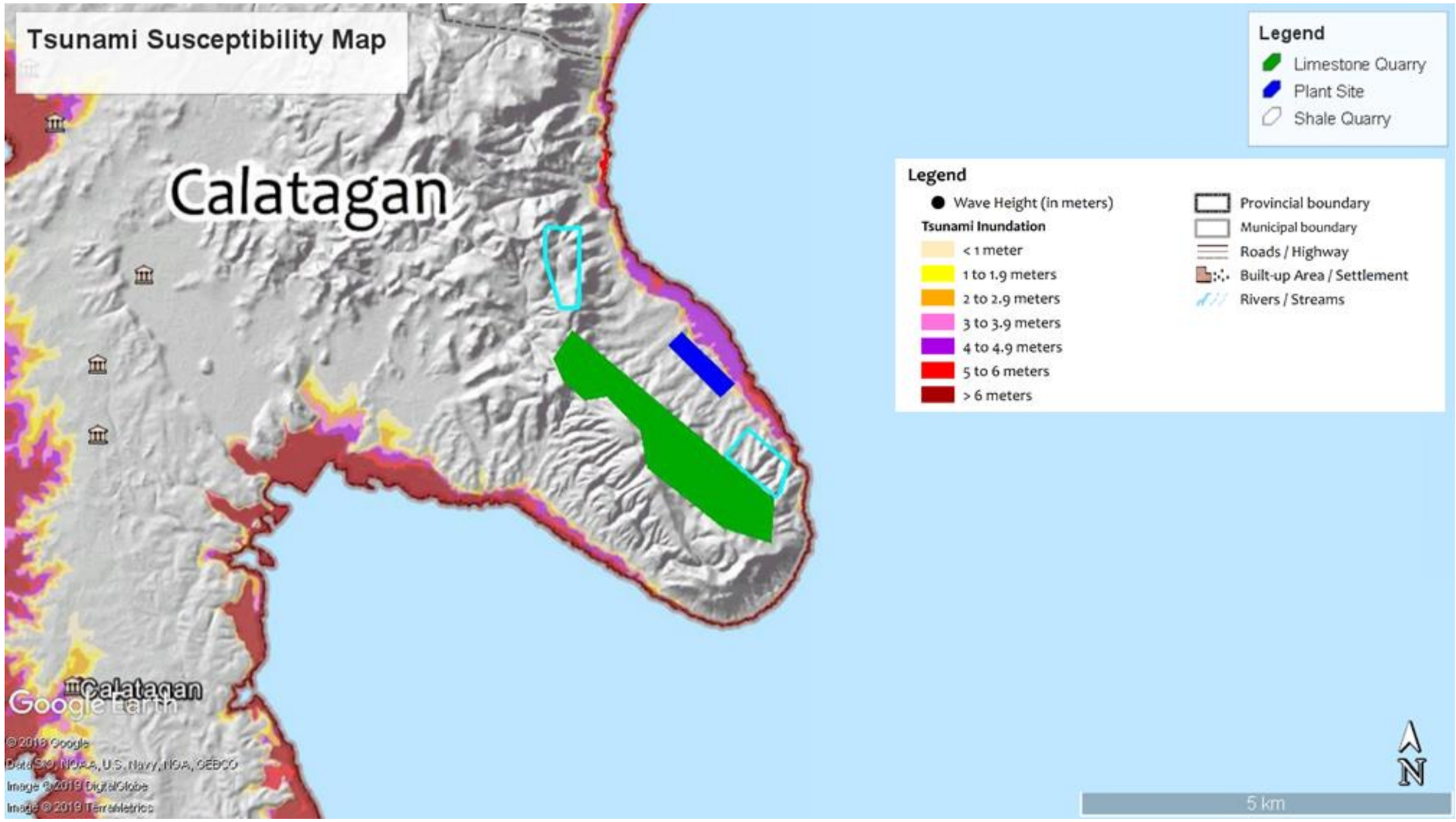


Source: MGB

FIGURE NO.:	FIGURE TITLE:
2-7	**LANDSLIDE SUSCEPTIBILITY MAP OF CALATAGAN**

PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
ASTURIAS INDUSTRIES INC	**3.0 MMTPY CEMENT PLANT COMPLEX WITH QUARRY** Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas	**LCI ENVI CORPORATION**

Figure 2-8: Tsunami Susceptibility Map of Calatagan

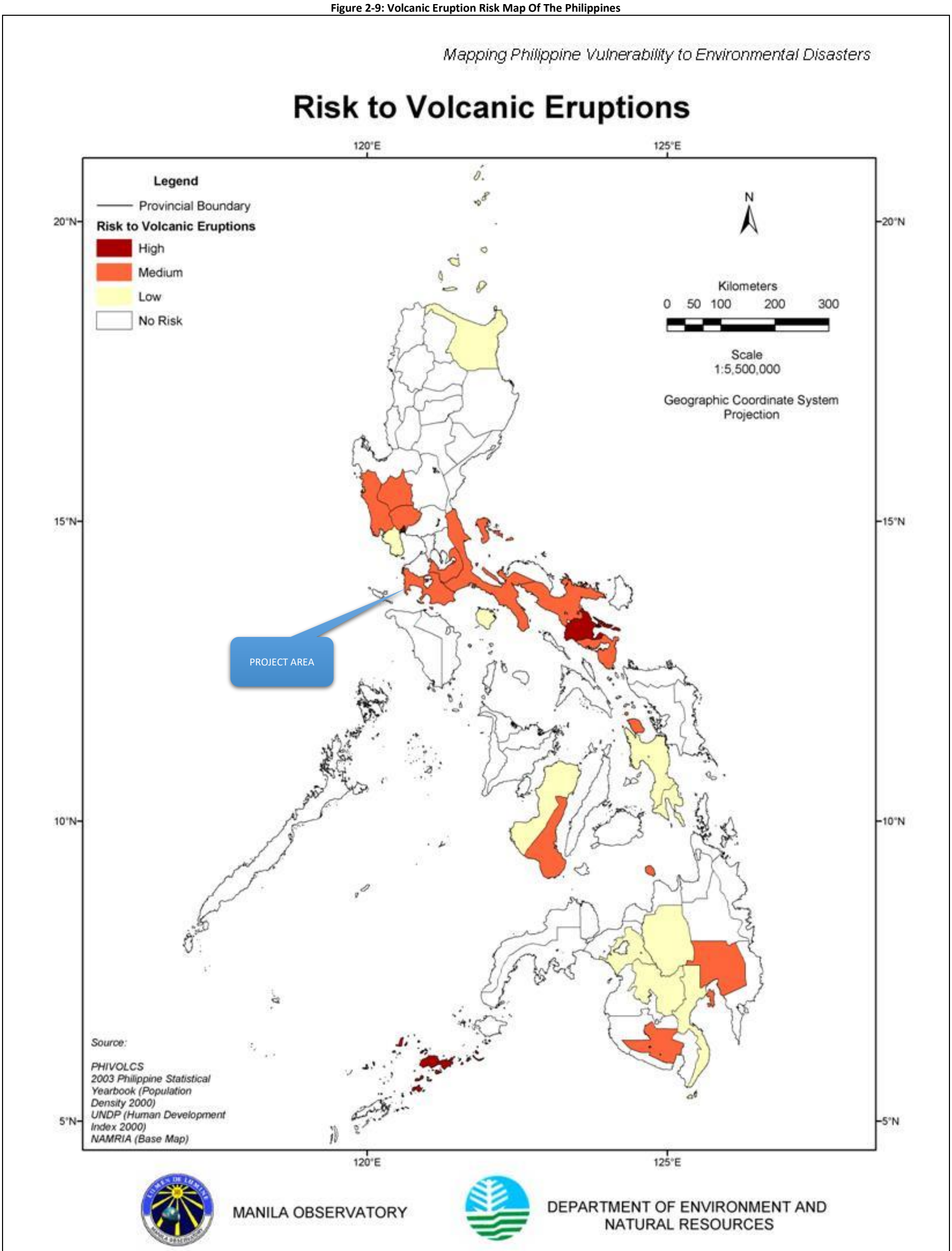


Source: PHIVOLCS

FIGURE NO.:	FIGURE TITLE:
2-8	**TSUNAMI SUSCEPTIBILITY MAP OF CALATAGAN**

PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
ASTURIAS INDUSTRIES INC	**3.0 MMTPY CEMENT PLANT COMPLEX WITH QUARRY** Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas	**LCI ENVI CORPORATION**

Figure 2-9: Volcanic Eruption Risk Map Of The Philippines



SOURCE: Manila Observatory

FIGURE NO.:	FIGURE TITLE:
2-9	**VOLCANIC ERUPTION RISK MAP OF THE PHILIPPINES**

PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
ASTURIAS INDUSTRIES INC	**3.0 MMTPY CEMENT PLANT COMPLEX WITH QUARRY** Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas	**LCI ENVI CORPORATION**

2.1.2.1 Change in surface landform/geomorphology/topography/terrain/slope

130 The proposed project, like any kind of facilities with mining and ore extraction activities, will create a direct impact on the land, specifically the gross modification and alteration of natural slope. The company maintains the bench slopes at 75 degrees while quarry slopes to 45 degrees to minimize this concern. Moreover, bench slopes are monitored for potential failures. Corresponding engineering interventions such as moderation of angle or bank refurbishment are currently implemented.

2.1.2.2 Change in sub-surface geology/underground conditions

131 The proposed project is not expected to cause any change in sub-surface geology or underground conditions in the impact area.

2.1.2.3 Inducement of subsidence, liquefaction, landslides, mud, debris flow, etc.

132 There might be some concerns on the susceptibility of the quarry sites of the Plant to mass wasting or sudden earth movements. The company currently employs safety guidelines and proper mining procedures to minimize the occurrence of erosions near the quarry area.

2.1.3 Pedology

2.1.3.1 Soil Type

133 The soil in the project site originated from volcanic ejecta. The soil developed is loose, very friable sandy loam to sand. Permeability is very high. This could explain the absence of well-developed river system in the area and the availability of groundwater at the foot of the hills and in flat lands near the coastal areas.

134 The soil types in the Municipality of Calatagan are Calumpang Clay Loam, Taal Sandy Loam and Sibul Clay. **Table 2-3** shows the soil types found in the Municipality of Calatagan.

135 The Calumpang Clay Loam is characterized as brownish gray, hard and compact clay loam. The sub soil is dark gray, stiff, and waxy loam to clay.

136 The Taal Sandy Loam consist of brownish gray, loose and structure-less sandy loam soil ranging in depth from forty (40) to fifty (50) centimeters. In level areas, the surface soil is deeper than in rolling areas. The sub soil consists of two or more layers of volcanic sand and between these layers is the light gray sandy loam soil. The substratum is either light gray volcanic sand or gray volcanic tuff with sands.

137 Lastly, the Sibul Clay loam is fine and granular, somewhat porous when dry, but sticky when wet. The vegetation of the area is luxuriant, as is always the case of a limestone region.

Table 2-3: Different Soil Types found in Calatagan

Soil Type	Land area	Percentage
Calumpang Clay Loam	1,063.32	**10.10**
Taal Sandy Loam	282.15	**2.68**
Sibul Loam	9,182.42	**87.22**
TOTAL	**10,527.89**	**100.00**

2.1.3.2 Soil Erosion/loss of topsoil/overburden

138 In general, soil erosion is considered a major problem in Batangas. Of the total area of the province, 92.3% has been classified by the NEPC Erosion Survey Team as erosion prone (EMB, 1990). The mountainous areas along its southwestern and southeastern boundaries, including the central highlands, are considered as highly prone to soil erosion.

139 The project area is highly erodible. Soil erosion map developed by NWRC (1983) earlier shows that sheet erosion has already eroded about 75% of the original soil surface and 25% of the subsoil. It was observed that deep gullies can be seen everywhere, and downstream areas were already heavily silted.

2.1.3.3 Sedimentation

140 As mentioned in this report, soil erosion in the area is very high. Naturally, sedimentation in the coastal area, especially in the vicinity of the project site is also high. During the survey, all creeks and big gullies have been silted badly such that water disappears a kilometer from the outlet to the sea. Boulders, stones and gravel have flattened the area near the outlets of creeks due to upland activities. It can be deducted from the erosion rate data at 50% delivery ratio, that the siltation rate could be at 140 to 150 tons/ha/year.

2.1.3.4 Change in soil quality/fertility

141 Sub-surface soil sampling was conducted last 27 June 2018 to determine the existing soil quality. Photos and coordinates of the two sampling areas are shown in **Figure 2-10,** while the sampling map is shown in **Figure 2-11**.

143 Table 2-4 shows the results of the soil quality analysis. The parameters that analyzed were lead, chromium, cadmium, and arsenic. Heavy metals are a special concern since these substances are hazardous, even in small amounts. Moreover, heavy metals have a potential to contaminate the surrounding environment since the Plant involves soil excavation

144 Since there are no established soil quality standards in the Philippines, the results were compared with the soil remediation intervention values specified in Annex 1 (Table 1) of the Dutch Soil Remediation Circular 2013 (version of 1 July 2013). The results show that the soil quality in the area is below the prescribed limits.

Table 2-4: Soil Analysis Results

PARAMETER	UNIT	DETECTED LEVEL AT THE SAMPLING POINTS BASED ON LABORATORY ANALYSIS		DUTCH INTERVENTION VALUE	REMARKS
		Soil 1	***Soil 2***	*(Dutch Soil Remediation Circular 2013)*	
A. HEAVY METALS					
Arsenic	mg/kg	**2.5**	**2.4**	**76**	**Acceptable**
Cadmium	mg/kg	**1.6**	**1.4**	**13**	**Acceptable**
Chromium	mg/kg	**8.2**	**8.5**	*	**Acceptable**
Lead	mg/kg	**3.5**	**3.2**	**530**	**Acceptable**

NOTES: ND = Not Detected | mg/kg = milligrams per kilogram | (*) Numeric value below detection level / no lower detection limit
REFERENCES: Varian Analytical Methods of Spectrophotometry, 1976; Standard Methods of Analysis for Soil, Plant Tissue, Water and Fertilizer, 1980; Dutch Soil Remediation Circular, 2013, Annex 1, Table 1

Figure 2-10: Photographs and Coordinates of Soil Sampling Sites

Soil 1: 13.862128°, 120.719249°

Soil 2: 13.875526°, 120.707353°

FIGURE NO.:	FIGURE TITLE:
2-10	**PHOTOGRAPHS AND COORDINATES OF SOIL SAMPLING SITES**

PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
ASTURIAS INDUSTRIES INC	**3.0 MMTPY CEMENT PLANT COMPLEX WITH QUARRY** Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas	**LCI ENVI CORPORATION**

Figure 2-11: Soil Sampling Map

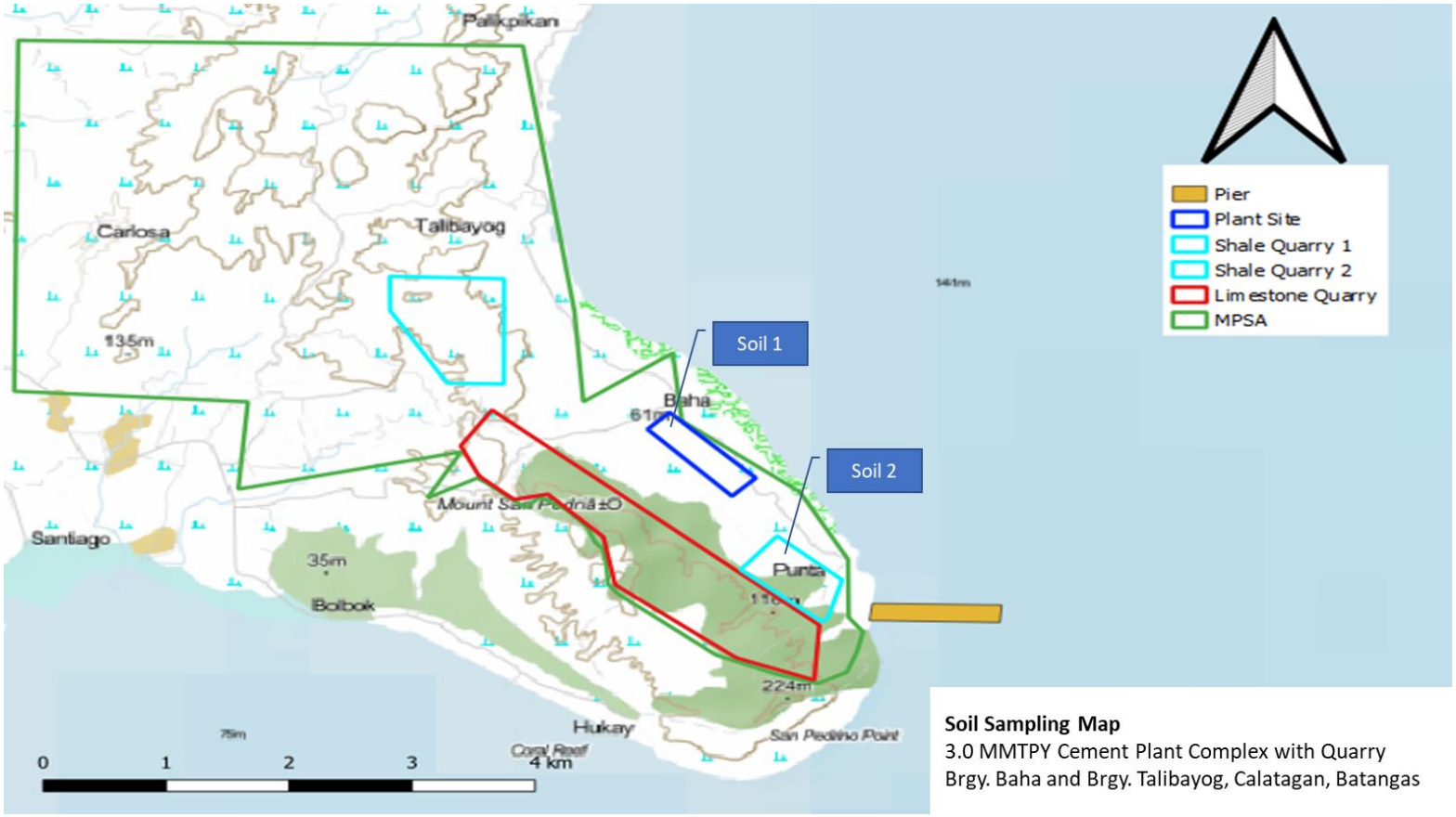


FIGURE NO.:	FIGURE TITLE:	
2-11	**SOIL SAMPLING MAP**	
PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
ASTURIAS INDUSTRIES INC	**3.0 MMTPY CEMENT PLANT COMPLEX WITH QUARRY** Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas	**LCI ENVI CORPORATION**

2.1.4 Terrestrial Ecology

145 A terrestrial assessment was conducted in the project site last 18 August 2018. The objective of the assessment was to identify existing vegetation cover and prevailing wildlife species in the watershed of the proposed project. This is undertaken to assess the biodiversity composition of the area and link the possible impacts of the project to the watershed. In addition, the study will provide recommendation on the possible mitigating measures to minimize impact of the project to the remaining flora and fauna species.

146 In the terrestrial assessment, plots were established in these particular sites to examine the tree and plant species for vegetational analysis. In addition, tree and plant species that is sporadically located within the grassland/shrublands and outside the plots are also identified and enumerated. For faunal dimension, the study is limited on the observed species during the field survey, claims of the local and collected species on the established plots and through netting.

147 The species conservation status and endemicity were also determined. The International Union for Conservation of Nature (IUCN) Red List of Threatened Species 2016 and DENR-AO 2007-01 "Establishing the National List of Threatened Philippine Plant and Their Categories were employed in determining conservation status and endemicity of each species. This is to provide scientifically based information on the status of the species and subspecies at a global level; draw attention to the magnitude and importance of threatened biodiversity; influence national and international policy and decision-making; and provide information to guide actions to conserve biological diversity (*Source: Convention on International Trade of Wild Flora and Fauna, Joint Meeting of the Animals and Plants Committee, Shepherds town, USA., December 2000, retrieved November 2012*). The IUCN Red list is set upon precise criteria to evaluate the extinction of thousands of species and sub-species. The aim of the Red List is to convey the urgency of conservation issues to the public and policy-makers, as well as to help the international community to try to reduce species extinction. In addition, the DENR AO 2007-01 was also used pursuant to Section 22 of Republic Act 9147, otherwise known as the Wildlife Conservation and Protection Act of 2001.

2.1.4.1 Terrestrial Flora

Methodology

148 Quadrat sampling method was used during the assessment of the flora in the project site. Twenty sampling plots were established for the flora assessment to represent the vegetation cover of the project site. Plants were identified as well as patches of trees located within the project area. Other species of plants encountered outside the sampling plots were photo documented. The collected data were consolidated to form a species checklist indicating common name, scientific name and family name of the plants recorded.

149 Photos during the survey are shown in **Figure 2-12** while **Figure 2-13** shows map for the established sampling plots.

Figure 2-12: Terrestrial Flora Survey

FIGURE NO.:	FIGURE TITLE:
2-12	**TERRESTRIAL FLORA SURVEY**

PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
ASTURIAS INDUSTRIES INC	**3.0 MMTPY CEMENT PLANT COMPLEX WITH QUARRY** Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas	**LCI ENVI CORPORATION**

Figure 2-13: Location of Flora Sampling Sites

FIGURE NO.:	FIGURE TITLE:	
2-13	**Location of Flora Sampling Sites**	
PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
ASTURIAS INDUSTRIES INC	**3.0 MMTPY CEMENT PLANT COMPLEX WITH QUARRY** Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas	**LCI ENVI CORPORATION**

Floristic Composition

150 A total of 121 species were observed from the project area. Relative to the plant life-form, trees were the dominant group with 78% (93 species) while grass and vine were least observed with 2% (2 species) as shown in **Figure 2-12.**

151 There were 33 families identified from the study sites within the sample plots. Fabaceae is the dominant family with 11 species followed by Malvaceae and Moraceae with 7 species. **Table 2-5** shows the list of the species that were observed within the sample plots.

Figure 2-14: Distribution of Plant Species

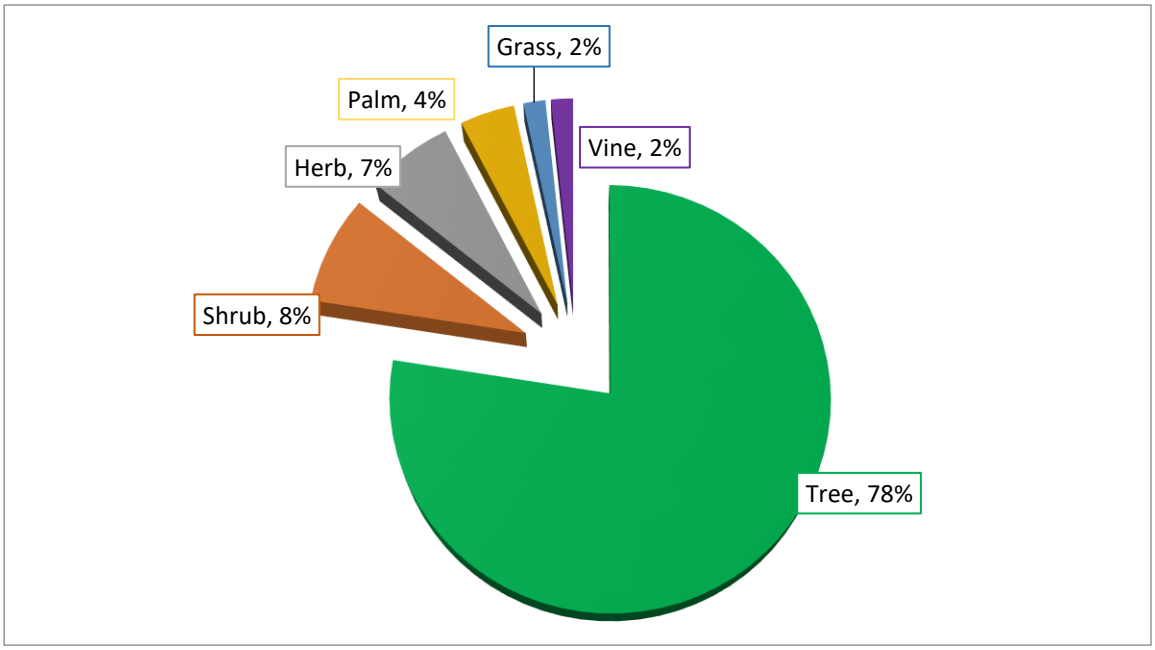


FIGURE NO.:	FIGURE TITLE:
2-14	**Distribution of Plant Species**

PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
ASTURIAS INDUSTRIES INC	**3.0 MMTPY CEMENT PLANT COMPLEX WITH QUARRY** Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas	**LCI ENVI CORPORATION**

Table 2-5: List of Floral Species observed within the Sample Plots

COMMON NAME	SCIENTIFIC NAME	FAMILY NAME	Number of Species
Bungalon	*Avicennia marina*	ACANTHACEAE	1
Balinghasai	*Buchanania arborescens*	ANACARDIACEAE	6
Dao	*Dracontomelon dao*		
Mangga	*Mangifera indica*		
Ligas	*Semecarpus cuneiformis*		
Kamiring	*Semecarpus philippinensis*		
Sineguelas	*Spondias purpurea*		
Guyabano	*Annona muricata*	ANNONACEAE	5
Atis	*Annona squamosa*		
Takulao	*Miliusa vidalii*		

COMMON NAME	SCIENTIFIC NAME	FAMILY NAME	Number of Species
Yellow lanutan	*Polyalthia flava*		
Biriba	*Rollinia mucosa*		
Pandakaki	*Tabernaemontana pandacaqui*	APOCYNACEAE	3
Bayag-usa	*Voacanga globosa*		
Lanete	*Wrightia pubescens*		
Niog	*Cocos nucifera*	ARECACEAE	1
	Vernonia lancifolia	ASTERACEAE	1
Anonang	*Cordia dichotoma*	BORAGINACEAE	1
Anabiong	*Trema orientalis*	CANNABACEAE	1
Paguringon	*Cratoxylum sumatranum*	CLUSIACEAE	1
Talisai	*Terminalia catappa*	COMBRETACEAE	2
Kalumpit	*Terminalia microcarpa subsp. microcarpa*		
Bayag turo	*Dioscorea bulbifera*	DIOSCOREACEAE	1
Anang	*Diospyros pyrrhocarpa*	EBENACEAE	1
Takip Asin	*Macaranga grandifolia*	EUPHORBIACEAE	5
Binunga	*Macaranga tanarius*		
Banato	*Mallotus philippensis*		
Alim	*Melanolepis multiglandulosa*		
Apanang	*Neotrewia cumingii*		
Falcata	*Acacia falcata*	FABACEAE	11
Aroma	*Acacia farnesiana*		
Malaipil	*Afzelia borneensis*		
Akle	*Albizia acle*		
Alibangbang	*Bauhinia malabarica*		
Kakauate	*Gliricidia sepium*		
Ipil-Ipil	*Leucaena leucocephala*		
Makahiya	*Mimosa pudica*		
Narra	*Pterocarpus indicus*		
Rain tree	*Samanea saman*		
Sampalok	*Tamarindus indica*		
Gmelina	*Gmelina arborea*	LAMIACEAE	2
Molave	*Vitex parviflora*		
Avocado	*Persea gratissima*	LAURACEAE	2
Sablot	*Litsea glutinosa*		
Kaliantan	*Leea philippinensis*	LEEACEAE	1
Banaba	*Lagerstroemia speciosa*	LYTHRACEAE	2
Pedada	*Sonneratia caseolaris*		
Anilau	*Colona serratifolia*	MALVACEAE	7
Danglin	*Grewia multiflora*		
Gumamela de araña	*Hibiscus schizopetalus*		
Tan-ag	*Kleinhovia hospita*		
Taluto	*Pterocymbium tinctorium*		
Kalumpang	*Sterculia foetida*		
Bayok	*Pterospermum diversifolium*		

COMMON NAME	SCIENTIFIC NAME	FAMILY NAME	Number of Species
Malasaging	*Aglaia edulis*	MELIACEAE	2
Danupra	*Toona sureni*		
Nangka	*Artocarpus heterophyllus*	MORACEAE	7
Himbabao	*Broussonetia luzonica*		
Tibig	*Ficus Nota*		
Hauili	*Ficus septica*		
Is-Is	*Ficus ulmifolia*		
Malanangka	*Parartocarpus venenosus*		
Kalios	*Streblus asper*		
Malungai	*Moringa oleifera*	MORINGACEAE	1
Saging-saging	*Aegiceras corniculatum*	MYRSINACEAE	2
Tagpo	*Ardisia squamulosa*		
Bayabas	*Psidium guajava*	MYRTACEAE	2
Duhat	*Syzygium cumini*		
Tamayuan	*Strombosia philippinensis*	OLACACEAE	1
Kamias	*Averrhoa bilimbi*	OXALIDACEAE	1
Binayuyu	*Antidesma ghaesembilla*	PHYLLANTHACEAE	1
Bakauan-babae	*Rhizophora mucronata*	RHIZOPHORACEAE	1
Bangkal	*Nauclea orientalis*	RUBIACEAE	2
Lisak	*Neonauclea bartlingii*		
Talitan	*Casearia fuliginosa*	SALICACEAE	1
Alupag	*Litchi chinensis*	SAPINDACEAE	2
Kusibeng	*Sapindus saponaria*		
Malasapsap	*Ailanthus integrifolia*	SIMAROUBACEAE	1
Coronitas	*Lantana camara*	VERBENACEAE	1

Importance Value (IV), Density (ρ), and Frequency (f)

152 Importance value (IV) is the sum of relative density, relative frequency and relative dominance. A high importance value indicates that species is well represented in the stand because of some combination of a) a large number of individuals of species compared with other species in the stand, or b) a smaller number of individuals of species, but the trees are large compared with others in the stand.

153 Bungalon or *Avicennia marina* of family Acanthaceae dominates the canopy cover with 38.50% IV. It is followed by mangga or *Mangifera indica* (35.54%) and Tan-ag or *Kleinhovia hospital* (23.83%). While the remaining 47 species listed have less than 20% IV.

154 Density (ρ) is defined as a measurement of the individuals' number in an area. It is the degree of compactness of a species. It can be used for the thickness description of particular vegetation, extent regeneration and the extent of standing biomass or ground cover.

155 Ipil-ipil or *Leucaena leucocephala* has the highest relative density in the intermediate layer with relative density of 19.80%. While the remaining 39 species listed has below 10% computed relative density.

156 For the understory layer, Bungalon or *Avicennia marina* has the computed highest relative density of 31.50% while the remaining thirty-six (36) species have a value less than 10% relative density.

Biodiversity Index

157 Species richness and evenness are the important factors in determining biodiversity of an area. Richness is defined as the total number of species present in a sample while evenness is the relative abundance of the species in a sample. Richness' takes on diversity is - the more different the species in a community, the more diverse the area. Evenness considers the number of the individual belonging to the same species (www.countrysideinfo.co.uk). It expresses how evenly the individuals in the community are distributed over the different species. Based from the assessment conducted, the project area has very low diversity and moderate to very high eveness.

Flora Conservation Status

158 Based on the table below, out of the 121-species identified from the project area, thirteen (13) species are included in the *The IUCN Red List of Threatened Species version 2017-3*. Out of the 13 species recorded, one (1) species is under critical endangered (CR), one (1) species is endangered (E), three (3) are vulnerable (VU), and six (6) are least concern (see **Table 2-6**).

Table 2-6: List of Flora Species and its corresponding Conservation Status

SPECIES NAME		FAMILY NAME	CONSERVATION STATUS
COMMON NAME	SCIENTIFIC NAME		
Narra	*Pterocarpus indicus*	FABACEAE	CR
Molave	*Vitex parviflora*	LAMIACEAE	EN
Anabiong	*Trema orientalis*	CANNABACEAE	LC
Bakauan-babae	*Rhizophora mucronata*	RHIZOPHORACEAE	LC
Bungalon	*Avicennia marina*	ACANTHACEAE	LC
Danupra	*Toona sureni*	MELIACEAE	LC
Makahiya	*Mimosa pudica*	FABACEAE	LC
Pedada	*Sonneratia caseolaris*	LYTHRACEAE	LC
Saging-saging	*Aegiceras corniculatum*	MYRSINACEAE	LC
Sampalok	*Tamarindus indica*	FABACEAE	LC
Is-Is	*Ficus ulmifolia*	MORACEAE	VU
Malasaging	*Aglaia edulis*	MELIACEAE	VU
Takip Asin	*Macaranga grandifolia*	EUPHORBIACEAE	VU

Economic Importance

159 There are some species observed in the project site that have a high economic importance. Molave has high economic value and are used for high-grade construction, house building, agricultural implements and Narra and Kamagong which are both widely known to have high economic value aesthetically and commercially. There are also major and/or important agriculcural crops that are found in the area such as niyog, and banana.

160 One of the significant ecosytem within the project area is the Mangrove forest. Presence of small patches of mangrove forest can be found along the coastal line of Calatagan. Mangroves are critical habitat not only for the faunal species but also as breeding site for marine fauna

species. Mangoves also plays as natural buffer against strong wind, natural calamaties including tidal wave, flooding and other more.

2.1.4.2 Terrestrial Fauna

Methodology

161 The survey covers the four groups of wildlife-vertebrates which include the avi-fauna and herpetofauna species. Prior to the conduct of sampling, general habitat assessment was undertaken to consider different ecosystems in the project area for the selection of areas for observation. Direct rapid survey method was employed in the conduct of faunal diversity assessment.

162 Rapid survey was employed in the conduct of faunal assessment within the project area. Species not encountered during the period of field assessment is generated through ethnobiological interview with local informants to obtain other important information on the presence of other wildlife species not encountered throughout the survey. Photo documentation of observed wildlife was also undertaken for further species verification when necessary.

163 A total of twelve (12) observation sites was selected within the study area representing different ecosystem types and elevations. This is to be able to determine faunal composition and diversity in each ecosystem and in relation to elevation. Five (5) observations are situated along the coastal zone representing portions of mangrove areas (adjacent the study area-downslope), grass land and agro-ecosystem sites which topography is from flat to rolling. Another five (5) observation sites was situated upslope the mountain side, represented by grass land, shrub land and agro-ecosystem. The remaining two (2) observation sites was situated in the mountain top, within the project boundary which is represented by shrubland ecosystem. **Figure 2-15** shows the locations of faunal sampling sites while summarized in **Table 2-7** are the corresponding habitat types and geographical coordinates of the twelve observation sites.

Table 2-7: Description and geographic location of selected observation sites

Sampling Site #	Description/habitat	Geographic Coordinates (WGS 84)		Remarks
		Latitude	Longitude	
1	Amalgamation of agro-ecosystem and mangrove ecosystem	13°53'23.60"	120°41'46.81"	Mangrove is outside the 808 hectares
2	Amalgamation of grass land and agro-ecosystem	13°52'49.58"	120°42'6.71"	Formerly cultivated area
3	Grass land ecosystem	13°52'21.68"	120°42'34.78"	Formerly residential and cultivated area
4	Amalgamation of grass land and mangrove ecosystem	13°52'1.51"	120°42'50.03"	Formerly cultivated area
5	Shrub land ecosystem	13°51'28.60"	120°43'11.44"	Formerly cultivated area
6	Shrub land ecosystem	13°51'10.40"	120°42'51.87"	Upslope, adjacent an orchard plantation
7	Shrub land ecosystem	13°51'52.46"	120°42'35.47"	Upslope, formerly cultivated area
8	Grass land ecosystem	13°52'15.49"	120°42'5.08"	Upslope, formerly cultivated area
9	Shrub land ecosystem	13°52'37.98"	120°41'49.94"	Upslope, formerly cultivated area
10	Amalgamation of grass land and Shrub land ecosystem	13°53'14.53"	120°41'35.93"	Upslope, formerly cultivated area
11	Forest ecosystem	13°52'5.07"	120°41'40.21"	Vegetation dominated by Taluto, Calumpang, Anonang and other broad leaf forest trees
12	Shrub land ecosystem	13°52'17.66"	120°41'35.68"	Mountain ridge

Figure 2-15: Locations of Faunal Sampling Sites

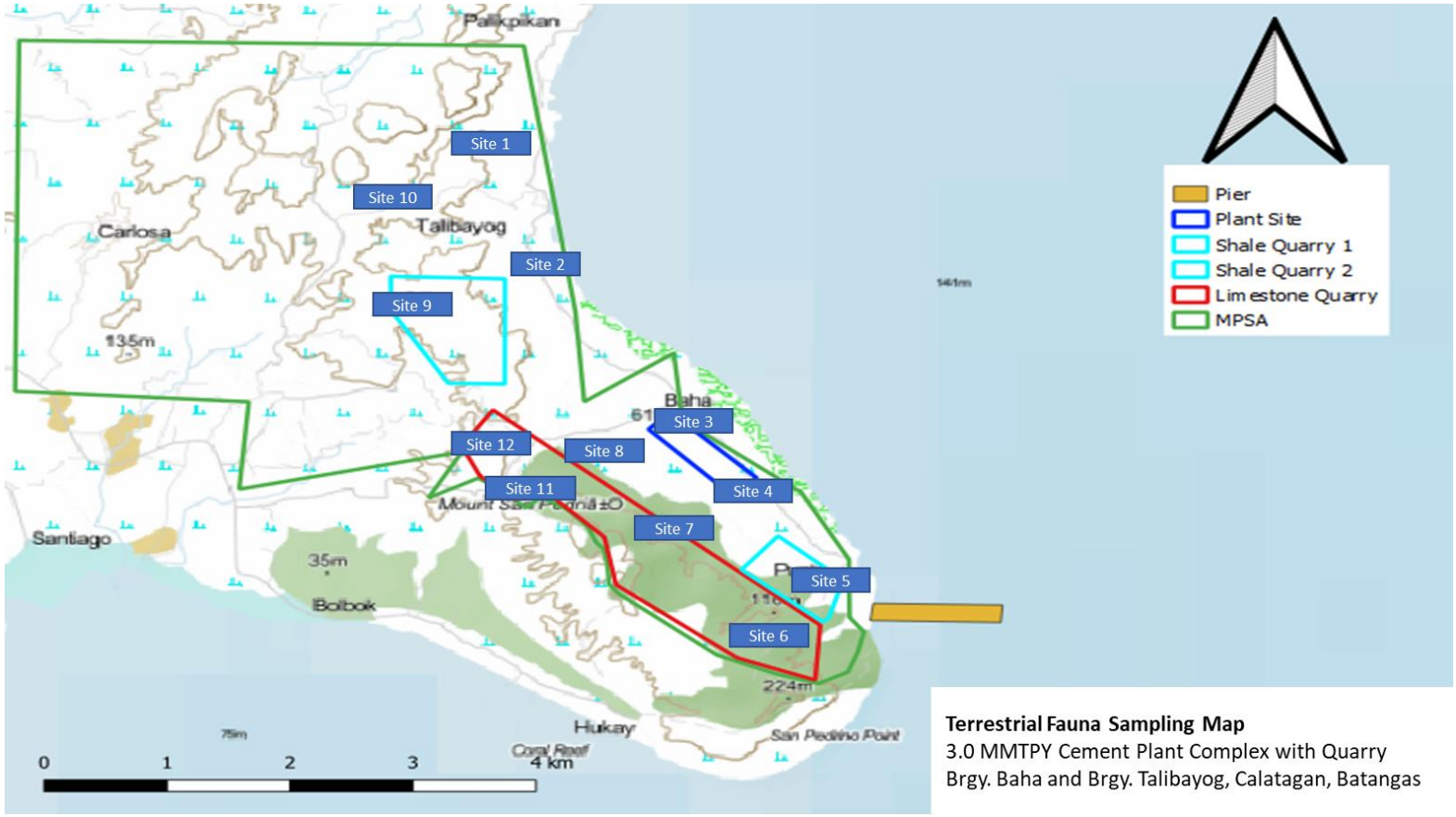


FIGURE NO.:	FIGURE TITLE:	
2-15	**Locations of Faunal Sampling Sites**	
PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
ASTURIAS INDUSTRIES INC	**3.0 MMTPY CEMENT PLANT COMPLEX WITH QUARRY** Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas	**LCI ENVI CORPORATION**

Fauna Composition and Richness

Birds

164 Recorded fauna species during the entire duration of survey are dominated by birds. A total of 43 species of birds were recorded from the 10 observation sites with a total abundance of 551. Recorded bird species belonged to 16 avi-fauna families, dominated by Columbidae. In terms of abundance, the Yellow Vented Bulbul (*Pycnonotus goiavier*) is the dominant species followed by the White Collared King Fisher (*Halchyon chloris*) and White -breasted Wood Swallow (*Artamus leucocrynchus*) with a total abundance of 83, 30 and 28, respectively.

165 In terms of species distribution, the Black-Naped Oriole (Oriolus chinensis) has the highest frequency of occurrence in the study area with a computed Relative Frequency of 5.988% followed by the White Collared King Fisher (Halchyon chloris) and Yellow Vented Bulbul (Pycnonotus goiavier) with Relative Frequency of 5.389% and 4. 790%, respectively.

166 Site 4 has the highest species diversity composition followed by Site 1 and Site 3 while Site 8 and Site 12 have the least species diversity. In terms of abundance, Site 2 has the utmost abundance followed by Site 3 while Site 6 has the least abundance.

167 Most of the observed species are noted to be common in lowland areas and in wide range of habitats including agricultural areas, shrub lands, grass lands and in settlement areas. Many of these species thrive even in highly disturbed areas including settlement areas. Endemism of recorded bird species showed that 12 species (27.3%) are endemic in the country and the rest are non-endemic species.

168 List of the bird species observed, and their corresponding abundance and frequency are summarized in **Table 2-8.**

Table 2-8: Abundance and Frequency of Bird Species observed within the Sampling Sites

Species Name	Scientific Name	Family	Total Abundance	Frequency	Relative Frequency
Ashy-headed Babbler	*Malacocincla cinereiceps*	Timaliidae	7	3	1.796
Asian Glossy Starlings	*Aplonis panayensis*	Sturnidae	7	2	1.198
Barn Swallow	*Hirundo rustica*	Hirundinidae	22	3	1.796
Barred Rail	*Gallirallus torquatus*	Rallidae	3	2	1.198
Black-Crowned Night Heron	*Nycticorax nycticorax*	Ardeidae	1	1	0.599
Black-Naped Oriole	*Oriolus chinensis*	Oriolidae	23	10	5.988
Blue Throated Bee Eater	*Merops viridis*	Meropidae	15	6	3.593
Bright-capped Cisticola	*Cisticola exilis*	Cisticolidae	3	2	1.198
Brown-tit Babbler	*Macronus striaticeps*	Timaliidae	4	2	1.198
Buff Banded Rail	*Hypotaenidia philippensis*	Rallidae	3	2	1.198
Chestnut Munia	*Lonchura mallaca*	Estrildidae	31	4	2.395
Common Emerald Dove	*Chalcopaps indica*	Columbidae	4	3	1.796
Eurasian Tree Sparrow	*Passer montanus*	Passeridae	53	6	3.593
Grey-Tailed Tattler	*Heterocelus brevipes*	Scolopacidea	4	1	0.599
Guaiabero	*Bolbopsittacus lunulatus*	Psittacidae	5	2	1.198
Lesser Coucal	*Centropus bengalensis*	Cuculidae	1	1	0.599
Long-Tailed Shrike	*Lanius schach*	Laniidae	8	4	2.395
Olive-backed Sunbird	*Nectarinia jugularis*	Nectariniidae	7	3	1.796
Pacific Swallow	*Hirundo tahita*	Hirundinidae	15	4	2.395
Philippine Bulbul	*Hypsipetes philippinus*	Pycnonotidae	11	3	1.796
Philippine Coucal	*Chalcophaps indica*	Cuculidae	15	7	4.192
Philippine Pygmy Wood Pecker	*Picoides maculatus*	Picidae	16	4	2.395
Pied Buschat	*Saxicola caprata*	Muscicapidae	12	6	3.593
Pied Fantail	*Rhipidura javanica*	Muscicapidae	11	5	2.994
Pied Thriller	*Lalage nigra*	Campephagidae	9	6	3.593
Pygmy Flower Pecker	*Dicaeum pygmaeum*	Dicaeidae	22	6	3.593

Species Name	Scientific Name	Family	Total Abundance	Frequency	Relative Frequency
Purple Heron	*Ardea purpurea*	Ardeidae	2	2	1.198
Red Jungle Fowl	*Gallus gallus*	Phasianidae	6	4	2.395
Red Turtle Dove	*Streptopelia tranquebarica*	Columbidae	14	5	2.994
Reddish Cuckoo Dove	*Macrophygia phasianella*	Columbidae	4	3	1.796
Red-keeled Flower Pecker	*Dicaeum australe*	Dicaeidae	3	2	1.198
Scally-breasted Munia	*Lonchura atricapilla*	Estrildidae	9	2	1.198
Slender Billed Crow	*Corvus macrorhynchos*	Corvidae	2	2	1.198
Spotted Button Quail	*Butorides striatus*	Turnicidae	2	2	1.198
Spotted Dove	*Spilopelia chinensis*	Columbidae	6	2	1.198
Straited Grass Bird	*Megalurus palustris*	Locustellidae	4	2	1.198
Tawny Grass Bird	*Megalurus timoriensis*	Sylviidae	7	4	2.395
White -breasted Wood Swallow	*Artamus leucocrynchus*	Motacillidae	28	7	4.192
White Collared King Fisher	*Halchyon chloris*	Alcedinidae	30	9	5.389
White-eared Brown Dove	*Phapitreron leucotis*	Columbidae	14	7	4.192
White-eared Tailor Bird	*Orthotomus cinereiceps*	Cisticolidae	1	1	0.599
Yellow Vented Bulbul	*Pycnonotus goiavier*	Pycnonotidae	83	8	4.790
Yellow-bellied Whistler	*Pachycephala philippinensis*	Pachycephalidae	1	1	0.599
Zebra Dove	*Geopelia striata*	Columbidae	23	6	3.593
Total Abundance			551		100
No. of Species			44		

Figure 2-16: Non-Endemic Avifauna Species within the Project Area

Above species are A) White Collared King Fisher (*Halchyon chloris*), B) Scally-breasted Munia (*Lonchura atricapilla*), C) Yellow Vented Bulbul (*Pycnonotus goiavier*), D) Black-Naped Oriole (*Oriolus chinensis*), E) Common Emerald Dove (*Chalcopaps indica*), F) Eurasian Tree Sparrow (*Passer montanus*), G) Purple Heron (*Ardea purpurea*), H) Pacific Swallow (*Hirundo tahita*), I) White -breasted Wood Swallow (Artamus leucocrynchus) and Zebra Dove (*Geopelia striata)*

FIGURE NO.:	FIGURE TITLE:	
2-16	**Non-Endemic Avifauna Species within the Project Area**	
PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
ASTURIAS INDUSTRIES INC	**3.0 MMTPY CEMENT PLANT COMPLEX WITH QUARRY** Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas	**LCI ENVI CORPORATION**

Mammal

169 There are 3 mammal species that were seen within the project area during the survey. These species were observed within the grass land ecosystem in Site nos. 4 and 5. Aside from these, the company personnel who were guarding the area mentioned that there are other 2 species that were observed several times this year within the project area which are the Long-tailed macaque (Philippine macaque) and Wild Pig (*Sus philippensis*).

Amphibian and Reptiles

170 A total of 8 herpetofauna species (5 reptiles and 3 amphibians) are recorded in the area. These species were observed and were accounted based on wildlife calls heard during the survey except for the Reticulated Python (*Python reticulatus*) which is discerned from the ethnobiological interview.

Fauna Endemism and Conservation Status

171 There are no critically endangered fauna species observed within study area. However, there is 1 considered nearly threatened and 3 are considered vulnerable (see **Table 2-9**).

Table 2-9: Conservation Status of Observed Fauna Species within the Study Area

Conservation status	Aves	Mammal/s	Reptiles	Amphibians	Total
Critically endangered	0	0	0	0	0
Near Threatened	1	0	0	0	1
Vulnerable	1	1	0	1	3
Least Concern	42	3	4	2	51
Not evaluated	0	0	1	0	1
TOTAL	**44**	**4**	**5**	**3**	**56**

Birds

172 Endemism of recorded bird species showed that 12 species or 27.3% are endemic in the country and the rest are non-endemic species. Recorded endemic species are as follows:

- Barred Rail (Garillus torquatus)
- Pygmy Flower Pecker (Dicaeum pygmaeum)
- White-Eared Brown Dove (*Phapitreron leucotis*)
- Philippine Bulbul (Hypsipetes philippinus)
- Red-Keeled Flower Pecker (*Dicaeum australe)*
- Ashy-headed Babbler (Malacocincla cinereiceps)
- Brown-tit Babbler (*Macronus striaticeps*)
- Guaiabero (Bolbopsittacus lunulatus)
- Philippine Pygmy Wood Pecker (*Picoides maculatus*)
- Philippine Coucal (*Chalcophaps indica*)
- White-eared Tailor Bird (*Orthotomus cinereiceps*)

- Yellow-bellied Whistler (Pachycephala philippinensis)

173 Based on the International Union for Conservation of Nature (IUCN) (2016), 41 bird species are under least concern (LC) category and the remaining 2 are under near threatened (NT) (Grey-Tailed Tattler/ *Heterocelus brevipes*) and nearly endangered (NE) (Reddish Cuckoo Dove/ *Macrophygia phasianella*).

Table 2-10: Conservation Status and Endemicity of Observed Birds

Species Name	Scientific Name	Family	Conservation Status (IUCN)	Endemicity
Ashy-headed Babbler	*Malacocincla cinereiceps*	Timaliidae	LC	Endemic
Asian Glossy Starlings	*Aplonis panayensis*	Sturnidae	LC	Non-endemic
Barn Swallow	*Hirundo rustica*	Hirundinidae	LC	Non-endemic
Barred Rail	*Gallirallus torquatus*	Rallidae	LC	Endemic
Black-Crowned Night Heron	*Nycticorax nycticorax*	Ardeidae	LC	Non-endemic
Black-Naped Oriole	*Oriolus chinensis*	Oriolidae	LC	Non-endemic
Blue Throated Bee Eater	*Merops viridis*	Meropidae	LC	Non-endemic
Bright-capped Cisticola	*Cisticola exilis*	Cisticolidae	LC	Non-endemic
Brown-tit Babbler	Macronus striaticeps	Timaliidae	LC	Endemic
Buff Banded Rail	*Hypotaenidia philippensis*	Rallidae	LC	Non-endemic
Chestnut Munia	*Lonchura mallaca*	Estrildidae	LC	Non-endemic
Common Emerald Dove	*Chalcopaps indica*	Columbidae	LC	Non-endemic
Eurasian Tree Sparrow	*Passer montanus*	Passeridae	LC	Non-endemic
Grey-Tailed Tattler	*Heterocelus brevipes*	Scolopacidea	NT	Non-endemic
Guaiabero	*Bolbopsittacus lunulatus*	Psittacidae	LC	Endemic
Lesser Coucal	*Centropus bengalensis*	Cuculidae	LC	Non-endemic
Long-Tailed Shrike	*Lanius schach*	Laniidae	LC	Non-endemic
Olive-backed Sunbird	*Nectarinia jugularis*	Nectariniidae	LC	Non-endemic
Pacific Swallow	*Hirundo tahita*	Hirundinidae	LC	Non-endemic

Species Name	Scientific Name	Family	Conservation Status (IUCN)	Endemicity
Philippine Bulbul	*Hypsipetes philippinus*	Pycnonotidae	LC	Endemic
Philippine Coucal	*Chalcophaps indica*	Cuculidae	LC	Endemic
Philippine Pygmy Wood Pecker	*Picoides maculatus*	Picidae	LC	Endemic
Pied Buschat	*Saxicola caprata*	Muscicapidae	LC	Non-endemic
Pied Fantail	*Rhipidura javanica*	Muscicapidae	LC	Non-endemic
Pied Thriller	*Lalage nigra*	Campephagidae	LC	Non-endemic
Pygmy Flower Pecker	*Dicaeum pygmaeum*	Dicaeidae	LC	Endemic
Purple Heron	*Ardea purpurea*	Ardeidae	LC	Non-endemic
Red Jungle Fowl	*Gallus gallus*	Phasianidae	LC	Non-endemic
Red Turtle Dove	*Streptopelia tranquebarica*	Columbidae	LC	Non-endemic
Reddish Cuckoo Dove	*Macrophygia phasianella*	Columbidae	NE	Non-endemic
Red-keeled Flower Pecker	*Dicaeum australe*	Dicaeidae	LC	Endemic
Scally-breasted Munia	*Lonchura atricapilla*	Estrildidae	LC	Non-endemic
Slender Billed Crow	*Corvus macrorhynchos*	Corvidae	LC	Non-endemic
Spotted Button Quail	*Butorides striatus*	Turnicidae	LC	Non-endemic
Spotted Dove	*Spilopelia chinensis*	Columbidae	LC	Non-endemic
Straited Grass Bird	*Megalurus palustris*	Locustellidae	LC	Non-endemic
Tawny Grass Bird	*Megalurus timoriensis*	Sylviidae	LC	Non-endemic
White -breasted Wood Swallow	*Artamus leucocrynchus*	Motacillidae	LC	Non-endemic
White Collared King Fisher	*Halchyon chloris*	Alcedinidae	LC	Non-endemic
White-eared Brown Dove	*Phapitreron leucotis*	Columbidae	LC	Endemic
White-eared Tailor Bird	*Orthotomus cinereiceps*	Cisticolidae	LC	Endemic

Species Name	Scientific Name	Family	Conservation Status (IUCN)	Endemicity
Yellow Vented Bulbul	*Pycnonotus goiavier*	Pycnonotidae	LC	Non-endemic
Yellow-bellied Whistler	*Pachycephala philippinensis*	Pachycephalidae	LC	Endemic
Zebra Dove	*Geopelia striata*	Columbidae	LC	Non-endemic

Mammal

174 Most of the mammal species observed are endemic while only Wild Pig (*Sus philippensis)* is categorized as vulnerable under the IUCN category.

Table 2-11: List of Mammal Species observed within the Study Area

Species Name	Scientific Name	Family	Conservation Status (IUCN)	Endemicity
Common Rat Snake	*Elaphe erythrura*	Colubridae	LC	Endemic
Greater Musky Fruit Bat	*Ptenochirus jagorii*	Pteropodidae	LC	Endemic
Long-tailed macaque	*Philippine macaque*	Cercopithecidae	LC	Endemic
Polynesian coconut rat	*Rattus exulans*	Muridae	LC	Non-endemic
Wild Warty Pig	*Sus philippensis*	SUIDAE	VU	Endemic

Amphibian and Reptiles

175 From the reptiles, the Reticulated Python (*Python reticulatus*) is considered nearly endangered (NE) based on the IUCN categorization. For the Monitor Lizard (*Varanus sp.*), it is under the least concern (LC) category of IUCN but is considered vulnerable according to the Convention on International Trade in Endangered Species of Fauna and Flora (CITES). All of the reptile species observed are non-endemic.

176 For the amphibian group, only the Busuanga Wart Frog *(Limnonectes acanthi)* is considered as vulnerable according to IUCN and is endemic.

Table 2-12: List of Herpetofauna Species observed within the Study Area

Species Name	Scientific Name	Family	Conservation Status (IUCN)	Endemicity
Reptiles				
Monitor Lizard	*Varanus salvator*	Varanidae	LC (IUCN), VU (CITES app.2)	Non-endemic
Gecko/Tokay	*Gecko gecko*	Gekkonidae	LC	Non-endemic
Bubuli/Skink	*Eutropis multifasciata*	Scincinidae	LC	Non-endemic
Reticulated Python*	*Python reticulatus*	Pythonidae	NE (IUCN), OTS (CITES app.2)	Non-endemic

Species Name	Scientific Name	Family	Conservation Status (IUCN)	Endemicity
Amphibian				
Busuanga Wart Frog	*Limnonectes acanthi*	Dicroglossidae	VU	Endemic
Marine Toad	*Rhinella marina*	Bufonidae	LC	Non-endemic
Banded bullfrog	*Kaloulo pulchra*	Microhylidae	LC	Non-endemic

Computed Biodiversity Index

177 The study area has **low biodiversity with very high species evenness**. Among the 12 sampling sites, 4 sites have moderate diversity with high species evenness having Site 4 as the highest level of diversity index measured. There are also 4 sites that have very low diversity but with high species evenness. These sites are mostly located in the upper section or those in higher elevation.

2.1.4.3 Vegetation removal and loss of habitat

178 The project development will require removal of vegetation communities and associations. The removal of vegetation will also result to reduction in the population of the plant species growing within the disturbance area. However, vegetation clearing will be limited to the area where the project facilities and equipment will be located. The surrounding vegetation will be preserved to act as natural air and noise buffers.

179 It is recognized that preservation of the magrove forest in the area is necessary. The project will therefore promote its protection and enhancement to maintain its natural function to the ecosystem as home to remaining flora and fauna species, carbon sink, and as natural buffer to extreme climate variabilities.

2.1.4.4 Threat to existence and/or loss of important local species

180 The project will require land clearing resulting to the removal of portions of remaining vegetation's to give way for the construction of proposed cement plant complex and quarry. This entails to disturbance of wildlife, loss of habitats and reduction to biodiversity composition of the area.

2.1.4.5 Threat to abundance, frequency and distribution of important species

181 Continuous loss of faunal habitats due to degradation of forest cover brought by land clearing, conversion of remaining sites into settlements and other land uses. Though faunal species are mobile in nature, this situation will force them to migrate in other areas to search for new habitat. Migration of other wildlife to new territories or ecosystem will pose threat to their existence. They can be further exposed to hunting, persecution and trading. Continuous destruction of faunal habitats and disturbance will threaten the remaining species population and survival in the near future if not prevented. Decrease of population to some species in this area will be expected to happen while others may not significantly be affected.

2.1.4.6 Hindrance to wildlife access

182 Wildlife disturbance due to noise generated during construction brought about by the operation of heavy equipment's will force faunal species to migrate in other or nearby areas/habitat where disturbance is less.

183 Wildlife may find habitat to the erected structures recognized by species within and around built structures and or canals in the long run. Animals sighted within and around the facilities may be allowed to habituate unless they pose danger, damage and/or malfunction to the structure.

2.1.5 Summary of Baseline Findings, Impacts and Mitigation on Land

184 The following table summarizes the impacts and mitigating measures on Land.

Table 2-13: Summary of Significant Baseline Findings and Potential Impacts and Mitigation on Land

SUMMARY OF BASELINE FINDINGS ON LAND

- **Land Use and Classification**
  - Existing land use is industrial area. (Calatagan 2017-2027 CLUP)
- **Geology and Geomorphology**
  - The area is susceptible to the following geologic hazards: flooding, landslides, tsunamis.
- **Pedology**
  - Based on the soil quality assessment, the detected levels of all parameters tested were way below the respective threshold limits/intervention values.
  - Sedimentation and erosion are already present even before site development.
- **Terrestrial Ecology**
  - Out of the 121-species of flora identified from the project area, thirteen (13) species are included in the The IUCN Red List of Threatened Species version 2017-3.
  - There are no critically endangered fauna species observed within study area. However, there is 1 considered nearly threatened and 3 are considered vulnerable.

POTENTIAL IMPACTS	PROJECT PHASES	FINDINGS/OBSERVATIONS	MITIGATING MEASURES
Geology and Geomorphology			
Modification of existing terrain	Construction, Operation	Existing terrain will be modified due to earth movement and excavation	Proper backfilling may be required to prevent impact to surrounding areas
Devaluation of land value a result of improper solid waste management	Construction, Operation, Abandonment	Generation of construction spoils and debris and solid wastes from operations	• Provision of disposal area • Segregation of debris according to recyclable and non-recyclables • Hauling of debris items by duly-licensed traders • Implementation of a solid waste management plan
PEDOLOGY			
Change in soil quality/fertility	Construction, Operation, Abandonment	There is a risk of soil contamination due to the maintenance of heavy equipment	• Collect, store and dispose wastes in safe and sealed containers • Treatment and dispose wastes through accredited treaters • Use sawdust, rice hulls, or coir dusts to absorb the oil spills
Soil erosion / loss of topsoil	Construction	The removal of vegetation cover will lead to loss/removal of topsoils resulting from excavation activities.	• Establish buffer zones with vegetation • Avoid unnecessary earth movement and removal of vegetation

		Erosion and siltation of the nearby coastal water may occur due to occasional rains and during movement of heavy equipment passing over unpaved roads and soil stockpile area.	
TERRESTRIAL BIOLOGY			
Vegetation removal and loss of habitat	Construction, Operation	Disturbance and/or displacement of flora and fauna	• Prepare management plans and protection/conservation strategies • Perform earth-balling for trees when necessary • Avoidance of unnecessary tree-cutting • Create reserve or protected areas to still produce and sustain biodiversity even with the implementation of the proposed Project • Establishment of plant nurseries • Retaining and managing viable habitat units within and surrounding the project's development block areas • Reforestation • Conduct trainings, seminars and field demonstrations on company personnel on how to identify, care, propagate these threatened native tree species

2.2 The Water

2.2.1 Hydrology/Hydrogeology

185 The general drainage flow at the proposed project site is towards the northeast direction or Balayan Bay. Within the project site, there is no river or perennial stream, only natural gullies that channel water runoff from upslope down to the low-lying areas. Drainage canals or ditches have been constructed to properly collect and direct water to the bay or coastal area.

186 Based on the existing topography of the site, there are five (5) major natural gullies or swales that make up the drainage system of the area. These gullies collect, channel and drain water runoff from the project site to the coastal area. Four (4) of these gullies are connected to constructed open canals that cross the existing public road. One drainage canal is located near the boundary of Brgy. Baha and Brgy. Talibayog, two in the middle part of Brgy. Baha and one at the southeastern end of the project site in Sitio Punta.

187 The canals are concrete-lined on the main road, but without lining from the road to the coastal area. **Figure 2-17** shows the general drainage flow at the project site with the major gullies plotted. On a normal dry period, the drainage canals are totally dry. However, on a rainy period, water level in the drainage canals can reach to about a foot deep.

188 Usually, water runoff from upslope areas in Brgy. Baha is observed to be highly turbid, indicating that considerable silt is entrained in the runoff. This could be attributed to the large open areas upslope which are being cultivated for agriculture. The highly turbid water runoff causes discoloration to the coastal waters during events of heavy rains.

Figure 2-17: Drainage Map Of the Proposed Site

FIGURE NO.:	FIGURE TITLE:
2-17	**DRAINAGE MAP OF PROPOSED SITE**

PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
ASTURIAS INDUSTRIES INC	**3.0 MMTPY CEMENT PLANT COMPLEX WITH QUARRY** Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas	**LCI ENVI CORPORATION**

2.2.1.1 Change in drainage morphology/inducement of flooding/reduction in stream volumetric flow

189 Change in drainage morphology is inevitable given the nature of the project. Furthermore, removal of vegetation may reduce the water holding capacity of the watershed, which may result to higher discharges during heavy rainfall.

190 To minimize the impact to the natural drainage, the proponent shall develop the drainage during the quarry development. Canals shall also be constructed in the plant site to prevent flooding. Sedimentation ponds shall also be constructed in strategic areas around the plant site and in the quarry areas. The drainage and sedimentation ponds shall be regularly desilted to maximize its water holding capacity.

191 The project will not also induce flooding in the area since there will be a stormwater drainage system that will be developed in the project site. Also, discharges from the project will be limited to the treated domestic wastewater only. The drainage system will drain in the nearest coastal water.

2.2.1.2 Change in stream, lake water depth

192 There are no streams or lakes near the project site/vicinity as shown in **Figure 2-18**. The project will not affect the stream of any surface water body in the area.

2.2.1.3 Depletion of water resources/competition in water use

193 The main water source of Brgy. Baha and Brgy. Talibayog is deep wells. However, according to the list of the National Water Resources Board, there are no permit holders in the said barangays for the extraction of the groundwater.

194 The construction of the cement plant complex will require 100 m^3/day for domestic and construction usage and will be sourced from deep wells. For dust mitigation, 300 m^3/day of water will be needed for water spraying which will be supplied by the nearby coastal water. For the operation of the cement plant and quarry, 370 m^3/day of the water requirement will be supplied by deep wells while the remaining 300 m^3/day water requirement will be sourced from the coastal water.

195 Depletion of water resource or competition in water use in the area is not expected once the activities of the project start. Asturias will be developing its own deep wells and NWRB permits will be secured. Also, there are no immediate communtiies located in the project site.

196 Competition in water use will not also be an issue since all the residents of Brgy. Baha and some residents of Brgy. Talibayog are already relocated. The nearest community to the project site is approximately 2-km away, hence competition in water use should not be observed during project operation.

Figure 2-18: Hydrogeological Map of the Proposed Site

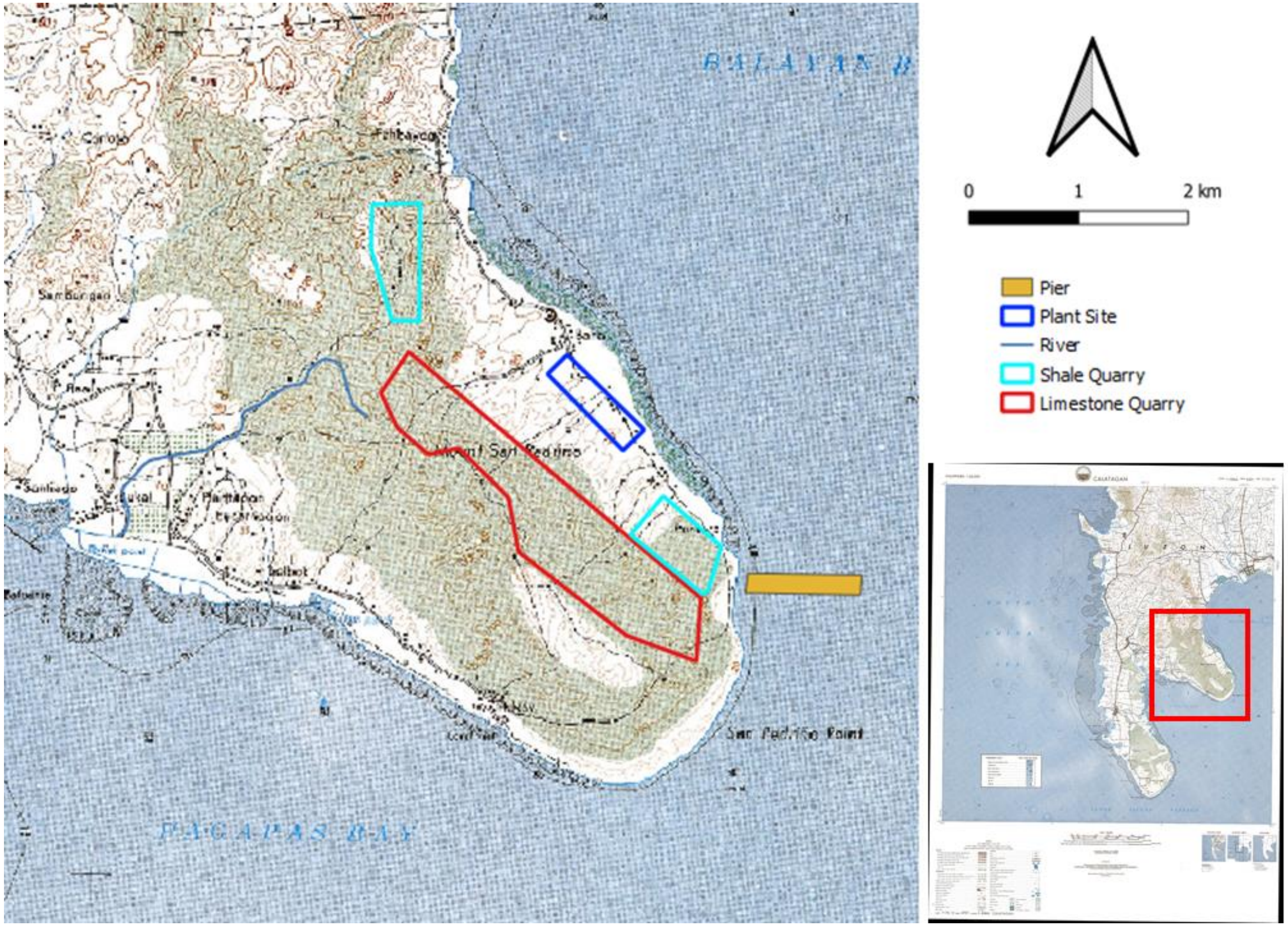


FIGURE NO.:	FIGURE TITLE:	
2-18	**HYDROGEOLOGICAL MAP OF PROPOSED SITE**	
PROJECT PROPONENT: **ASTURIAS INDUSTRIES INC**	PROJECT TITLE & LOCATION: **3.0 MMTPY CEMENT PLANT COMPLEX WITH QUARRY** Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas	REPORT PREPARER: **LCI ENVI CORPORATION**

2.2.2 Oceanography

197 The study areas for physical oceanography are the coastal waters adjacent to the southwestern shores of Balayan Bay. This is where the sediments coming from the limestone quarry are expected to be delivered by small creeks and other natural drainage ways**.**

198 This part of the bay is quite deep with depths of up to 100 to 150 meters within <1 km offshore. Near the coastline, the sea bed is mud and sand. Sea grasses have been observed along the coastal waters from Barangay Baha to Barangay Talibayog. Corals are found near the coasts from Barangay Punta to Barangay Baha. Sandy seabed was observed from Barangay San Firo to Balayan. The bathymetry of the study area is shown in **Figure 2-19.**

Tides

199 The tidal patterns in Balayan Bay follow closely the tidal characteristics of the Manila Bay Reference Station. This reference tide station is located in the Manila South Harbor at Pier 15. Its data shows an MHW of 0.861 m, MSL of 0.475 m, MLW of 0.099 m and MHHW of 1.004 m. Its bench mark elevation is 3.240 meters.

Waves

200 The wave heights in Balayan Bay differ with season. During the southwest monsoon season, the bay is partly exposed to SW winds and the sea surface is relatively rough with significant wave heights of up to about 1.5 meters. During NE monsoon season, the bay is shielded by the land mass and the significant wave height is only up to about 0.6 meters. However, during typhoons, wave heights of up to 3 meters were reportedly observed. Observed tidal waves in Balayan are presented in **Figure 2-20.**

Observed Currents

201 A hydrographic survey was conducted on September 1996 (Gaia South, Inc. 1996). The purpose of the survey was to measure current speeds and directions near the coasts in order to estimate longshore currents. The flood tide current measures were made from 8:00 AM to 12:00 NN while the ebb tide current were measured from 2:00 PM to 6:00 PM. The observed current data are presented in

202 **Table** 2-14. It is noted that current directions are generally northward during flood tide and generally southward during ebb tide. The measured currents were quite strong for a bay. The current speeds range from 1.5 cm/s to 7.2 cm/s during flood tide and from 1.8 to 12.2 during ebb tide. Observed seawater temperatures at 1 meter from sea surface range from 27.5 to 29.0 ^{o}C.

Simulated Wind-Driven Currents

203 The current patterns in the study area were simulated using a depth-integrated barotropic circulation model. These simulated flow patterns show north to northwesterly wind-driven currents near the project site for winds coming from SW and southerly to southwesterly currents with NE and E winds. These show a maximum current speed of about 3 cm/s at the southern coastlines but very weak wind-driven of only 1 cm/s in the coasts near the project site. It should be noted, however, that these currents are depth-integrated and are more related to net transport velocities rather than estimates of surface currents. The results of the simulated wind-driven currents are presented in **Figure 2-21** to **Figure 2-23.**

Table 2-14: Observed Ocean Current Speed and Direction in Balayan Bay

Station	Depth (m)	FLOOD TIDE			EBB TIDE		
		Local Time (hrs)	Current		Time (hrs)	Current	
			Speed (cm/s)	Direction (Azimuth)		Speed (cm/s)	Direction (Azimuth)
1	5	0820	6.0	321	1405	12.2	**186**
2	5	0830	39	334	1425	4.0	**172**
3	5	0922	1.5	316	1542	3.5	**173**
4	5	1014	5.1	16	1556	1.8	**218**
5	5	1054	3.8	88	1622	3.8	**250**
6	**5**	**1124**	**7.2**	**142**	**1646**	**1.9**	**358**

2.2.2.1 Change/disruption in water circulation pattern, littoral current and coastal erosion and deposition

204 The proposed project will not involve construction of a pier facility however the operation of the cement plant complex will utilize the pier facility of the industrial park where it will be located.

2.2.2.2 Change in bathymetry

205 The proposed project is not expected to change the bathymetry of the area since the project willl not involve the construction of pier facility.

Figure 2-19: Bathymetry of the Study Area

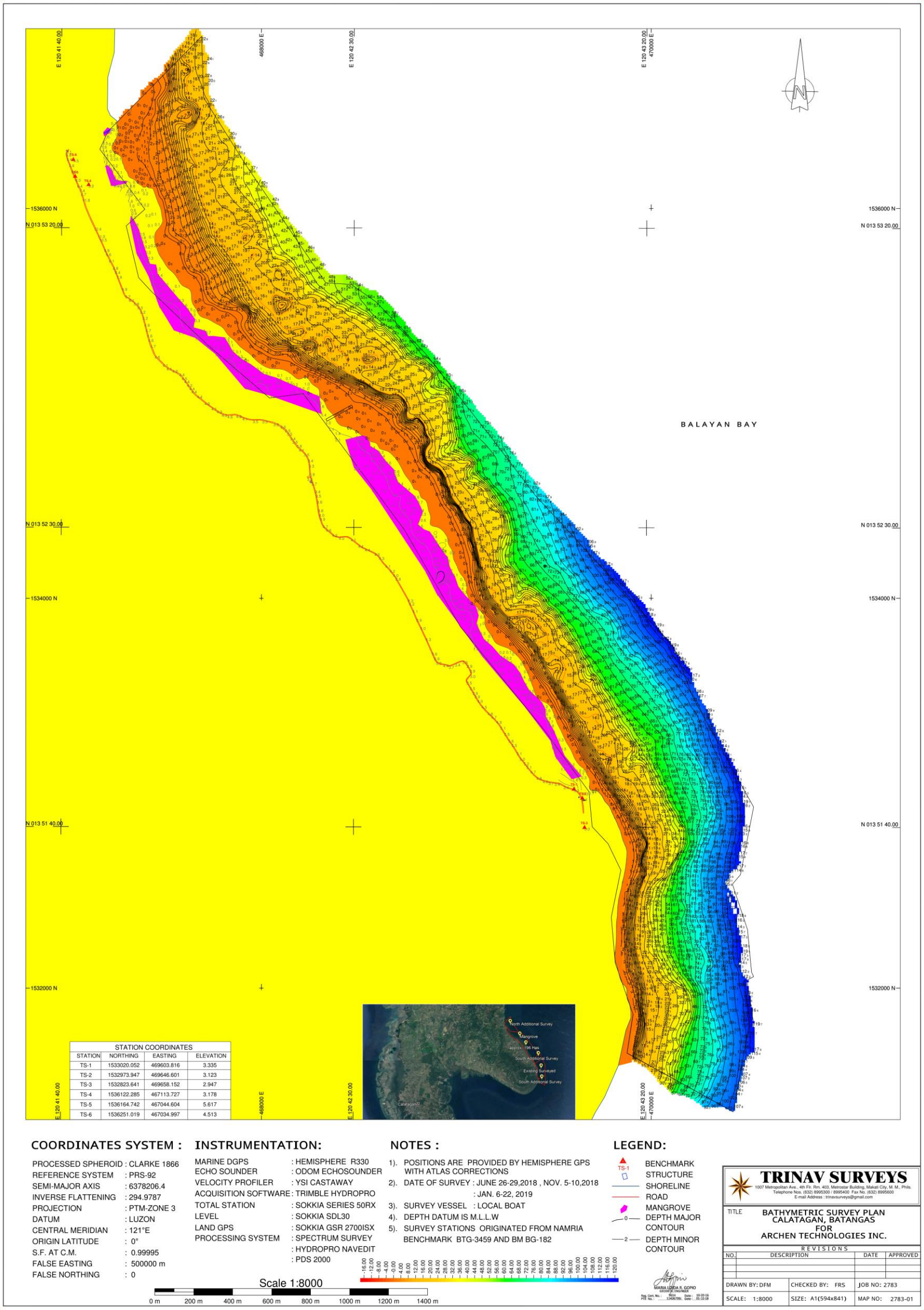


FIGURE NO.:	FIGURE TITLE:
2-19	**BATHYMETRY OF THE STUDY AREA**

PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
ASTURIAS INDUSTRIES INC	**3.0 MMTPY CEMENT PLANT COMPLEX WITH QUARRY** Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas	**LCI ENVI CORPORATION**

Figure 2-20: Observed Tidal Heights in Balayan Bay

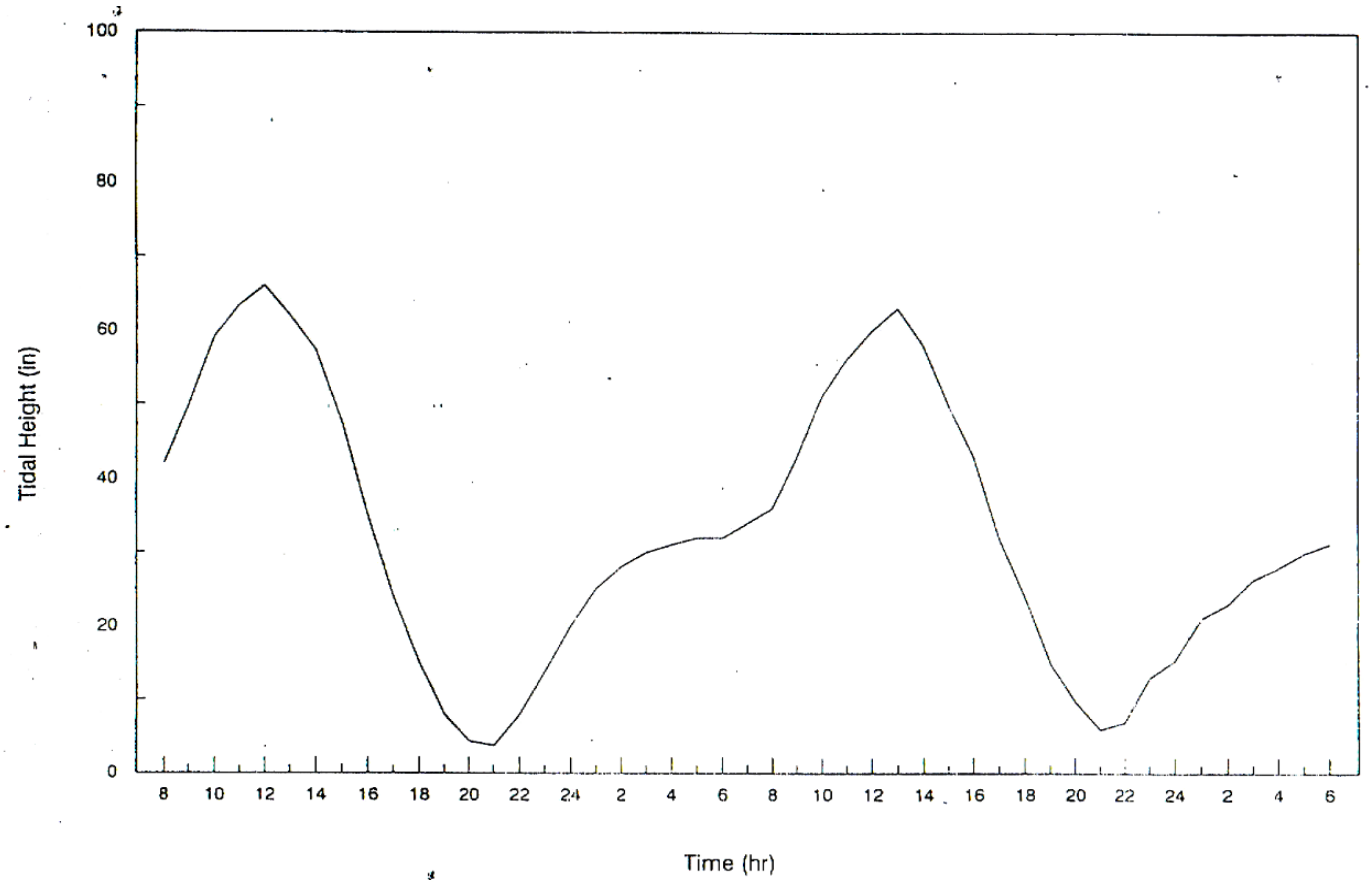


FIGURE NO.:	FIGURE TITLE:
2-20	**OBSERVED TIDAL HEIGHTS IN BALAYAN BAY**

PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
ASTURIAS INDUSTRIES INC	**3.0 MMTPY CEMENT PLANT COMPLEX WITH QUARRY** Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas	**LCI ENVI CORPORATION**

Figure 2-21: Simulated Wind-Driven Current Directions (SW Wind)

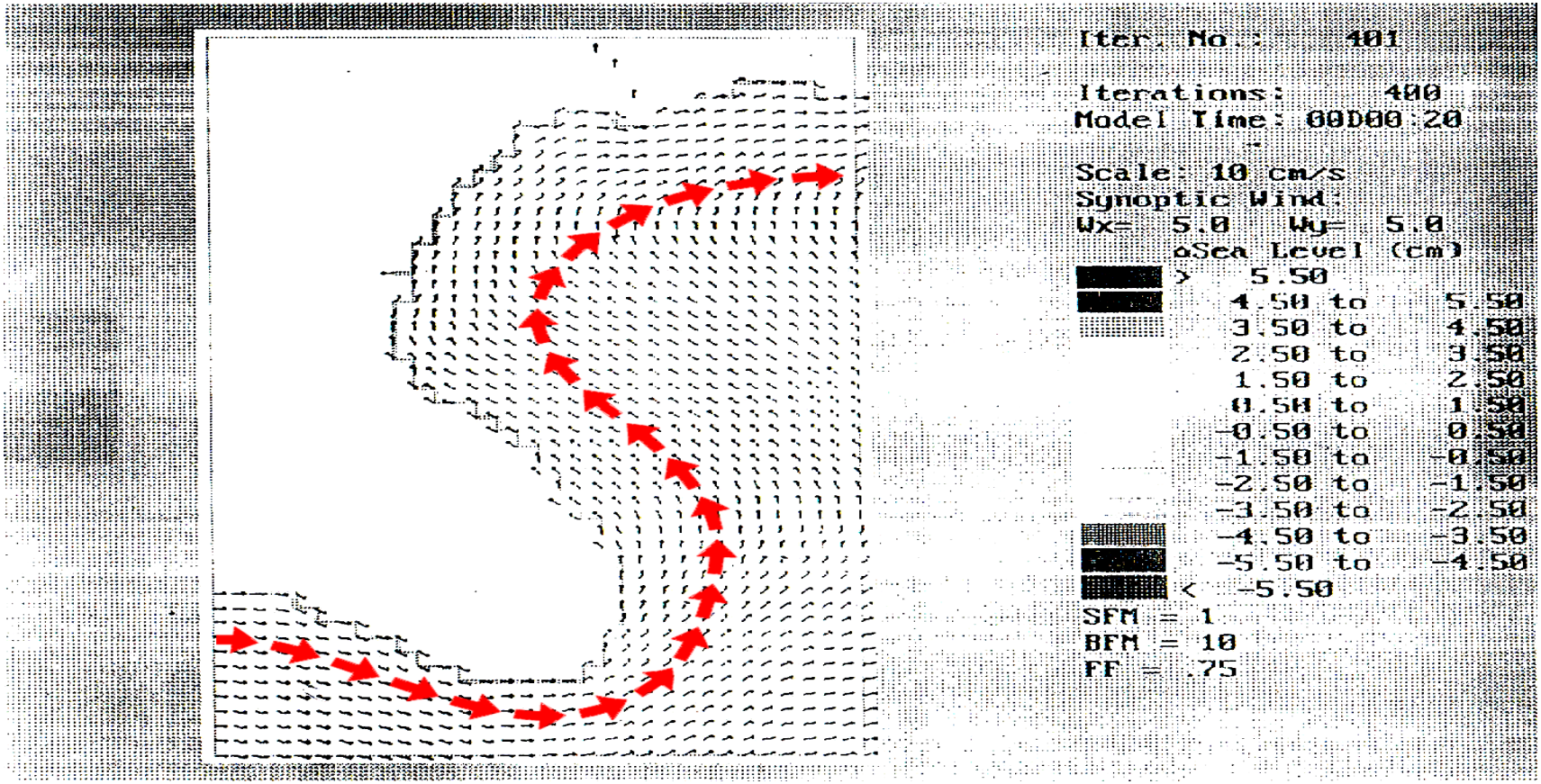


FIGURE NO.:	FIGURE TITLE:
2-21	**Simulated Wind-Driven Current Directions (SW Wind)**

PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
ASTURIAS INDUSTRIES INC	**3.0 MMTPY CEMENT PLANT COMPLEX WITH QUARRY** Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas	**LCI ENVI CORPORATION**

Figure 2-22: Simulated Wind-Driven Current Directions (NE Wind)

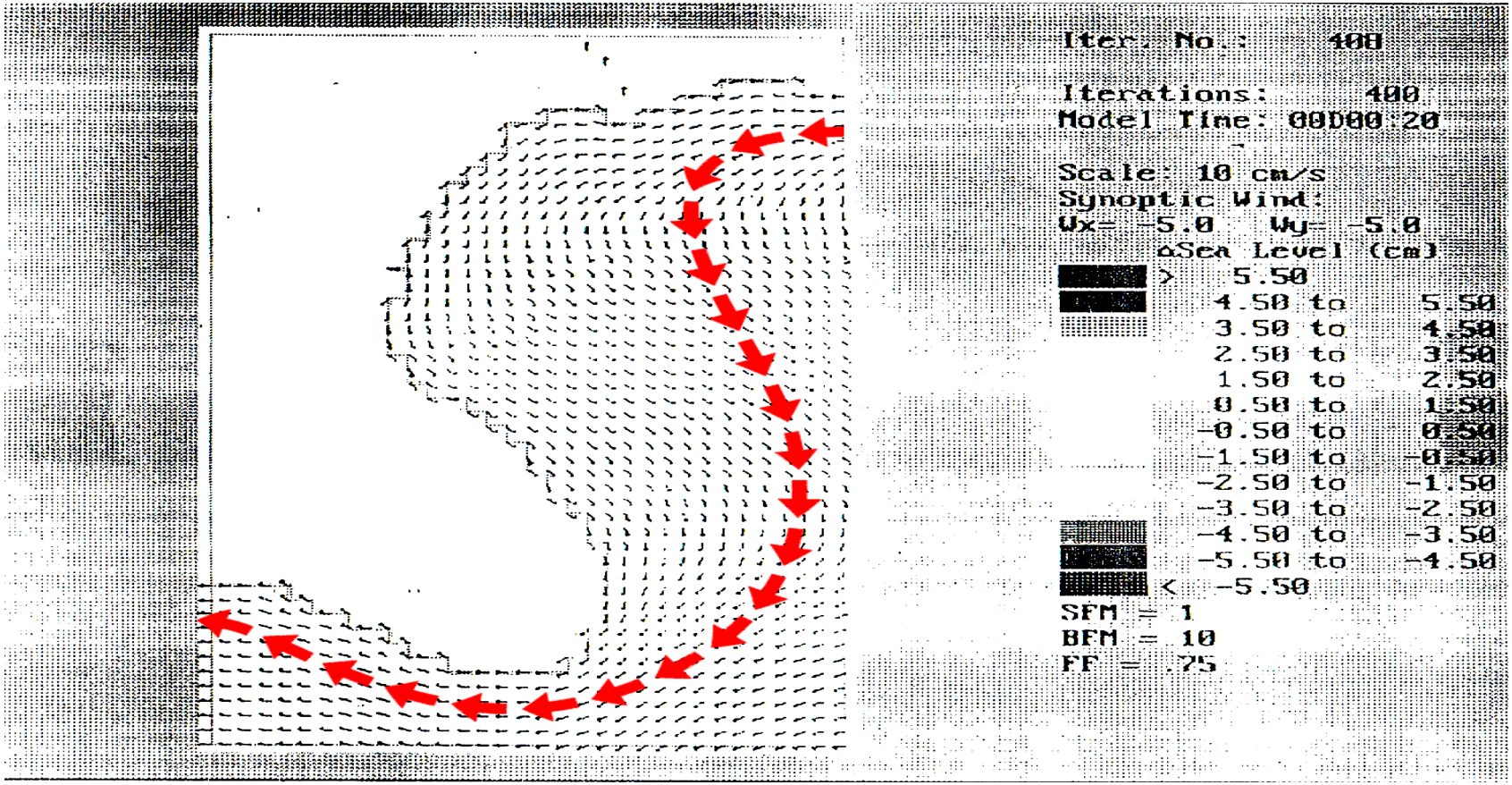


FIGURE NO.:	FIGURE TITLE:
2-22	**Simulated Wind-Driven Current Directions (NE Wind)**

PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
ASTURIAS INDUSTRIES INC	**3.0 MMTPY CEMENT PLANT COMPLEX WITH QUARRY** Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas	**LCI ENVI CORPORATION**

Figure 2-23: Simulated Wind-Driven Current Directions (E Wind)

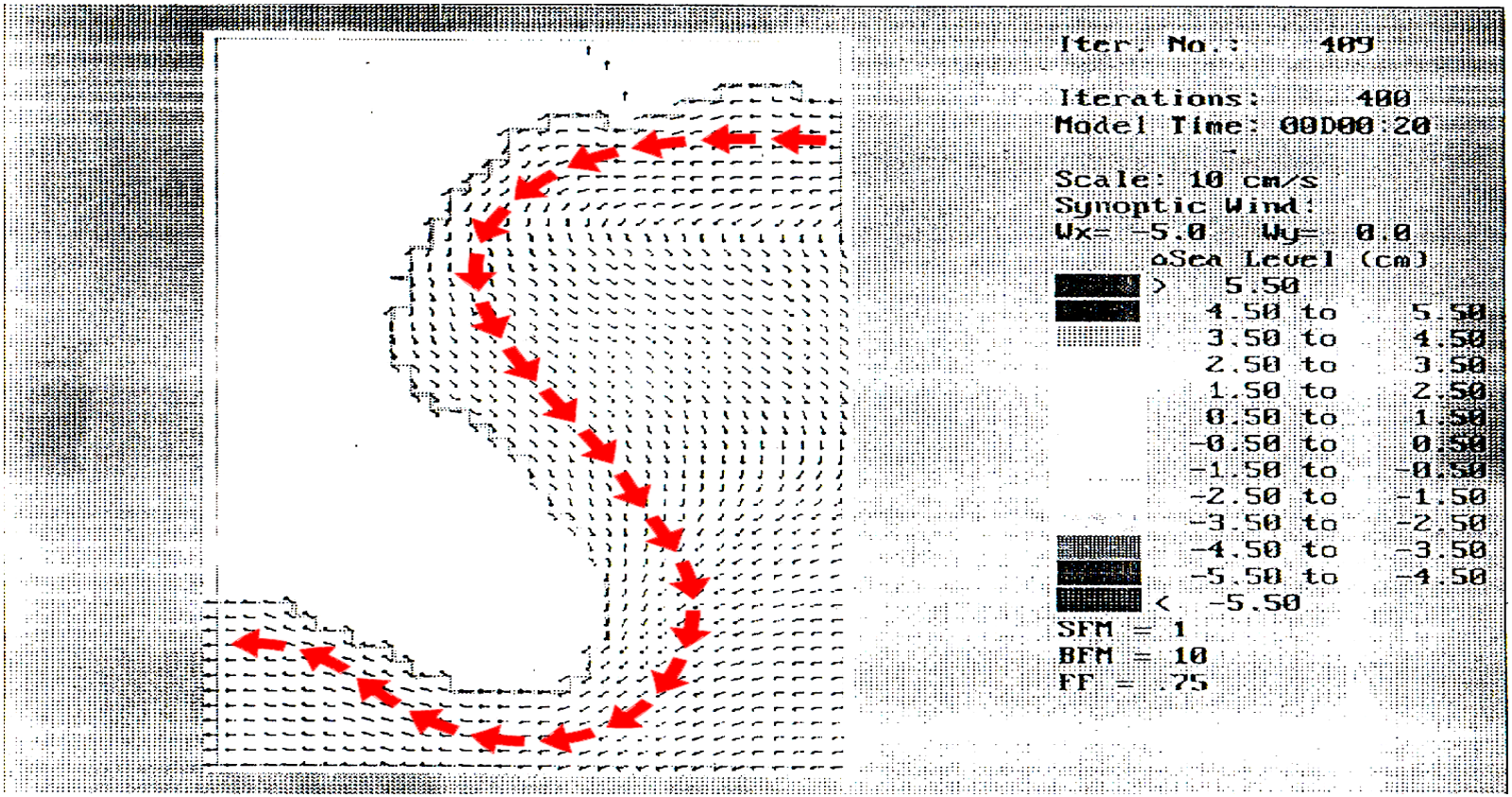


FIGURE NO.:	FIGURE TITLE:
2-23	**Simulated Wind-Driven Current Directions (E Wind)**

PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
ASTURIAS INDUSTRIES INC	**3.0 MMTPY CEMENT PLANT COMPLEX WITH QUARRY** Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas	**LCI ENVI CORPORATION**

2.2.3 Water Quality

2.2.3.1 Degradation of groundwater quality

206 Groundwater samples were collected on 27 June 2018 from 11:00am to 1:00pm. Samples were collected from four shallow wells within the property. Details on the location of the groundwater sampling stations within the project site are shown in **Figure 2-24** and **Figure 2-25.**

207 The summary of the results on the groundwater analysis is shown in **Table 2-15**. The results were compared with the Philippine National Standards for Drinking Water (PNSDW) of 2017 and with the DENR AO No. 2016-08 for Class A water body. The following were observed to exceed the standards. This could have been due to the contamination at the water table source or from the water piping.

- GW3 and GW4 exceeded the DENR limit for Nitrate;
- GW4 exceeded the DENR limit for TSS; and,
- GW1, GW2 and GW4 have Fecal Coliform above the limit of PNSDW and DENR.

208 The ground water quality may be affected by accidental oil spills due to the influx of heavy equipment during the construction phase. Maintenance of these equipment must be limited in an area lined with cement.

209 Accidental oil spills may also happen during the operation phase since there will be trucks that will deliver the products. The trucks shall not have access to areas that are not lined with cement. The proponent has a truck marshaling area within the project site.

210 Diesel oil will also be stored in the area. Storage of fuel in the area increases the risk of accidental oil spills. Bund walls and secondary containment areas are part of the design of the fuel storage.

211 Another aspect that may affect ground water quality is the influx of workers in the area. Ground water quality may be affected by domestic wastewater. The proponent will install proper sanitation facilities and will also construct sewage treatment plant to ensure proper treatment of the domestic wastewater prior to discharge.

212 **Asturias Industries, Inc.** will monitor ground water quality from the deep well that will be installed within the plant site. The parameters to be monitored are pH, fecal coliform, and oil & grease.

Table 2-15: Results of Groundwater Sampling

PARAMETER	UNIT	DETECTED LEVEL AT THE SAMPLING POINTS BASED ON LABORATORY ANALYSIS (values in RED exceed the reference standard/s)				GUIDELINE VALUE FOR DRINKING WATER QUALITY	GUIDELINE VALUE FOR CLASS A WATER BODY
		GW 1	*GW 2*	*GW 3*	*GW 4*	*(DOH AO No. 2017-10)*	*(DENR AO No. 2016-08)*
pH	pH	**7.2**	**6.9**	***7.1***	***6.5***	**6.5 – 8.5**	**6.5 – 8.5**
Nitrate as NO_3-N	mg/L	**10**	**2.0**	***8.5***	***9.0***	**50.00**	**7**
Phosphate	mg/L	**0.2**	**0.2**	***0.2***	***0.2***	*	**0.5**
Total Suspended Solids	mg/L	**4.0**	**31**	***3.0***	***34***	*	**26-30**
Oil & Grease	mg/L	**0.4**	**0.6**	***0.5***	***0.7***		
Fecal Coliform	MPN/100mL	**2.2**	**2.2**	***1.0***	***12***	**<1.1**	**<1.1**
Arsenic	mg/L	**<0.008**	**<0.008**	***<0.008***	***<0.008***	**0.01**	**0.01**
Cadmium	mg/L	**<0.001**	**<0.001**	***<0.001***	***<0.001***	**0.003**	**0.003**
Chromium	mg/L	**<0.005**	**<0.005**	***<0.005***	***<0.005***	**0.05**	**0.01**
Lead	mg/L	**<0.005**	**<0.005**	***<0.005***	***<0.005***	**0.01**	**0.01**

NOTES: mg/L = Milligrams per liter | MPN/100mL = Most probable number per 100 milliliters
(*) No guideline value at present

Figure 2-24: Photographs and Coordinates of Groundwater Sampling Sites

GW1: 13.861128°, 120.720409°

GW2: 13.863806° 120.717264°

GW3: 13.883298°, 120.699456°

GW4: 13.890903°, 120.695579°

FIGURE NO.:	FIGURE TITLE:
2-24	**Photographs and Coordinates of Groundwater Sampling Sites**

PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
ASTURIAS INDUSTRIES INC	**3.0 MMTPY CEMENT PLANT COMPLEX WITH QUARRY** Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas	**LCI ENVI CORPORATION**

Figure 2-25: Groundwater Sampling Map

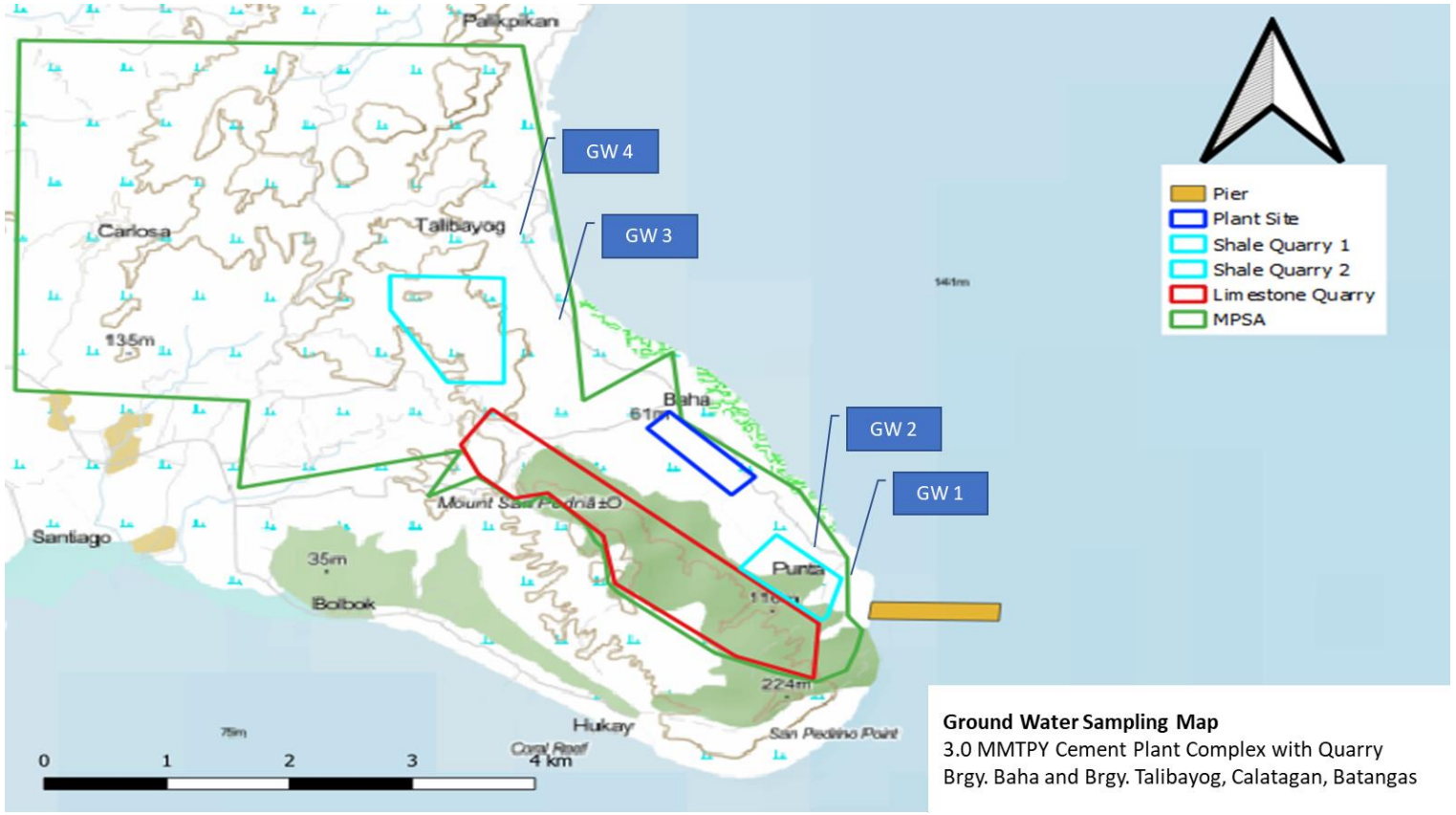


FIGURE NO.:	FIGURE TITLE:	
2-25	**GROUNDWATER SAMPLING MAP**	
PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
ASTURIAS INDUSTRIES INC	**3.0 MMTPY CEMENT PLANT COMPLEX WITH QUARRY** Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas	**LCI ENVI CORPORATION**

2.2.3.2 Degradation of surface water quality

213 There are no immediate surface water within the project site, therefore the proposed project will not cause degradation of surface water quality.

2.2.3.3 Degradation of coastal/marine water quality

214 Four water samples were also collected in the Balayan bay, the nearest coastal water in the project site, last 27 June 2018. Details of the coastal water sampling is shown in **Figure 2-26** and **Figure 2-27.**

215 Results of the laboratory analysis are presented in **Table 2-16** and were compared to the water quality criteria of DENR for Class SC water. Based from the results, only CW4 exceeded the standard limit for fecal coliform. This may be due to the disposal of domestic wastewater into the coastal water.

Table 2-16: Results of Coastal Water Sampling

PARAMETER	UNIT	DETECTED LEVEL AT THE SAMPLING POINTS BASED ON LABORATORY ANALYSIS (values in RED exceed the reference standard/s)				GUIDELINE VALUE FOR CLASS SC WATER BODY
		CW 1	*CW 2*	*CW 3*	*CW 4*	*(DENR AO No. 2016-08)*
pH	pH	**8.0**	**8.1**	***8.1***	***8.1***	**6.5 – 8.5**
Nitrate as NO_3-N	mg/L	**0.09**	**0.6**	***0.02***	***0.4***	**10**
Phosphate	mg/L	**<0.006**	**0.04**	***0.01***	***<0.006***	**0.5**
Total Suspended Solids	mg/L	**3.3**	**3.7**	***3.7***	***3.0***	**80**
Oil & Grease	mg/L	**0.5**	**0.5**	***0.7***	***0.5***	**3**
Fecal Coliform	MPN/100mL	**23**	**23**	***<1.8***	***350***	**200**

NOTES: mg/L = Milligrams per liter | MPN/100mL = Most probable number per 100 milliliters

216 The project may have impacts on the coastal water quality, particularly on the concentration of total suspended solids, during the construction and operation of the cement plant complex.

217 During construction, building materials and debris may affect the quality of the coastal water if not properly managed. To mitigate this concern, sediment traps and erosion barriers shall be installed prior to any construction activities.

218 Since heavy equipment will be used, another concern during the construction is accidental oil spills. An oil spill management plan must be in place. Furthermore, the canal in the assigned repair area of vehicles must be maintained.

219 Influx of workers may entail higher organic load through wastes. Proper sanitation facilities must be installed given the projected influx of workers during the construction phase. A sewage treatment plant will also be provided to reduce the organic load of the human wastes that will be generated once operation starts.

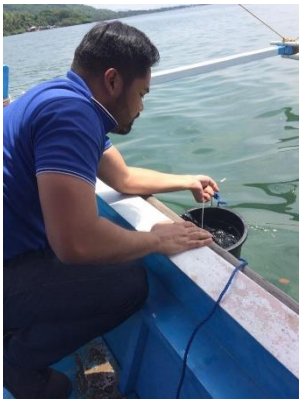
220 Operation of the cement plant will also utilize the pier facility of the industrial parkfor the delivery of the cement products. This activity might also cause spillage of oil and of the cement products in the coastal water. An oil spill management plan will be prepared by the proponent and will be applied in case of oil spill in the coastal area.

221 Surface run-off from the quarry areas and cement plant may also affect the TSS level of the nearby coastal water. Siltation ponds will be constructed in strategic areas around the project site to collect and reduce the suspended solids of run-off.

222 The proponent commits to quarterly monitoring of coastal water. The main parameters that will be monitored are pH, TSS, oil & grease, and fecal coliform.

Figure 2-26: Photographs and Coordinates of Coastal Water Sampling Sites

CW1: 13.861357°, 120.722615°



CW2: 13.865555°, 120.719968°

CW3: 13.884391°, 120.703207°

CW4: 13.891385°, 120.699631°

FIGURE NO.:	FIGURE TITLE:
2-26	**PHOTOGRAPHS AND COORDINATES OF COASTAL WATER SAMPLING SITES**

PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
ASTURIAS INDUSTRIES INC	**3.0 MMTPY CEMENT PLANT COMPLEX WITH QUARRY** Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas	**LCI ENVI CORPORATION**

Figure 2-27: Coastal Water Sampling Map

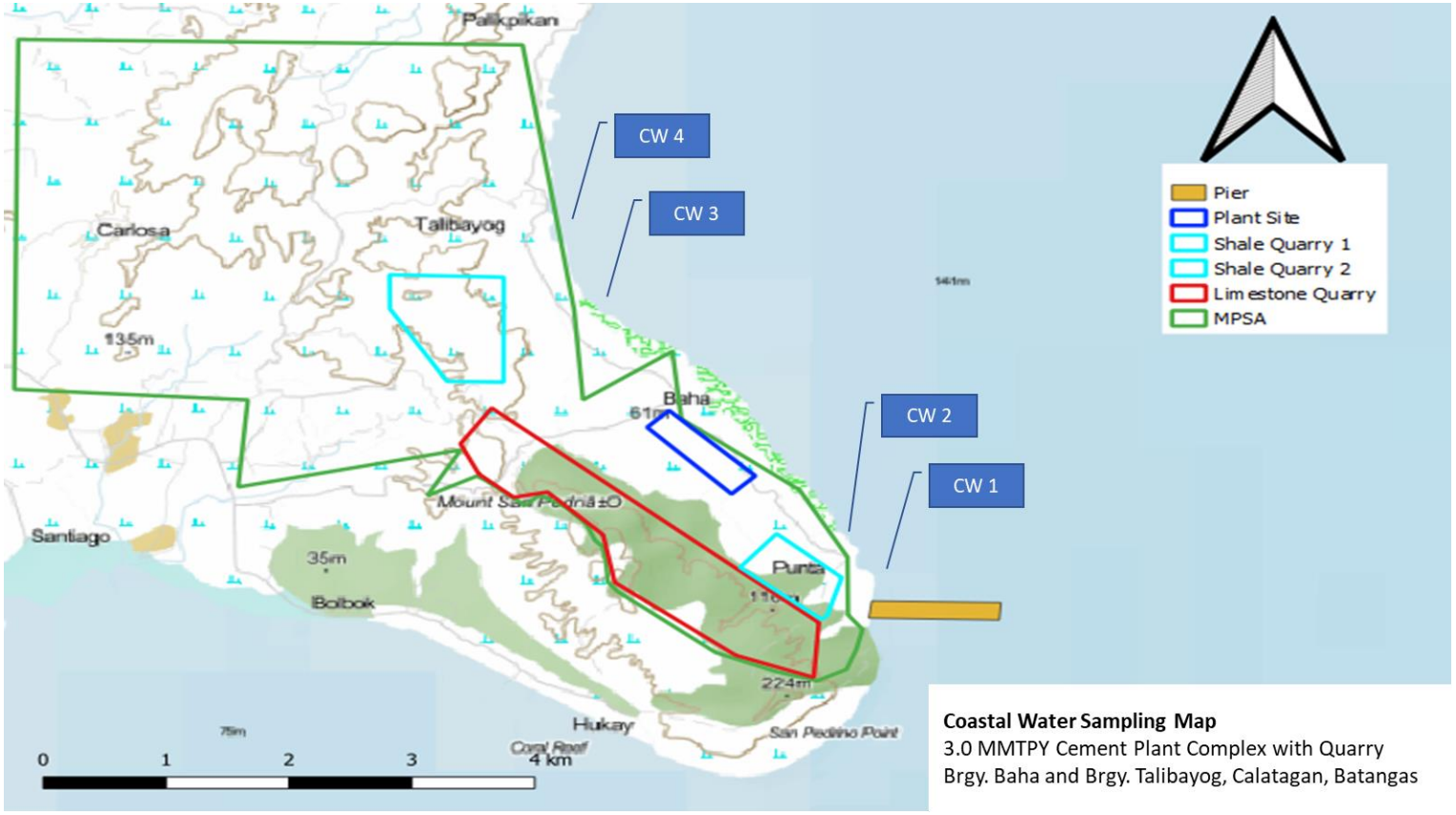


FIGURE NO.:	FIGURE TITLE:	
2-27	**COASTAL WATER SAMPLING MAP**	
PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
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223 The operation of the waste heat recovery system will be using secondary cooling water. The used secondary cooling water will have an increase in temperature of 5-10°C. The maximum allowable change in temperature for the discharge in the nearby coastal warer is only 3°C. With this, the secondary cooling water will be stored in a pond prior to returning back to the sea water to cool down its temperature.

Contaminant Transport and Thermal Dispersion Model for Proposed Outfall

224 A simplified two-dimensional transport-dispersion model was applied to predict the likely degree of contaminant dispersion on the shallow coastal areas from the outfall discharge of the proposed site particularly from the discharge of the secondary cooling water from the waste heat recovery system.

225 One component of the cement plant is the waste heat recovery which will harness excess heat from the kiln to produce electricity which will be used internally in the plant. The WHR system will require re-circulating cooling water, initially estimated at a rate of ~1,650 m^3/hr per unit. The water will be sourced from the deep wells and will be re-circulated. About ~600 m^3/hr of sea water will be used for the cooling of the recirculating cooling water. A worst case scenario is assumed in this modeling where all the cooling water will be discharged at 10°C above the ambient condition. The outfall is estimated/assumed at 200 m from coastline.

226 The numerical model solves shallow water flow and transport equations using Galerkin finite element method. The shallow-water hydrodynamic equations used for depth average flow consist of the equations for the conservation of mass, momentum, and energy. This assumption is reasonable for the study area as the depth of flow is small compared with the horizontal length scales involved, resulting to depth-average equations. The flows are approximated in a numerical finite element grid and calculated on the basis of information on the bathymetry, bed resistance coefficients, wind field and boundary conditions. The transport-dispersion model simulates the spreading of a substance in the environment under the influences of the fluid flow and existing dispersion processes.

227 The transport equation is given by the equation below where c is the pollutant concentration, or excess temperature, ***u*** is the velocity within each element taken from the solution of the hydrodynamic model, D_x is the longitudinal dispersion coefficient, D_y is the transversal dispersion coefficient, ***H*** is the total water depth, ***S*** is the flux term to account for the pollutant source or sink, ***Q*** is the injection rate, and c_o is the concentration or excess temperature of the injected water. As for the far-field dispersion of heat from the outfall discharge in the coastal area, the equation $S=\lambda_A \cdot c$ is used to compute the heat dissipation between the atmosphere and the ocean where the areal decay parameter, λ_A, can be defined as $\lambda_A=K/(rC_p)$ where ***K*** is the atmospheric cooling factor , ***r*** is the density of water, and C_p is the specific heat of water.

$$\frac{\partial}{\partial x}\left(HD_x \frac{\partial c}{\partial x}\right) + \frac{\partial}{\partial y}\left(HD_y \frac{\partial c}{\partial y}\right) - Hu \frac{\partial c}{\partial x} = H \frac{\partial c}{\partial t} + S - Q(c_o - c)$$

228 The atmospheric cooling factor can be calculated by using the equation below where T is the reference temperature, w is the wind speed, and c is the excess temperature.

$$K = 0.2388\,[4.6-0.09(T+c)] + 4.06w]\exp[0.033(T+C)]$$

229 In this study, the pollutant load, for example, a heavy metal associated with the outfall is assumed to be conservative. On the other hand, the thermal load is assumed to be at a temperature above the natural ambient seawater. The computational domain for the study area is about 3 km x 3 km**.** This covers the general coastal area fronting the proposed cement plant location, and several hundred meters north and south of the location of the outfall.

230 The mesh (**Figure 2-28**) was generated on triangular formation by inserting nodes manually within the study area. In order to approximate the bathymetry, additional nodes were inserted at fast-varied depth sections. The mesh density was also greater in in the area near the possible location of the outfall than the open external boundary. The open sea boundary was specified by tidal variations that approximate a sinusoidal function and the model was then run for two prevailing (NE and SW) wind directions at an average wind speed of 4 m/s. For transport dispersion study, it is assumed that the outfall discharges cooling water with 10^{o}C higher than the receiving sea temperature (which is a worst case scenario) and an initial pollutant load of 100 units.

231 Results obtained from the transport-dispersion model of a conservative pollutant are shown in **Figure 2-29**. The plume dispersion during the NE wind forcing tends to move near the shallow coastal areas in a more elongated shape south of the indicated outfall site. On the other hand, the plume during SW wind forcing showed a fan-like shaped plume following the wind movement and spread generally to southeast.

232 The predicted pattern of plume dispersion at northeast monsoon suggests the impact (10 % of initial pollutant load) would extend to about 1.2 km south of the outfall and 500 m from the coastline as the general current direction is southerly near the coastal area. As for the southwest monsoon, the plume is predicted to extend about a kilometer south of the outfall and 800 m eastward from the coastline.

233 Similar patterns of thermal plume dispersion from the outfall were also observed from the model as shown in **Figure -2-30**. The general direction of spreading moves toward the south to southwest from the discharge with mixing along the wind direction. Based on DENR criterion of 3 degree-centigrade maximum rise in temperature due to thermal effluent discharge, the mixing zone is estimated to be 0.10 km^2. Thus, the impact of thermal pollution as defined by the said mixing zone could extend to an area about 200 meters from coastline southeast of the outfall with plume width of about 500 m. The model may again be validated once the final location of the outfall is fixed.

Figure 2-28: Computational Domain of the Study Area

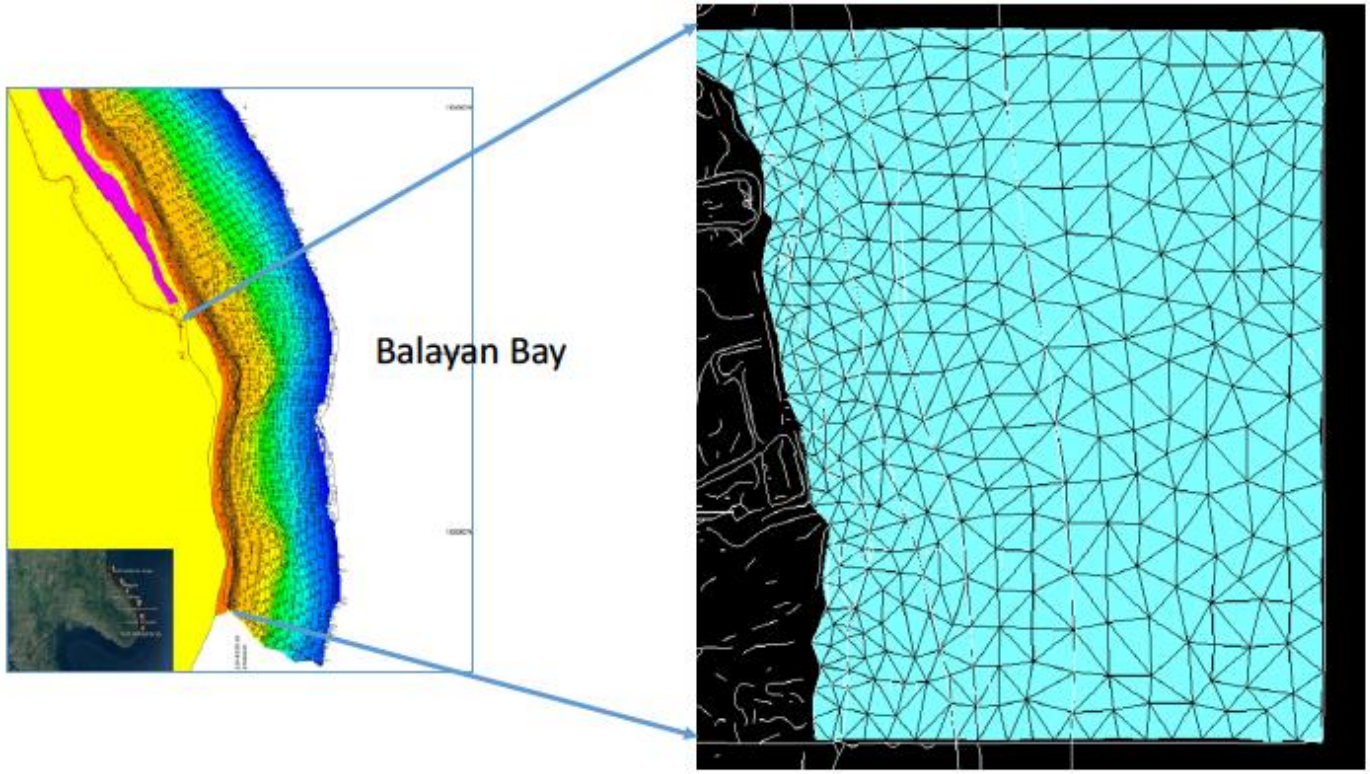

FIGURE NO.:	FIGURE TITLE:
2-28	**COMPUTATIONAL DOMAIN OF THE STUDY AREA**

PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
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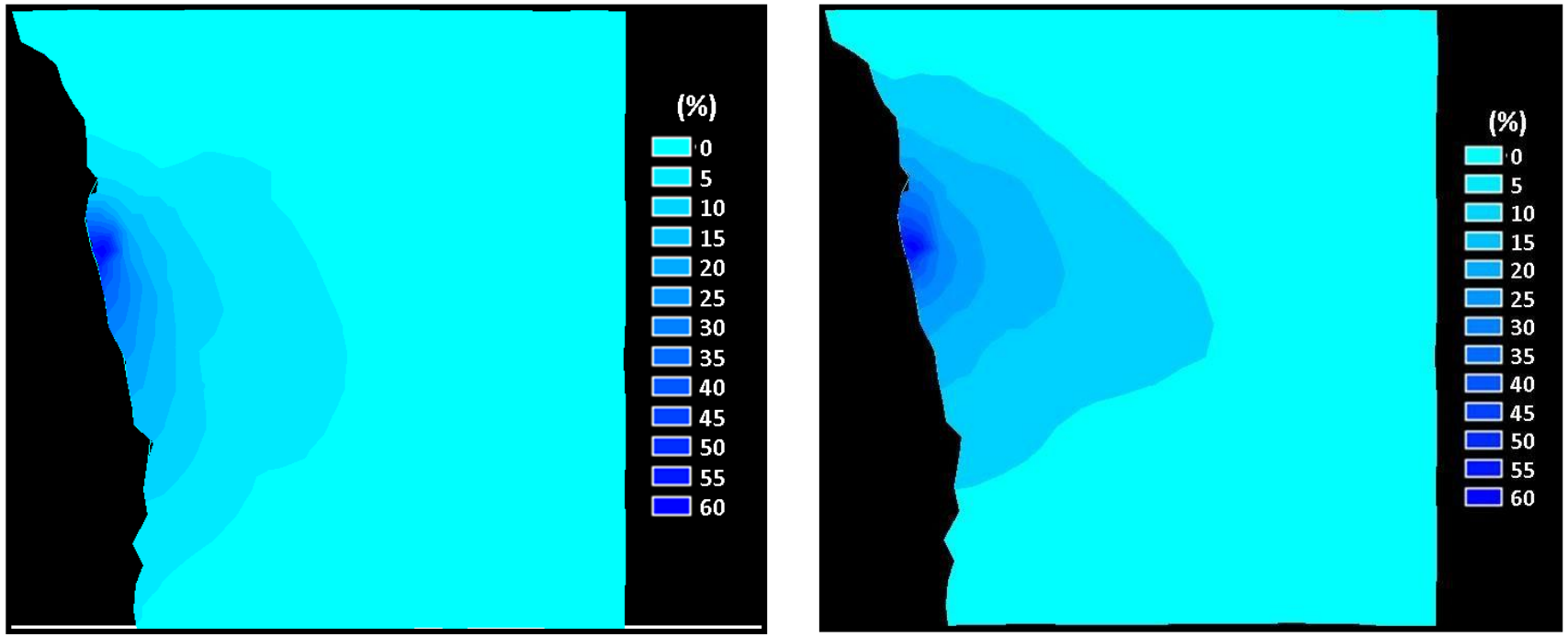
Figure 2-29: Predicted Contaminant Plume Dispersion after 1 Day of Simulation for Northeasterly and Southwesterly Wind Forcing



a. Northeasterly Wind Forcing

b. Southwesterly Wind Forcing

FIGURE NO.:	FIGURE TITLE:
2-29	**PREDICTED CONTAMINANT PLUME DISPERSION AFTER 1 DAY OF SIMULATION FOR NORTHEASTERLY AND SOUTHWESTERLY WIND FORCING (IN TERMS OF PERCENTAGE OF THE INITIAL POLLUTANT LOAD)**

PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
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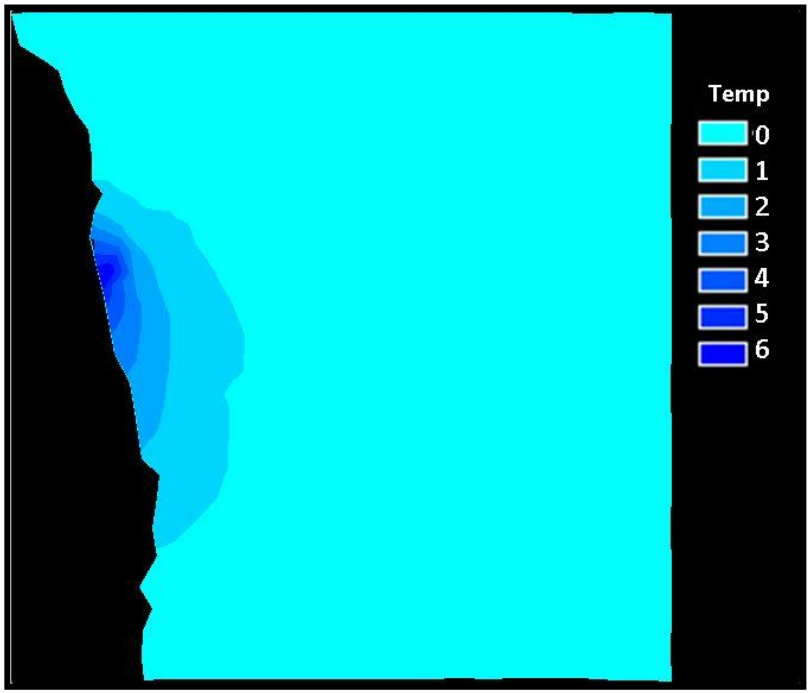
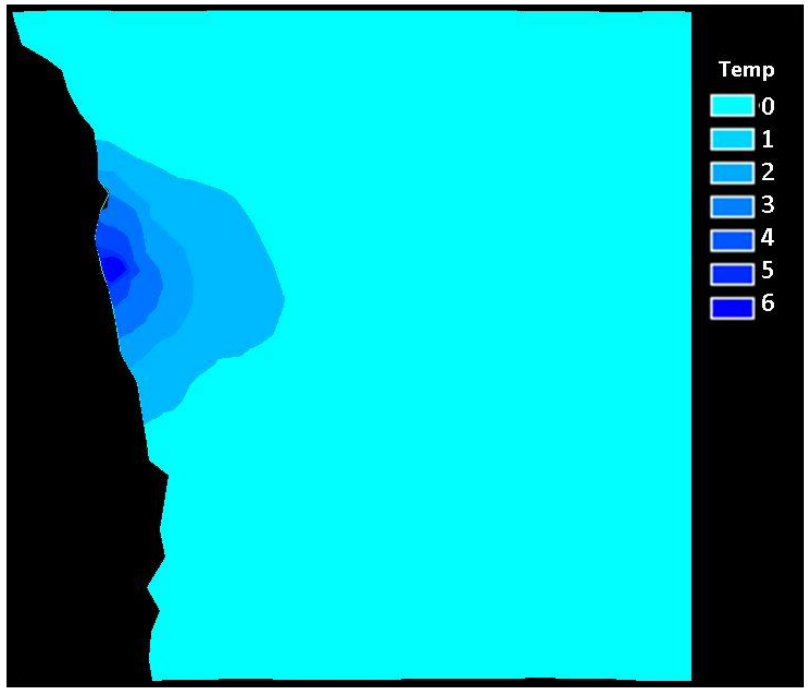
Figure -2-30: Predicted Thermal Plume Dispersion after 1 Day of Simulation for Northeasterly and Southwesterly Wind Forcing



a. Northeasterly Wind Forcing



b. Southwesterly Wind Forcing

FIGURE NO.:	FIGURE TITLE:
2-30	**PREDICTED THERMAL PLUME DISPERSION AFTER 1 DAY OF SIMULATION FOR NORTHEASTERLY AND SOUTHWESTERLY WIND FORCING (IN TERMS OF EXCESS TEMPERATURE IN CENTIGRADE)**

PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
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2.2.4 Freshwater Ecology

234 There is no any freshwater located inside or within the project site.

2.2.5 Marine Ecology

235 Updating of resource assessment and profiling of the coastal marine ecosystem of Barangay Baha, Calatagan, Batangas was conducted last July 2018. The assessment aims to establish a new baseline data on critical coastal marine habitat and community parameters and evaluate the state of the aquatic ecosystems within the vicinity of the project site. The key parameters of the aquatic biological communities examined were species richness, species composition, density and biomass. The methods used to acquire the information were robust, standard and scientifically established to accurately determine the desired community parameters. The specific objectives of the study are the following:

- Conduct a rapid/broad area assessment of the subtidal benthic habitat in front of the Project site;
- Determine community structure of hard corals, associated reef fish, seagrass beds, soft bottom fauna and plankton in pre-determined stations at the study site; and,
- Identify and document important reef stressors (natural and anthropogenic) at the study site.

236 **Figure 2-31** shows the location of the important marine habitat found during the marine survey.

Study Site and Sampling Stations

237 The study site is in the western of Balayan Bay Peninsula, in Barangay Baha, Calatagan, Batangas. The high elevation section of the peninsula remains forested where dense, old-growth forests were observed near the ridge line and in areas close to ravines. In contrast, the low-elevation area near the coast is primarily agricultural. Before the community relocation, the relatively lower elevation area was heavily cultivated as evidenced by abandoned plots visible from satellite imagery. Moving further towards the coast, the peninsula is fringed by a narrow strip of critical coastal habitats. Mangrove forestland patches of seagrass were observed from the intertidal to the subtidal section. Further offshore from the mangrove stands, a shallow and relatively narrow fringing coral communities line the peninsula. No major river drains in the area. Despite this and the relatively sheltered location, extensive coral reef development was absent in the study site. **Figure 2-32** shows the location and the important geographic features in the study site.

238 The subtidal, coastal marine habitats along the coast of Asturias property in Calatagan, Batangas were assessed to determine the current state of these resources before development activities in the area are initiated. The survey included broad scale and detailed surveys, focusing on five coralline, three seagrass stations and six offshore stations for the plankton analysis. The three coral community stations (CR1, CR2 and CR3) were the established monitoring stations from previous studies, while two more stations were added in the current study to have a better representation of the condition of the coral communities fronting the property. The methods employed were standard and scientifically established to accurately determine the community parameters of interest. The location of the established stations assessed across habitat types is shown in **Figure 2-33**.

Figure 2-31: Location of Important Marine Habitat in the Project Area

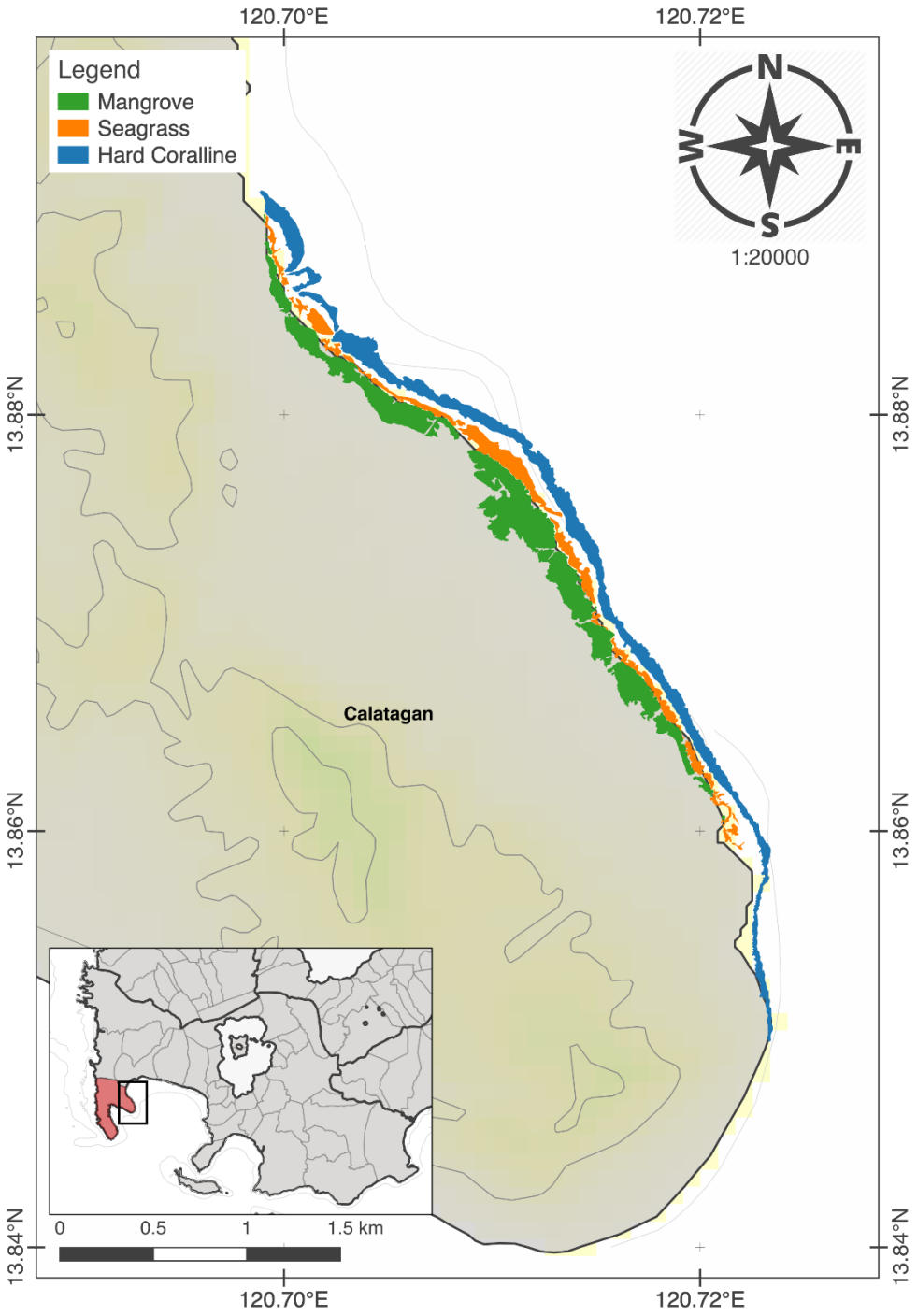

FIGURE NO.:	FIGURE TITLE:
2-31	**LOCATION MAP OF THE IMPORTANT MARINE HABITAT IN THE PROJECT AREA**

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Methodology

Coral

Broad Area Survey

239 A rapid, broad scale benthic habitat survey was conducted in the general study area using a modified manta tow technique (English *et al.* 1997). The method validated the location and of the different subtidal features in an approximately 30km^2 (5,000 x 6 meters) stretch of coastal waters in front of the project development site.

240 In the survey, percentage cover of the hard corals, other invertebrate fauna, dead corals with algae, and abiotic reef components, specifically sand and rubble, were estimated and recorded. Distinct reef features were also recorded for reference. The hard corals were then based on the benthic classification scheme established by Gomez et al. (1994).

Table 2-17: Classification of Live Corals

Percent cover of live coral	Category
<25%	Poor
26-50%	Fair
51-75%	Good
>75%	Excellent

Detailed Coral Reef Assessment

241 The photo transect method (Vergara and Licuanan, 2007) and a modified randomization protocol for transect deployment (Licuanan *et al*. 2017) were used in the study to adjust to the narrow characteristic of the coralline community.

242 For the life form identification, the standard 28 benthic lifeform categories of English *et al*. (1997) were used. Percent cover was computed using the following equation:

$$\%Cover = \frac{Total\ Sampled\ Points\ of\ Category}{Total\ No.of\ Points\ per\ Transect}\ x\ 100\%$$

- **Associated Reef Fish Community**

243 Reef survey stations were pre-selected and distributed based on the predicted impact areas along the property line.The abundance or number of fishes for each estimated size was determined by actual counts whenever possible. For schooling and aggregating species, counts were estimated by clusters, wherein the number of fishes within a cluster was multiplied by the number of clusters that made up the school or aggregation. Fish biomass was calculated using the length and abundance estimates.

$$W = a\ x\ L^b$$

Where: W= weight (grams)

L= total length (cm)

a,b= constants (Kulbicki *et al.,* 1993; Letourneur, 1998; Letourneur *et al.,* 1998; Gonzalez *et al.,* 2000; and FishBase.org).

244 Fish species were categorized based on their diet and importance information (FishBase.org).

Table 2-18: Categorization of Fish Species

Fish Category	Description
Indicator	These are reef-health indicators. These fish mainly feed on coral polyps and their variety and abundance in a given area may give an indication of the relative health of the coral communities (Crosby and Reese, 1996; Nañola and Aliño, 1999).
Commercial or target	Commercial or target species are fish which are taken in fisheries. These include high-value fish such as groupers, snappers and breams, as well as some low-value species such as some wrasses, triggerfish and goatfish among others.
Major or non-target	Non-target or major species include all the other species that do not fall under the first two categories. These fish are important members of fish communities because they occupy unique niches and serve as important trophic links. These fish include, but are not limited to, most damselfishes and wrasses, as well as cardinalfishes, blennies and gobies.

- **Seagrass Community**

245 Seagrass meadows of Pagaspas Bay in Calatagan, Batangas were surveyed at three pre-identified sites that were selected to cover the potential impact areas of the project site. Seagrass species within the sampling quadrats were identified up to the lowest taxonomic level (Calumpong and Meñez, 1997), and the percentage cover of each species observed were estimated (McKenzie, 2003; English *et al*., 1997). Associated fauna and other benthic features were also noted.

- **Soft Bottom Macrofaunal Community**

246 Sediments were also collected in the coral reef and seagrass stations to determine soft bottom macrofaunal community structure in the study site. Sediment samples were collected in a 20cm x 20cm x 10cm (0.004m^3) area using a quadrat and a metal trowel with gradations.

- **Plankton Community Survey**

247 At each station, 60 µm plankton net was used and hauled vertically from a depth of 10 m to collect the samples. Abundance of each phytoplankton and zooplankton taxa were calculated using the following formula:

$$\frac{Number\ of\ cells\ or\ individuals}{m^3} = \frac{C\ x\ V'}{V"\ x\ V'''}$$

Where: C= number of counted organisms per taxa
V'= volume of concentrated sample (mL)
V''= volume of analyzed sample (mL)
V'''= volume of grab sample (m^3)

Figure 2-32: Location Map of the Coastal Marine Survey

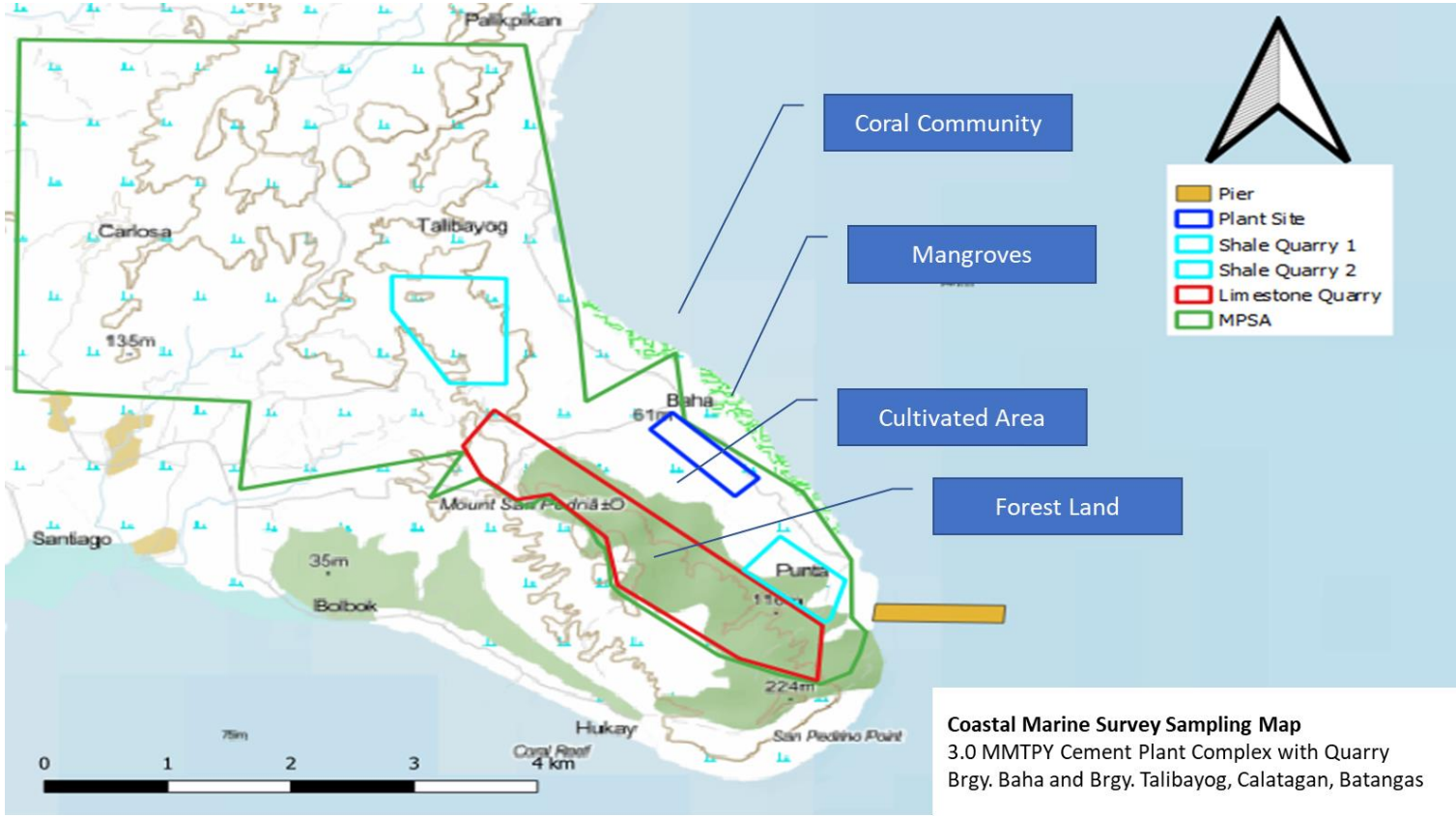

FIGURE NO.:	FIGURE TITLE:
2-32	**LOCATION MAP OF THE COASTAL MARINE SURVEY**

PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
ASTURIAS INDUSTRIES INC	**3.0 MMTPY CEMENT PLANT COMPLEX WITH QUARRY** Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas	**LCI ENVI CORPORATION**

Figure 2-33: Sampling Location Map of the Coastal Marine Survey

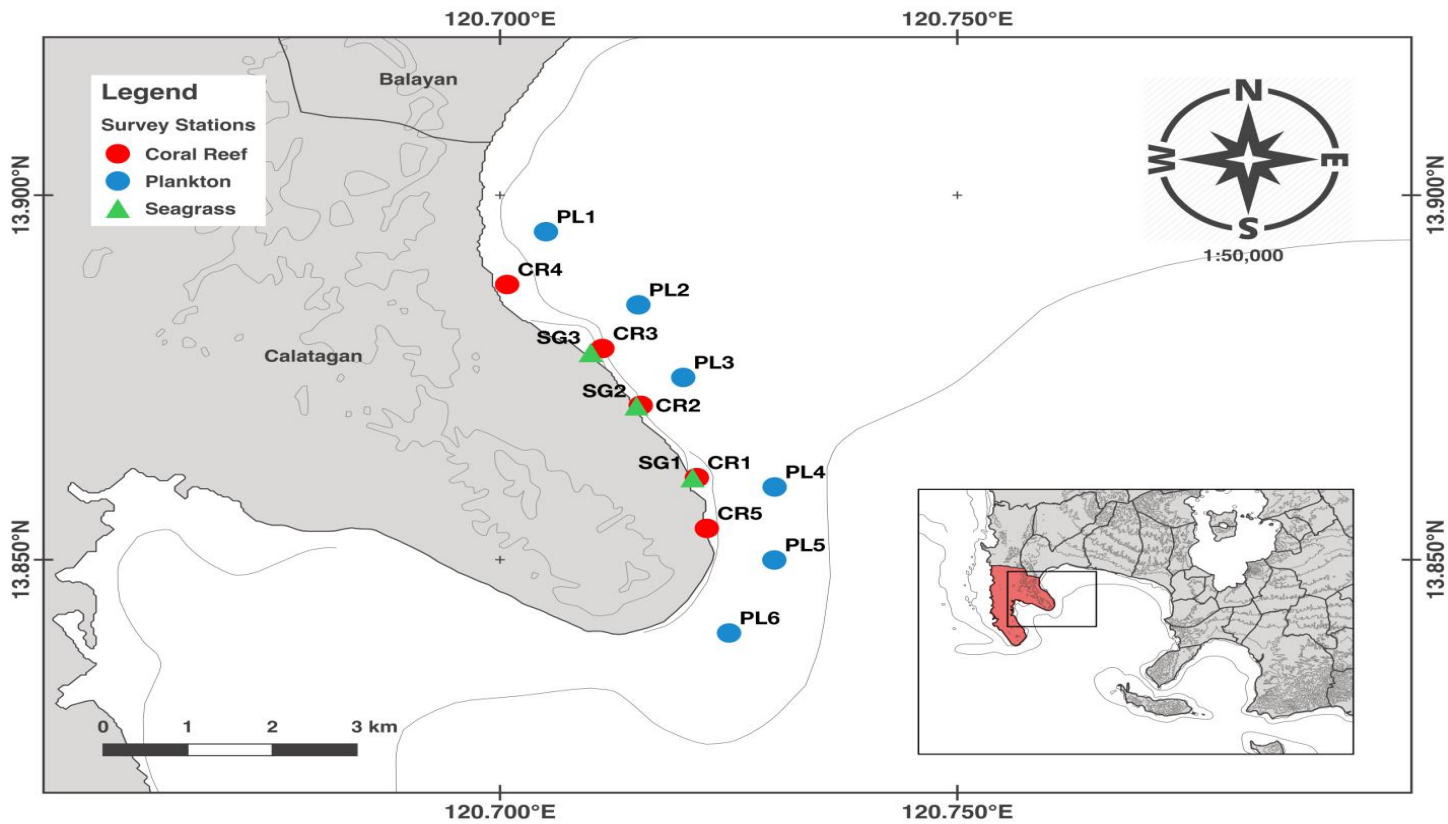

FIGURE NO.:	FIGURE TITLE:
2-33	**SAMPLING LOCATION MAP OF THE COASTAL MARINE SURVEY**

PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
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2.2.5.1 Coral Community Assessment

Broad Area Survey

248 Tows conducted in the 30 km^2 stretch of the peninsula were observed to be a predominantly coralline area. Hard corals, dead corals with algae and rubbles were mostly seen in the area. **Figure 2-34** shows the result of the rapid broad area assessment of the coral community conducted in the study site.

249 A stretch of sandy habitat was only observed in the first tow. However, this could be attributed to the inability of the team to start the tow closer to the coast because of fishing nets deployed in the area during the time of the survey. It is very much likely that a coral community line the area near the coast. Overall, hard coral cover within the designated study was generally in "fair" condition with only 3 of 13 areas estimated to fall below 20%.

250 Hard coral community in the study site was dominated primarily by massive and encrusting forms. Porites and a suite of Faviids dominate the coral community in the study site. In spite of the generally fair condition of the reefs, dead corals with algae and sand were the predominant benthic feature in majority of the reefs surveyed.

251 Dead coralline substrates overgrown with algae were most abundant in 6 of the 13 tows while sand was found dominant in 5 of the 13 stations. Hard corals were found to dominate in only 2 of 13 areas surveyed. No section of the reef was dominated by invertebrate fauna. However, this category was present across the reef and their mean cover was notable in majority of the tows. Patches of seagrass were intercepted in half of the tows conducted, the most extensive of which were in the fifth and tenth tows**.**

252 No algal beds were noted in the areas surveyed. Throughout the 30km^2 area surveyed, signs of man induced stress on reefs were minimal. Although plastics were found floating in the water column, none were found entangled on reefs. However, nets and fishing lines were observed in sections of the reef.

Figure 2-34: Rapid Broad Assessment of the Fringing Coral Community

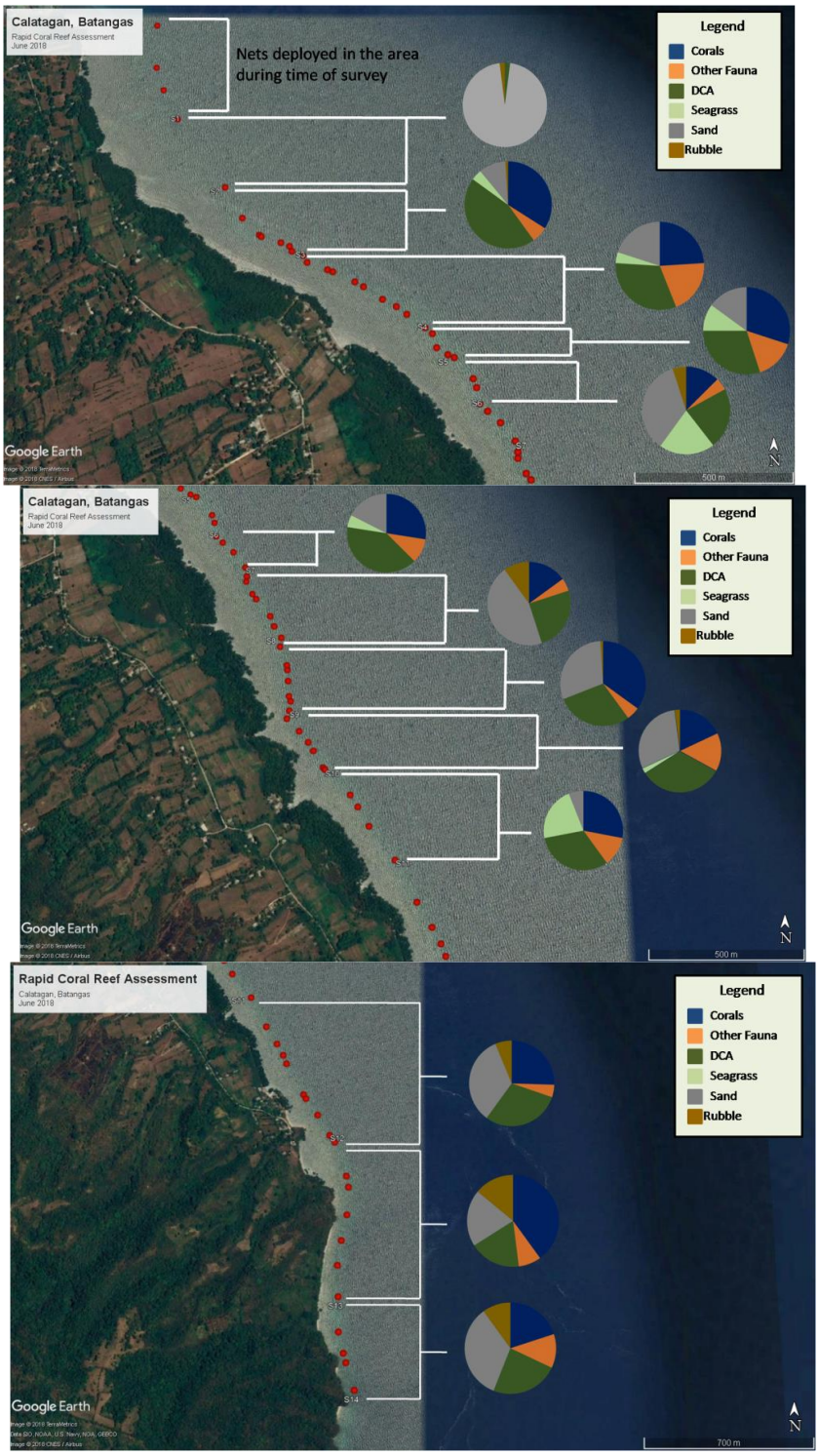

FIGURE NO.:	FIGURE TITLE:
2-34	**RAPID BROAD ASSESSMENT OF THE FRINGING CORAL COMMUNITY**

PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
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Detailed Coral Reef Assessment

253 The coral communities surveyed in the established stations showed notable consistencies in its general physical and biological attributes. In terms of physical structure, the coral communities were generally patchy. Across stations, large coverage of loose substratum, particularly sand, were intercepted in the transects. Aside from abiotic, the reefs assessed consistently have high mean cover of dead coralline substrate overgrown with algae. In contrast, relative cover of hard corals and other fauna remain generally low across stations. The results of the detailed survey were generally consistent with the estimates generated from the broad scale assessment of the area.

254 The coral community in the study site were observed to exist in a poor to fair state. In general, the coral communities in Station 3 and Station 4, which were both located in the more embayed section of the peninsula, recorded a mean hard coral cover that was below the Indo-Pacific average. In contrast, the remaining stations, located in the more wave exposed section of the peninsula had mean hard coral cover that were slightly above the regional average. Overall, hard coral cover was significantly lower in Stations 3 and 4.

255 Following a similar trend, hard coral genera intercepted were also found to be lower in Stations 3 and 4. Consistently however, massive forms of hard corals dominate the coral community in the study site. Massive forms of hard corals dominate the coral community in the study site. Massive forms comprised more than half of the hard corals intercepted in the stations surveyed. This created notable vertical relief from the substrate, increasing topographic complexity of the substrate. Combined with other growth forms, particularly high relief massive, branching and foliose forms, the substrate becomes structurally heterogenous notably increasing the ecological value of this habitat. Diverse hard coral growth forms create an important 3-dimensional physical structure that is essential in maintaining the diversity of organisms in coral reefs. This complexity acts as an important driver that sustains the diverse aggregation of organisms in the area. This is especially true for juveniles and small bodied, shelter dependent reef fishes (Ticzon *et al*., 2014).

256 In spite of the relatively low hard coral cover of the fringing reefs in the study site, the area continues to harbor a rich aggregation of hard coral genera. Overall, a total of 38 hard coral genera classified under 13 families were identified in the study site. A few faviids and encrusting hard corals remained unidentified up to present.

257 Porites was consistently the most important hard coral genera across stations. Overall, Porites was estimated to comprise 40% of the hard corals intercepted in the study area. The overall predominance of Porites, specially the massive forms, could be attributed to their high silt rejection ability, their high resistance to strong wave energy, and overall resilience (Loya, 1976; Cortes and Risk, 1985). This makes Porites one of the primary reef building corals in the Indo-Pacific (Montaggioni 2005). Other important hard corals in the study site include Acropora, Goniastrea and Goniopora. In general, majority of the hard corals intercepted were uncommon and were only encountered one to three times in each station.

Table 2-19: Mean Percent Coverage of Hard Corals

Taxa		Station					Importance
Family	Genus	CR1	CR2	CR3	CR4	CR5	Value
Acroporidae	Acropora	1.29	3.87	2.50	0.45	0.90	0.09
	Astreopora	0.00	0.00	0.08	0.00	0.00	0.00
	Isopora	0.00	0.32	0.00	0.00	0.06	0.00
	Montipora	0.77	0.45	0.40	0.00	0.90	0.03
Agariciidae	Gardineroseris	0.06	0.00	0.00	0.00	0.13	0.00
	Pachyseris	0.00	0.19	0.00	0.00	0.13	0.00
	Pavona	0.06	0.00	0.08	0.00	0.13	0.00
Agathiphylliidae	Diploastrea	0.00	0.97	1.05	0.00	0.00	0.02
Dendrophylliidae	Turbinaria	0.00	0.26	0.56	0.06	0.06	0.01
Euphyllidae	Euphyllia	0.00	0.39	0.00	0.00	0.13	0.01
	Galaxea	0.52	0.13	0.08	0.00	0.39	0.01
Faviidae	Cyphastrea	0.52	0.13	0.00	0.13	0.39	0.01
	Echinopora	1.16	1.10	0.08	0.00	1.23	0.04
	Favia	0.97	0.19	0.16	0.26	0.13	0.02
	Faviid	0.26	0.39	0.16	0.00	0.06	0.01
	Favites	0.84	0.77	0.08	0.13	1.29	0.03
	Goniastrea	0.58	0.97	1.05	0.19	1.42	0.04
	Merulina	0.65	0.71	0.16	0.06	0.90	0.03
	Montastrea	0.19	0.19	0.16	0.06	0.00	0.01
	Platygyra	0.71	0.45	0.00	0.06	0.97	0.02
	Trachyphyllia	0.00	0.06	0.00	0.00	0.00	0.00
	Pectinia	0.00	0.00	0.00	0.00	0.19	0.00
Fungiidae	Ctenactis	0.00	0.06	0.00	0.00	0.13	0.00
	Fungia	0.39	0.45	0.00	0.06	0.71	0.02

Taxa		Station					Importance
	Heliofungia	0.06	0.19	0.00	0.00	0.13	0.00
	Herpolitha	0.06	0.06	0.00	0.00	0.00	0.00
	Podabacia	0.00	0.06	0.00	0.00	0.00	0.00
	Sandalolitha	0.00	0.13	0.00	0.00	0.13	0.00
Lobophylliidae	Lobophyllia	0.39	0.45	0.89	0.71	0.45	0.03
	Symphyllia	0.06	0.19	0.00	0.00	0.13	0.00
Milleporidae	Millepora	0.00	0.06	0.08	0.00	0.39	0.01
Plesiastreidae	Plerogyra	0.00	0.13	0.00	0.00	0.00	0.00
Pocilloporidae	Pocillopora	1.23	0.52	0.00	0.26	1.03	0.03
	Seriatopora	0.13	0.52	0.97	0.00	0.19	0.02
	Stylophora	0.32	0.13	0.00	0.06	0.32	0.01
Poritidae	Goniopora	0.77	0.32	0.32	1.87	0.97	0.04
	Porites	11.68	7.68	3.71	3.68	11.10	0.40
Tubiporidae	Tubipora	0.00	0.13	0.00	0.00	0.39	0.01
Unidentified	Unidentified	0.13	0.26	0.00	0.00	0.06	0.00
Mean Cover		23.81	23.81	22.90	12.58	8.06	25.55
Number of Hard Coral Genera		23	23.00	34.00	18.00	15.00	30.00

258 All other fauna observed were classified under the "Other Fauna" (OT) category. Overall, mean cover of this benthic category was consistently low and showed significant variations across stations. Overall, mean cover of this benthic category was consistently low and showed significant variations across stations. CR1 had a significantly lower mean OT coverage compared to CR4 and CR5.

259 Mean coverage of other invertebrate fauna across stations could be attributed primarily to sponges and octocorals (excluding Tubipora) which were consistently intercepted in the different reef areas surveyed. In general, sponges were found to comprise a relatively large percentage of the OT intercepted in the more exposed stations (i.e., CR1, CR4 and CR5) while octocorals where more common in the more inland stations of CR3 and CR4. In spite of their relatively low abundance in the study site, structurally large OT remained an important component of the coral community, contributing to the structural complexity of the benthos. Other faunal groups intercepted in the survey include hydroids, crinoids, corallimorpharians, clams, sea stars, tube worms and ascidians. The predatory Crown of Thorns Sea Star was not seen in the stations surveyed.

260 Percent coverage of the different algal types such as algal assemblages (AA), calcareous algae (CA), macro-algae (MA), and those growing on the more recently dead corals (DCA), were combined under the Algae category. This category continues to dominate the coralline substrate in the stations surveyed. Consistent among sampling stations, the algal assemblage (AA) class continued to cover the largest section of the substratum across monitoring stations. This indicates that a large section of the reef is densely covered by a variety of algae, with an estimated height ranging from 0.5 to approximately 5 centimeters. This low relief algal assemblage, compared to the DCA type of algal form, has strong negative effects on hard coral recruitment. This densely growing algae traps sediments in its matrix that further prevent corals from colonizing hard substrates (Bellwood and Fulton, 2006). When corals are still able to recruit on the substrate, the faster growing algae smother the recruiting coral colony.

261 For CR1 and CR5, cover of DCA and did not exceed 10% cover while in the remaining 3 stations, this algal category did not exceed 5% cover. Mean coverage of coralline algae and turf algae were very low across stations. No macroalgal forms were intercepted in the survey. In general, it is likely that at least in CR4, it is possible that both invertebrate and vertebrate grazing pressure remains insufficient in the study site to regulate and control algal growth.

262 The nature and composition of the abiotic components partly influences the physical development of the coral community. In the study site, abiotic intercepted were primarily sand and rubble. Rubble was most commonly intercepted abiotic in CR1 while the remaining stations were observed to be mostly comprised of sand.

263 Relatively wide stretches of sandy area were seen in all stations surveyed, except in CR1 which is the most wave-exposed station. These wide stretches of sand and other loose abiotic in the study site contribute to the low coral cover and overall physical development of the coral community since coral larvae only recruits on hard, stable substrate. Lastly, domestic debris were found snagged in the coralline structures in Stations CR3 and CR4.

2.2.5.2 Reef Associated Fish Community

Fish Richness

264 A total of 142 species of reef fish that belonged to 32 families were identified from the survey transects at the five reef monitoring stations. There were 7 indicator species in total, 95 major species and 40 target species.

265 Indicator species included 6 butterflyfishes (Chaetodontidae) and a single coral-feeding damselfish (Pomacentridae: Cheiloprion labiatus);

266 Major fishes were the most diverse group among the three fish categories and they were mainly represented by damselfishes (37 species), wrasses (20 species), and cardinalfishes (Apogonidae; 14 species);

267 Important target fish families included the wrasses (7 species), parrotfishes (Scaridae; 5 species), groupers (Serranidae; 5 species), goatfishes (Mullidae; 4 species), breams (Nemipteridae; 4 species), and surgeonfishes (Acanthuridae; 3 species).

268 The mean total estimated fish species richness for the entire study area was 35 (±9) species per 250 m^2. Estimated fish species richness were higher than the mean total for the study site at three of the five surveyed reefs, Stations CR1, CR2 and CR5. Low fish species richness were estimated at Stations CR3 and CR4. The mean number of major species that may be identified within a 250m^2 area ranged between 22 and 30 species. Target fish species were less diverse and there are between 3 to 12 species of commercially important fish species per 250m^2 reef area at the study site. Indicator fish species were the least diverse with a mean richness that did not exceed 2 species at any of the stations surveyed.

Fish Abundance

269 The estimated mean abundance for the entire study area was about 367 (±153) individuals per 250m^2. Major fish species were the dominant group in terms of numbers. They comprised over 90% of the mean total abundance across all stations surveyed. The major fish species observed were mostly small-bodied aggregating species such as cardinal fishes, as well as damsel fishes, wrasses and the Moorish Idol, *Zanclus.*

270 Among the cardinal fishes, the species with the most notable abundances observed were Apogon sealei, Archamia fucata, and Cheilodipterus quinquelineatus (Apogonidae). C. quinquelineatus was the most common among these three cardinal fishes and was recorded across all the five stations, A. sealei was found at three stations, while A. fucata was only observed at Station CR4.

271 At least two species of wrasse had high numbers in the area and these were Cirrhilabrus cyanopleura and Thalassoma lunare. T. lunare was the more common of the two and was present at all the five survey stations while C. cyanopleura only occurred at Stations CR2 and CR5.

272 Damsel fishes were the main major fish family that dominated the fish communities in terms of their abundances. Among these, the charcoal damsel, Pomacentrus brachialis, was the most numerous with a mean total abundance of about 57 individuals/250m^2. This fish was present at all the survey stations and its mean abundance was estimated to be between 3 individuals/250m^2 at CR4 to as much as 103 individuals and 104 individuals/250m2 at CR1 and CR5, respectively.

273 The other damselfishes with high abundances were Abudefduf vaigiensis, Acanthochromis polyacanthus, Amblyglyphidodon curacao, Amphiprion clarkii, Dascyllus reticulatus, Dascyllus trimaculatus, Plectroglyphidodon lacrymatus, Pomacentrus adelus, Pomacentrus amboinensis, Pomacentrus cuneatus, and Pomacentrus moluccensis. It was interesting to note that there were numerous young Moorish Idol, Zanlcus cornutus (c. 6 to 10 cm), across the survey sites and their mean total abundance was about 15 individuals per 250 m2.

274 Target fish were not abundant and were often small in size. The schooling barracuda Sphyraena flavicauda was the most abundant target fish species however, it was only recorded at Stations CR4 and CR5. Two species of breams also had relatively high abundance compared to the rest of the other target fish species. These were Scolopsis ciliatus and Scolopsis lineatus. Unlike the barracuda, these species were common and were observed at all the five survey stations.

275 Among the 7 indicator species, the butterflyfishes Chaetodon octofasciatus and Chaetodon baronessa were the most abundant. These two species were common across all stations except for C. baronessa which was not recorded at Station CR4.

Fish Biomass

276 The estimated biomass of fish at the study site was poor and did not exceed 6 kg/250m^2. The mean total estimated fish biomass at the study site was 3.8 (±2.5) kg/250m^2. The estimated biomass of fish at Stations CR1 and CR4 were comparable to the mean total at 3.0 (±2.4) kg and 3.5 (±1.5) kg/250m^2, respectively, while Station CR3 had the lowest estimated biomass of 2.7 (±2.3) kg/250m^2.

277 Major fishes were still dominant in terms of their accumulated biomass contributions. However, target fish also contributed considerably towards the biomass at the survey stations (except at Stations CR1 and CR3), despite their very low numbers. Major fish species had mean biomass estimates between 2.2 to 3.9 kg/250m^2, while target species contributed as much as 1.3 to 1.9 kg towards the community biomass at Stations CR2, CR4 and CR5. No single species of fish had a mean biomass that exceeded 1 kg at any of the stations surveyed.

278 Among the major species, the most notable in terms of their biomass were Zanclus cornutus. Pomacentrus brachialis and Acanthochromis polyacanthus. These species were also among the most abundant. The three most abundant target species were also among the top 6 target species with the highest biomass contributions. These six target species included the barracuda (Sphyraena flavicauda), the breams (Scolopsis ciliatus and Scolopsis lineatus), the parrotfish (Scarus flavipectoralis), the fusilier (Caesio cuning) and the cornet fish (Fistularia commersonii).

Other Site Observations

279 Observations that help characterize the fish communities and their habitats at the five survey stations were also noted by the observers during roving diver surveys. Below is a summary of the observations made for each of the survey stations.

Station CR1

- School of “mating” wrasse *Stethojulis trilineata* were actively swimming across the reef.

- There was low diversity and abundance of butterflyfish.
- Some predatory fish such as groupers were present.
- Debris such as discarding fishing nets and tires were observed.
- Crown of thorns seastar.

Station CR2

- Fish were moderately abundant.
- Some stands of branching *Acropora* corals with dense aggregations of cardinalfish.
- Some predatory fish such as groupers were present.
- High number of large sized parrotfishes *Scarus flavipectoralis* and *Scarus chameleon* at the 60m mark of the third transect.
- High number of young Moorish Idol, *Zanclus cornutus.*

Station CR3

- Very low fish diversity.
- Very patchy coral community.
- High number of Moorish Idol, *Zanclus cornutus.*
- Some nesting *Dascyllus trimaculatus.*
- Some large colonies of branching *Acropora* corals with dense schools of cardinalfish, and the damselfishes *Chromis viridis* and *Pomacentrus moluccensis*.
- Low numbers of target fish.
- Some seagrass (*Halophila ovalis*) along the transects.

Station CR4

- School of barracuda, *Sphyraena flavicauda*.
- Debris such as small trees and branches were being used by cardinal fish for habitat.
- Juveniles of sweetlips *Plectorhinchus chaetodonoides*.
- Many Moorish Idol, *Zanclus cornutus*.

Station CR5

- High abundance of fish at deeper water at the end of transect three.
- High number of Moorish Idol, *Zanclus cornutus.*
- Many large herbivorous damselfish, *Plectroglyphidodon lacrymatus,* about 8cm in total length.
- Some newly broken table *Acropora* corals, presumably from anchor deployment.

2.2.5.3 Seagrass Bed Community

280 A total of four seagrass species were identified from the survey transects at the three monitoring stations. The seagrass species recorded were *Cymodocea rotundata*, *Enhalus acoroides*, *Halodule uninervis* and *Halophila ovalis*. Among these, *C. rotundata* was the dominant species with a mean total estimated cover of 32.9%. The range of the mean estimated cover of *C. rotundata* was between 23.5% at Station SG1 up to 36.7% and 38.4% at Stations SG2 and SG3, respectively. C. rotundata also had the highest frequency of occurrence an on average was recorded at 15 to 19 of the 22 quadrats sampled at each transect.

281 Next to *C. rotundata* in terms of canopy cover was *H. pinifolia* with a mean total cover estimated at 18.4%. *Halodule pinifolia* covered a considerable area of the bottom sample at

Stations SG1 and SG2 with 28.2% and 25% covers. It has a low estimated canopy cover of only 2% at Station SG3.

282 Similar to *C. rotundata* and *H. pinifolia*, the seagrass species *H. ovalis* was also common across the three monitoring stations, but its mean total estimated cover was low at only 1.5%, and its mean cover estimates at the survey stations did not exceed 5%.

283 *Enhalus acoroides* was recorded in the area but was only sampled at Station SG3 with a mean canopy cover of only 2.3%. In contrast with the frequency of occurrence of *C. rotundata*, the other three species of seagrass were not sampled in more than 10 quadrats along the transects surveyed except for *H. pinifolia* which was recorded in 13 of the sampling quadrats at Station SG2.

Table 2-20: Mean Estimated Canopy Cover of Seagrass Species

Category	Species/Form	SG1	SG2	SG3	Mean Total Cover
Seagrass	*Cymodocea rotundata*	23.5	36.7	38.4	32.9
	Enhalus acoroides			2.3	0.8
	Halodule pinifolia	28.2	25.0	2.0	18.4
	Halophila ovalis	0.3	0.1	4.0	1.5
Algae	algal assemblage	4.0	12.2	6.8	7.7
	dead coral with algae			1.1	0.4
	macroalgae	3.6	1.9	1.1	2.2
Abiotics	rock	0.3	10.7	1.8	4.3
	rock with algae		3.2	0.7	1.3
	rubble	22.5	5.2	22.3	16.7
	rubble with algae	2.0			0.7
	sand	15.1	5.0	18.4	12.8
Associated fauna	hard coral			0.7	0.2
	sponge	0.5		0.3	0.3

Table 2-21: Mean Frequency of Occurrence of Seagrass Species

Species	SG1	SG2	SG3	Mean Total Frequency
Cymodocea rotundata	15	17	19	17
Enhalus acoroides	0	0	5	2
Halodule pinifolia	9	13	2	8
Halophila ovalis	2	1	6	3

284 Overall, the mean percentage coverage of seagrass were similar across stations but was highest at Station SG2 (62%), followed by Station SG1 (52%), and Station SG3 (47%). A total of four seagrass species were identified from the survey transects at the three monitoring stations. The seagrass species recorded were Cymodocea rotundata, Enhalus acoroides, Halodule uninervis and Halophila ovalis. Among these, C. rotundata was the dominant species, followed by Halodule pinifolia. Enhalus acoroides was recorded in the area but was only

sampled at Station SG3. The seagrass species H. ovalis was also common across the three monitoring stations.

285 Abiotic components also occupied large sections of the meadows surveyed. Abiotic components included rocks, rocks covered with thin layers of algae, rubble, rubble and algae, and sand. Among these, rubble and sand had the highest mean coverage which ate prominent at SG1 and SG3.

286 Algae was not a major feature at the seagrass meadows surveyed. Associated fauna that were observed included sponges, table corals, and the sea star Protoreaster sp. However, these other faunas were few and only covered less than 1% of the bottom at any of the stations.

Other Site Observations

Station SG1

- Site with the nearest residential area (community).
- Shoreline is a stretch of mangroves.
- Substrate is sand with rubble, but mostly rubble closer to shore.
- Among the three sites, this site has the most amount of solid waste/trash.

Station SG2

- Shoreline is a stretch of mangroves.
- Substrate is a mixture of sand and rubble.
- Trash was also observed in the area.
- Aggregations of *Diadema* sp. sea urchins were observed in areas outside the transect.

Station SG3

- Shoreline is a stretch of mangroves.
- Substrate is mixture of sand and rubble.
- Trash was also observed in the area.
- Patches of corals were observed at approximately 30 meters and beyond from the shoreline.
- Aggregations of *Diadema* sp. sea urchins were observed in sandy areas where coral patches were started.

2.2.5.4 Soft Bottom Macrofaunal Community

287 A diverse and dense aggregation of soft bottom macrofauna was observed between habitats and among stations. Overall, diversity was primarily driven by aggregations of annelids and mollusks while abundance was strongly driven by the dense aggregation of forameniferans in the study area. Removing forameniferan contribution in the analysis, mollusks and annelids would then comprise majority of the soft bottom infauna observed in the samples.

288 Overall, a total of 46 invertebrate taxa classified under 5 phyla were identified in the sediments collected in 8 different stations spread across the study area. In the present study, forameniferans, particularly the genus Calcarina, drove the abundance of soft bottom fauna in both habitats investigated. This formamenifera comprised 96% and 97% of the soft bottom fauna collected in the coral reef and seagrass habitats respectively.

289 In the present study, forameniferans, particularly the genus *Calcarina,* drove the abundance of soft bottom fauna in both habitats investigated. This formamenifera comprised 96% and 97% of the soft bottom fauna collected in the coral reef and seagrass habitats respectively.

290 Aside from foraminiferans in general, *Batillaria*, was the more commonly found invertebrate in both the coral and seagrass habitats. This benthic grazing gastropod was consistently found across stations. Furthermore, this genus had the second highest mean density (next to foraminiferans) across stations, except in SG2. In this station, the predatory Neritidae had the highest count.

291 In general, the results showed a generally rich and stable soft bottom macrofaunal community in both coral and seagrass habitats. Furthermore, the results point to the suitability of these habitats for the proliferation of soft bottom macrofauna.

Table 2-22: Mean Density (organisms/0.004 m3) of Soft Bottom Fauna

TAXA	STATION							
	CR1	CR2	CR3	CR4	CR5	SG1	SG2	SG3
Annelida	24	3.5	4.5	1.5	2	18.5	1	3
Glyceridae	0	1	1	0	0	5	0	0.5
Lumbrineridae	3.5	0	0	0	0	0	0	0
Nereididae	0	0	0.5	0.5	0	7.5	0	1.5
Sabellidae	18	1	3	0	1.5	0	0	0
Sedentaria	0	0.5	0	1	0.5	0	0.5	0
Syllidae	2.5	1	0	0	0	6	0.5	1
Arthropoda	0.5	0	0	0	0.5	2	0	1.5
Amphipoda	0	0	0	0	0	0	0	0.5
Cumacea	0	0	0	0	0.5	0.5	0	0
Decapoda (crabs)	0	0	0	0	0	0.5	0	0
Decapoda (shrimps)	0	0	0	0	0	0	0	0.5
Paguridae (hermit crabs)	0.5	0	0	0	0	1	0	0
Tanaidacea	0	0	0	0	0	0	0	0.5
Echinodermata	0	0	2	0.5	1.5	0.5	0.5	3.5
Holothuroidea	0	0	1.5	0	0	0.5	0	3
Ophiuroidea	0	0	0.5	0.5	1.5	0	0.5	0.5
Foraminifera	20,134	21142.5	20061	16787	18572.5	5663.5	8705.5	19094
Calcarina	19,283	20,140	19448.5	16251	18046	5443.5	8610.5	19049
Cycloclypeus	254	367.5	216.5	163	174	183.5	74.5	18.5
Operculina	597	635	396	373	352.5	36.5	20.5	26.5
Mollusca	108	169	98.5	127	117.5	52.5	58.5	61.5
Anodontia	0	0	0	0	0	0	0	0.5
Batillaria	44.5	62.5	41.5	57.5	33	30	14	35.5
Cerithiidae	7.5	14	12.5	3	10	1	0	1.5
Cerithiopsidae	10.5	24	15	13	7.5	0.5	2.5	3
Cerithiposidae	0	0	0	0	3.5	5.5	0	0
Conus	1.5	3	0	0.5	0	0	0.5	0.5
Cypraea	0	0	0	0.5	0	0	0.5	0
Diastomatidae	2.5	0	0	5	0	0	0	0
Epitoniidae	0	0	0.5	0	0	0	0	0
Fasciolariidae	0	0	0.5	0	0	1	0	0

TAXA	STATION							
	CR1	CR2	CR3	CR4	CR5	SG1	SG2	SG3
Lucinidae	0	1	0.5	0	0	0	0.5	0
Mactridae	0	0	0.5	0	0	0	0	0
Nassarius	4	9	4	11	14.5	10	1	3
Naticidae	0	0	0	0	0	0.5	0	0.5
Nereididae	0	0	0	0	0	1	0	0
Neritidae	0.5	0.5	0	0	0	1	24	0.5
Olividae	0	1	0	0	0	0	0	0
Ovulidae	0	0	0	0	0	0	0	1
Pyramidellidae	0	0	0	0	0	1	1.5	0
Strombidae	0.5	0	0	0	0	0	0	1
Tellinidae	0	0	0	0.5	0	0.5	0	0
Terebridae	11	30.5	4.5	11.5	11.5	0	8	7.5
Triphoridae	25.5	23	18	22	33.5	0	1.5	5.5
Trochidae	0	0	0	0	3.5	0	0	0.5
Turbinidae	0	0	0	0	0	0.5	0	0
Umbonium	0	0.5	0	0	0	0	2.5	0.5
unidentified gastropod	0	0	1	2.5	0.5	0	0	0
Vexillum	0	0	0	0	0	0	2	0.5
Platyhelminthes	0	0	0.5	0	0.5	5.5	1	1
Turbellaria	0	0	0.5	0	0.5	5.5	1	0
Mean Density	20266.5	21315	20166.5	16916	18694.5	5742.5	8766.5	19164.5

2.2.5.5 Plankton Community

Phytoplankton

292 The phytoplankton community observed in Calatagan, Batangas was composed of 57 taxa under three major groups namely Diatoms (*Bacillariophyta*), Dinoflagellates (*Dinophyta*), and Blue-Green Algae (*Cyanophyta*). Among the three, majority of the phytoplankton were Diatoms with 41 taxa, followed by Dinoflagellates with 13 taxa, and Blue-Green Algae with 3 taxa.

293 In terms of the relative abundance of the phytoplankton groups in each station, Diatoms were observed to be the dominant phytoplankton group in across sampling stations. Highest proportion of Diatoms was observed in PL1 whereas least was observed in PL6. Next to Diatoms, the Blue-Green Algae had the second highest density across stations. Overall, the highest proportion of Blue-Green Algae was observed in PL6 and the least was observed in PL1. Dinoflagellates were the least abundant across stations which comprise no more than 10% of the total abundance in each station. High species richness and population densities of Diatoms are common in coastal ecosystems where these organisms highly contribute to the ocean's productivity (Petrov et al., 2010; Romeo and Armand 2010).

294 Across stations, 4 taxa of phytoplankton were observed to have high relative abundances namely Thalassionema bacillare, Thalassionema nitzschioides, Chaetoceros affinis and Oscillatoria sp. (Figure 2). Among the four, T. bacillare has the highest relative abundance across the stations, followed by T. nitzschioides in PL1, PL3, PL4, and PL5, and Oscillatoria sp. in PL2 and PL6.

295 In terms of density, highest density was observed in PL5 whereas the lowest density was observed in PL6. This may indicate that phytoplankton productivity may be highest in PL5 and lowest in PL6 or it could indicate that grazing is more intense in PL6.

Table 2-23: Mean Densities of Phytoplankton Species

Phytoplankton	Mean density (cells/m3)						Overall Mean Density (cells/m^3)	Relative Mean Density (%)
	PL1	PL2	PL3	PL4	PL5	PL6		
DIATOMS (Bacillariophyta)								
1. Amphora sp.	28.42	0.00	0.00	0.00	0.00	0.00	4.74	0.00
2. Asterionellopsis sp.	0.00	0.00	0.00	1,250.50	824.19	0.00	345.78	0.24
3. Bacteriastrum delicatulum	0.00	0.00	0.00	369.47	284.20	0.00	108.95	0.07
4. Bacteriastrum hyalinum	4,291.49	3,495.72	2,415.74	4,092.55	5,399.89	994.72	3,448.35	2.37
5. Biddulphia sp.	0.00	0.00	0.00	0.00	284.20	0.00	47.37	0.03
6. Chaetoceros aequatorialis	2,245.22	1,875.75	596.83	795.77	1,051.56	483.15	1,174.71	0.81
7. Chaetoceros affinis	11,709.23	6,991.43	9,549.27	13,727.08	31,802.49	6,764.07	13,423.93	9.23
8. Chaetoceros borealis	7,900.89	4,774.64	2,216.80	3,637.82	4,632.53	1,307.34	4,078.34	2.81
9. Chaetoceros constrictus	0.00	2,671.52	966.30	1,506.28	284.20	28.42	909.45	0.63
10. Chaetoceros danicus	568.41	1,278.92	341.05	738.93	937.88	568.41	738.93	0.51
11. Chaetoceros decipiens	56.84	1,136.82	0.00	2,131.53	2,245.22	397.89	994.72	0.68
12. Chaetoceros lorenzianus	1,477.86	85.26	0.00	0.00	0.00	0.00	260.52	0.18
13. Coscinodiscus sp.	1,193.66	966.30	1,222.08	1,335.76	2,017.85	881.03	1,269.45	0.87
14. Cyclotella sp.	426.31	1,136.82	625.25	710.51	1,165.24	426.31	748.41	0.51
15. Cylindrotheca closterium	0.00	142.10	170.52	0.00	0.00	0.00	52.10	0.04
16. Diadesmis sp.	1,676.81	0.00	824.19	255.78	0.00	0.00	459.46	0.32
17. Diatoma sp.	0.00	483.15	0.00	0.00	0.00	0.00	80.52	0.06
18. Ditylum sp.	0.00	0.00	0.00	28.42	142.10	28.42	33.16	0.02
19. Entomoneis sp.	0.00	0.00	28.42	0.00	0.00	0.00	4.74	0.00
20. Eucampia sp.	397.89	1,364.18	1,733.65	568.41	369.47	142.10	762.62	0.52
21. Fragilaria sp.	142.10	284.20	738.93	341.05	454.73	511.57	412.10	0.28
22. Grammatophora sp.	0.00	0.00	0.00	0.00	0.00	28.42	4.74	0.00
23. Guinardia sp.	0.00	483.15	0.00	0.00	28.42	113.68	104.21	0.07
24. Gyrosigma sp.	28.42	28.42	0.00	0.00	0.00	0.00	9.47	0.01
25. Hemiaulus sp.	0.00	341.05	483.15	227.36	539.99	454.73	341.05	0.23
26. Melosira sp.	0.00	596.83	0.00	0.00	0.00	0.00	99.47	0.07
27. Navicula sp.	0.00	0.00	0.00	28.42	0.00	56.84	14.21	0.01
28. Nitzschia sp.	0.00	113.68	255.78	0.00	28.42	0.00	66.31	0.05

Phytoplankton	Mean density (cells/m3)						Overall Mean Density (cells/m^3)	Relative Mean Density (%)
	PL1	PL2	PL3	PL4	PL5	PL6		
29. Ornithocercus magnificus	0.00	0.00	0.00	0.00	227.36	0.00	37.89	0.03
30. Phalacroma rotundatum	0.00	0.00	0.00	0.00	0.00	85.26	14.21	0.01
31. Pleurosigma directum	28.42	28.42	28.42	28.42	0.00	0.00	18.95	0.01
32. Pleurosigma sp.	0.00	0.00	0.00	28.42	0.00	0.00	4.74	0.00
33. Pseudo-nitzschia sp.	0.00	28.42	284.20	0.00	0.00	0.00	52.10	0.04
34. Rhizosolenia bergonii	1,392.60	994.72	1,079.98	2,216.80	3,495.72	1,193.66	1,728.91	1.19
35. Rhizosolenia robusta	1,847.33	767.35	0.00	397.89	1,108.40	426.31	757.88	0.52
36. Stephanopyxis sp.	625.25	341.05	341.05	369.47	625.25	227.36	421.57	0.29
37. Surirella robusta	0.00	28.42	0.00	0.00	0.00	0.00	4.74	0.00
38. Synedra sp.	0.00	511.57	0.00	0.00	0.00	0.00	85.26	0.06
39. Synedra ulna	113.68	1,534.70	170.52	1,449.44	795.77	369.47	738.93	0.51
40. Thalassionema bacillare	78,440.47	24,157.39	58,148.26	65,423.90	108,225.11	26,203.66	60,099.80	41.34
41. Thalassionema nitzschioides	34,047.71	6,934.59	18,530.14	21,002.72	76,308.93	10,089.26	27,818.89	19.14
BLUE-GREEN ALGAE (Cyanophyta)								0.00
42. Anabaena sp.	0.00	113.68	142.10	85.26	625.25	227.36	198.94	0.14
43. Lyngbya sp.	0.00	0.00	28.42	28.42	0.00	0.00	9.47	0.01
44. Oscillatoria sp.	16,085.98	9,861.90	15,574.41	20,121.69	43,938.03	15,006.00	20,098.00	13.82
DINOFLAGELLATES (Dinophyta)								0.00
45. Ceratium furca	113.68	170.52	56.84	113.68	710.51	625.25	298.41	0.21
46. Ceratium fusus	0.00	85.26	682.09	596.83	1,222.08	227.36	468.94	0.32
47. Ceratium macroceros	682.09	568.41	284.20	454.73	625.25	426.31	506.83	0.35
48. Ceratium tripos	113.68	0.00	170.52	341.05	227.36	28.42	146.84	0.10
49. Dinophysis caudata	142.10	0.00	0.00	0.00	0.00	227.36	61.58	0.04
50. Dinophysis miles	511.57	113.68	397.89	596.83	397.89	142.10	359.99	0.25
51. Noctiluca sp.	0.00	28.42	0.00	0.00	113.68	0.00	23.68	0.02
52. Odontella aurita	0.00	142.10	113.68	28.42	0.00	113.68	66.31	0.05
53. Ornithocercus magnificus	198.94	0.00	397.89	341.05	198.94	255.78	232.10	0.16

Phytoplankton	Mean density (cells/m3)						Overall Mean Density (cells/m^3)	Relative Mean Density (%)
	PL1	PL2	PL3	PL4	PL5	PL6		
54. Peridinium sp.	113.68	0.00	28.42	227.36	198.94	142.10	118.42	0.08
55. Phalacroma rotundatum	341.05	198.94	28.42	255.78	113.68	170.52	184.73	0.13
56. Prorocentrum sp.	170.52	539.99	1,136.82	596.83	738.93	284.20	577.88	0.40
57. Protoperidinium sp.	28.42	113.68	227.36	454.73	625.25	28.42	246.31	0.17
GRAND TOTAL	**167,140.72**	**75,513.16**	**120,019.60**	**146,905.35**	**293,014.93**	**69,686.97**	**145,380.12**	**100.00**

2.2.5.6 Zooplankton

296 The zooplankton community observed in Calatagan, Batangas was composed of 13 taxa categorized under seven (7) groups namely Appendicularia, Bivalvia, Ciliatea, Polychaeta, Gastropoda, Echinodermata, and Copepoda. Among the groups, Copepoda was the most represented with five (5) taxa, followed by Polychaeta and Ciliatea with two (2) taxa each. The rest were represented by a single taxon only.

297 Across stations, Copepoda has the highest relative abundance and comprised more than 80% of the overall relative abundance of zooplankton in each station. Ciliatea was next to Copepoda. These taxa recorded their highest proportion in station PL6 (12%). Consistently across stations, the remaining groups were present only in small proportions.

298 The copepods sampled were present in different growth stages namely Nauplius, Cyclopoid, and Calanoid. Among the three, Nauplius consistently has the highest abundance in all stations. Aside from these copepods, ciliates Codonellopsis and Tintinnid were also observed to notable proportions in PL6 and PL4.

299 As for abundance, density of zooplankton was observed to be highest in PL5 with 16,228 individuals/m^3 and lowest in PL2 with 4,490 individuals/m^3. Among zooplankton groups, copepods are one of those which are characterized to have high growth rates and fecundity, hence, having the ability to maximize their reproductive output. Abundance of Nauplius, the larval stage of copepods, may indicate the continuous reproduction of copepods in the study site.

2.2.5.7 Threat to existence and/or loss of important local species and habitat

300 Quarry operation may cause increase in turbidity of the nearby coastal water due to stormwater run-off. Benthic organisms are specially affected by silt as they are filter feeders and may suffocate due to clogging from sediments.

301 Domestic wastewater will also be generated during the construction and operation of the proposed project. Discharge of untreated domestic wastewater in the coastal water may cause deterioration of its water quality making it unsuitable habitat for aquatic species.

302 Normal operations of the pier facility are not expected to pose a threat to the nearby coral reef and its associated biological communities. The piles (and the presence of hard substrates like revetment/armor rocks) on the pier structure could, in fact, acts as artificial hard substrates that could attract colonization for a variety of marine life and provide shelter to a number of organisms. The piles and revetment/armor rocks will also provide food and protection for numerous and diverse marine organisms but will also serve as attachment or substrate for attached forms; thus, these artificial hard structures will enhance the marine habitat, biodiversity and productivity quite similar to coral reefs in this site.

303 Pier operations, however, could introduce the risk of oil spill. The impact from accidental oil spills could be a wide range of consequences depending on the amount and physical characteristics of spilled oil and the prevailing meteorological and sea conditions during the accident. Due to the proximity of the pier to the shoreline, any accidental spillage that may occur is likely to affect the nearby coral reefs and beach habitats. The extent of the affected area, however, will depend on the volume of spilled fuel oil.

2.2.5.8 Threat to abundance, frequency and distribution

304 Impact of the construction activities within the project area and the quarry operation is the expected increased siltation/sedimentation (water turbidity) in the coastal marine areas resulting from earth -moving activities (clearing or removal of groundcover and vegetation, excavation, leveling, and filling). This may impact the nearby coastal water during rainy season and stormy conditions (or typhoon events). Turbidity would tend to limit light penetration in the water column which is essential in photosynthesis, a vital process in the marine ecosystem. Increased suspended sediment levels and turbidity may also cause marine species in the area to migrate to other suitable areas.

305 The project is predicted to have minimal impact on the abundance, frequency and distribution of marine species (or genera). Except for the pier, all development activities will be located further inland reducing the exposure of marine organisms to disturbance. Furthermore, majority of the species observed in the study area were relative common and were observed in more more than two stations in the study site. This indicates that there is a strong possibility that the community structure will recover and will be retained in the event of a temporary disturbance.

Table 2-24: Relative and Mean Densities of Zooplankton Groups

Zooplankton	Mean density (individuals/m3)						Overall Mean Density (individuals/m^3)	Relative Mean Density (%)
	PL1	PL2	PL3	PL4	PL5	PL6		
APPENDICULARIA								
1. Oikopleura	198.94	56.84	0.00	198.94	85.26	284.20	137.37	1.49
BIVALVIA								
2. Bivalve veliger larvae	113.68	56.84	28.42	0.00	0.00	28.42	37.89	0.41
CILIATEA								
3. Codonellopsis sp.	284.20	227.36	426.31	511.57	881.03	653.67	497.36	5.40
4. Tintinnid	170.52	142.10	85.26	1,079.98	511.57	341.05	388.41	4.21
COPEPODA								
5. Calanoid	1,193.65	426.31	539.99	909.45	369.47	710.51	691.56	7.50
6. Copepod egg sac	28.42	28.42	0.00	227.36	170.52	113.68	94.73	1.03
7. Cyclopoid	1,307.33	625.25	824.19	1,790.49	4,575.69	1,051.56	1,695.75	18.40
8. Harpacticoid	28.42	0.00	56.84	511.57	142.10	142.10	146.84	1.59
9. Nauplius	4,916.68	2,927.31	4,149.39	7,275.64	9,265.07	3,723.08	5,376.19	58.32
ECHINODERMATA								
10. Ophiopluteus larvae	170.52	0.00	0.00	28.42	0.00	0.00	33.16	0.36
GASTROPODA								
11. Mid gastropod veliger larvae	142.10	0.00	255.78	0.00	113.68	28.42	90.00	0.98
POLYCHAETA								
12. Polychaete metatrochophore larvae	0.00	0.00	28.42	0.00	113.68	0.00	23.68	0.26
13. Polychaete polynoid larvae	0.00	0.00	0.00	28.42	0.00	0.00	4.74	0.05
GRAND TOTAL	**8,554.46**	**4,490.43**	**6,394.60**	**12,561.84**	**16,228.08**	**7,076.69**	**9,217.69**	**100.00**

2.2.6 Summary of Baseline Findings Impacts and Mitigation on Water

306 The following table lists the impacts and mitigation on Water:

Table 2-25: Summary of Significant Baseline Findings and Potential Impacts and Mitigation on Water

Summary of Baseline Findings on Water:

- **Oceanography**
  - Bathymetry will not be changed since there will be no reclamation.
- **Groundwater Quality**
  - GW3 and GW4 exceeded the DENR limit for Nitrate.
  - GW4 exceeded the DENR limit for TSS.
  - GW1, GW2 and GW4 have Fecal Coliform above the limit of PNSDW and DENR.
- **Water Quality**
  - CW4 exceeded the standard limit for fecal coliform.
- **Marine Ecology**
  - Relative cover of hard corals and other fauna remain generally low across stations.
  - Fish assemblages were dominated by small non-commercial species, there was a scarcity of important target species, and biomass was relatively low. However, fish species richness was notably good.
  - Seagrass communities appeared to be in good condition with moderate estimates of diversity and canopy cover.
  - The reef benthic communities were in relatively poor condition as characterized by patchy distribution of coral communities and low live hard coral cover.
  - There are mangroves along a 4-km stretch of the shoreline.

POTENTIAL IMPACTS	PROJECT PHASES	DESCRIPTION	MITIGATING MEASURES
WATER QUALITY			
Degradation of ground water quality	Construction	Accidental oil spills from heavy equipment	Use sawdust, rice hulls, or coir dusts to absorb the oil spills. Maintain canal in the maintenance and repair area of vehicles and equipment.
	Operation	Accidental oil spill from delivery trucks and operation of pier facility	Oil Spill Management Plan
Degradation of ground water / coastal water quality	Construction/ Operation	Ground and coastal water contamination from improper disposal of wastes, percolated wastewater, sludge and fecal matter	Provision of sanitation facilities for workers (e.g. toilets, showers, etc.) Sewage Treatment Plant
Degradation of coastal water quality	Construction	Possible siltation and surface runoff Increase in turbidity of coastal water	Establishment of sediment traps and erosion barriers Regular removal of silt and sediments
	Operation	Runoff from plant and quarry operations Possible spillage of raw materials from pier	Installation and maintenance of drainage system within the plant and quarry areas. Provision of siltation ponds in the quarry areas.

POTENTIAL IMPACTS	PROJECT PHASES	DESCRIPTION	MITIGATING MEASURES
		Accidental oil spill from ship	Coastal water monitoring Oil spill contingency plan
HYDROLOGY/HYDROGEOLOGY			
Competition in water use	Construction/ Operation	Construction and operation activities of the project may cause water competition with the communities	NWRB permits will be secured for the operation of deep wells.
MARINE ECOLOGY			
Threat to existence and/or loss of important local species and habitat	Construction/ Operation	Possible siltation that may disturb nearby reefs	Installation of silt curtain

2.3 The Air

307 The coverage of the EIA study on Air Module includes the host barangays of Baha and Talibayog, particularly the residential areas in the vicinity.

2.3.1 Meteorology/Climatology

2.3.1.1 Change in the local micro-climate e.g. local temperature

308 Climate pertains to the average long-term weather of an area and is typically determined over a period of at least 30 years. It is an essential environmental factor as it affects general growth and development. In the Philippines, climate is classified into 4 types based on the rainfall distribution and pattern.

309 The meteorological situation in the area was based on a synthesis of climatological data as observed from the nearest weather station of the Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA) in Ambulong, Batangas, and from other published reports of PAGASA for the years 1981-2010.

310 The province of Batangas is located between 13° 30' to 14° 30' North latitude and 120° 30' to 121° 30' East Longitude. Its tropical climate is attributed to its proximity to the equator. It is bounded by the Sulu Sea on the south and the China Sea on the east where oceanic current is considered as one of the factors that make up the climate of the province. Variation in temperature is brought about by elevation which ranges 0 to 1,000 meters above sea level.

311 There are two types of wind systems that affect the province. The Northeast Monsoon is felt during the later part of October in northern and northeastern Batangas attaining a maximum intensity in January and receding gradually in the later part of April. The Southwest Monsoon which attains a maximum intensity in August affects the province as early as the month of May.

312 Climatological conditions prevailing in the area falls under Type I of the Modified Coronas Classification of Philippine Climate **(Figure 2-35)**. The area is subject to two pronounced seasons, dry from December to May and wet from June to November. Situated on the western side of Luzon, the project area is exposed to three major climatic influences: the southwest monsoon which prevails in the country from June to October; the northeast monsoon which prevails from October to March with maximum intensity in the month of January; and the warm North Pacific trades which prevails in April and May.

Temperature

313 April and May are the hottest months of the year, with a recorded mean temperature of 29.2 degrees Celsius (°C), while February is the coldest month, with average temperatures of 22.1°C **(Table 2-26)**.

314 According to the climatological extremes **(Table 2-27)**, the highest temperature recorded in the area is 38.8°C on May 15, 1921, while the lowest recorded temperature is 16.0°C on January 9, 1985.

Rainfall

315 The maximum rain period occurs during the prevalence of the southwest monsoon, usually from June to October. The rainiest months are from June to October with mean monthly rainfall values ranging from 228.7 to 218.4mm and with number of rainy days ranging from 15 to 19 days **(Table 2-26)**. The average annual rainfall in the area is 1,767 mm with 132 rainy days. The driest month in the area is February with only 16.0 mm of rainfall and 3 rainy days. Climatological normal values of rainfall for the area are shown in **Table 2-26** and the computed extreme values of rainfall are shown in **Table 2-27.**

Surface Wind

316 From October to April, northeastern winds prevail over the area as shown in **Table 2-26**. The southwest winds, on the other hand, prevail from June to September. The average wind speed throughout the year is 2 m/s.

Tropical Cyclones

317 Tropical cyclones pass through Batangas periodically from October to December. The area experiences an estimated 3 cyclones every two years. **Figure 2-36** shows the frequencies of tropical cyclones in various regions of the country.

PAGASA Climate Projection

318 In November 2011, Department of Environment and Natural Resources - Environmental Management Bureau (DENR-EMB) released a memorandum circular numbered 005 (MC 2011-005), which mandates the inclusion of DRR and CCA in the Philippine EIS System, to *"ensure that the project is resilient and that their environmental impact do not exacerbate natural hazards or climate change's effects on human or natural systems"* (DENR-EMB, 2011). The circular aims to provide information on changes that may happen to the area based on projections made by the Philippine Atmospheric, Geophysical, and Astronomical services Administration (PAGASA). The projections include data for 2020 and 2050. The PAGASA projections are shown in **Figure 2-37**.

319 From PAGASA projection in 2020 and 2050, Region 4A would experience higher temperatures during summer season and increased rainfall during the rainy season by year 2020 and 2050. Higher temperatures will result in water shortages, and increased rainfall may induce flooding.

320 Frequency of extreme events under medium-range emission scenario will increase in 2020 and 2050. Considering these figures, appropriate precautionary measures may be employed during the construction and operation phases of the project to avoid any complication in the long-run.

321 Considering these figures, water shortages may be the main impact of less rainfall and higher temperature. Appropriate measures such as tree planting and water conservation shall be employed during the construction and operation phases of the project to avoid any complications in the long-run.

Figure 2-35: Climatological Map of the Philippines

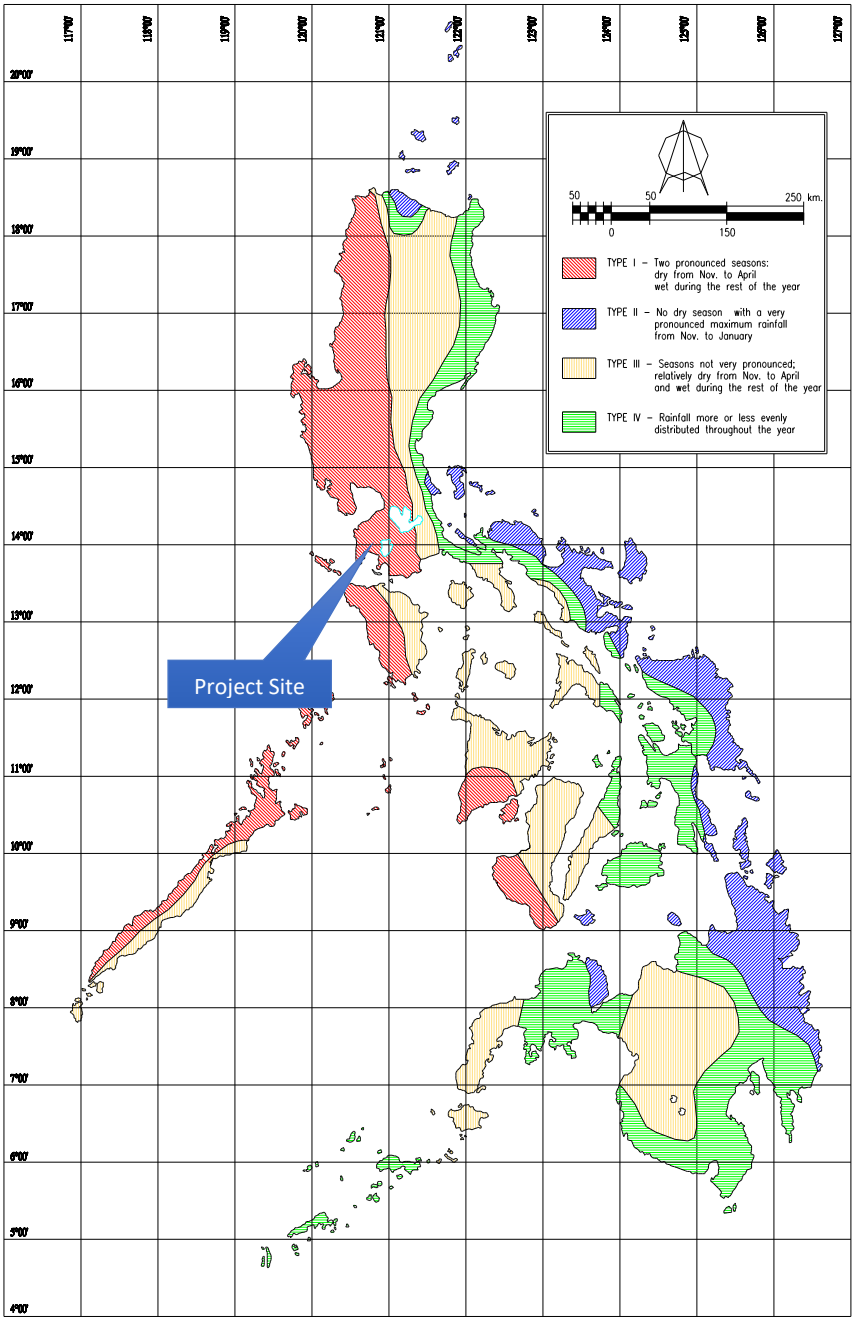


FIGURE NO.:	FIGURE TITLE:	
2-35	**CLIMATOLOGICAL MAP OF THE PHILIPPINES**	
PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
ASTURIAS INDUSTRIES INC	**3.0 MMTPY CEMENT PLANT COMPLEX WITH QUARRY** Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas	**LCI ENVI CORPORATION**

Figure 2-36: Frequencies of Tropical Cyclones in Various Regions of the Country

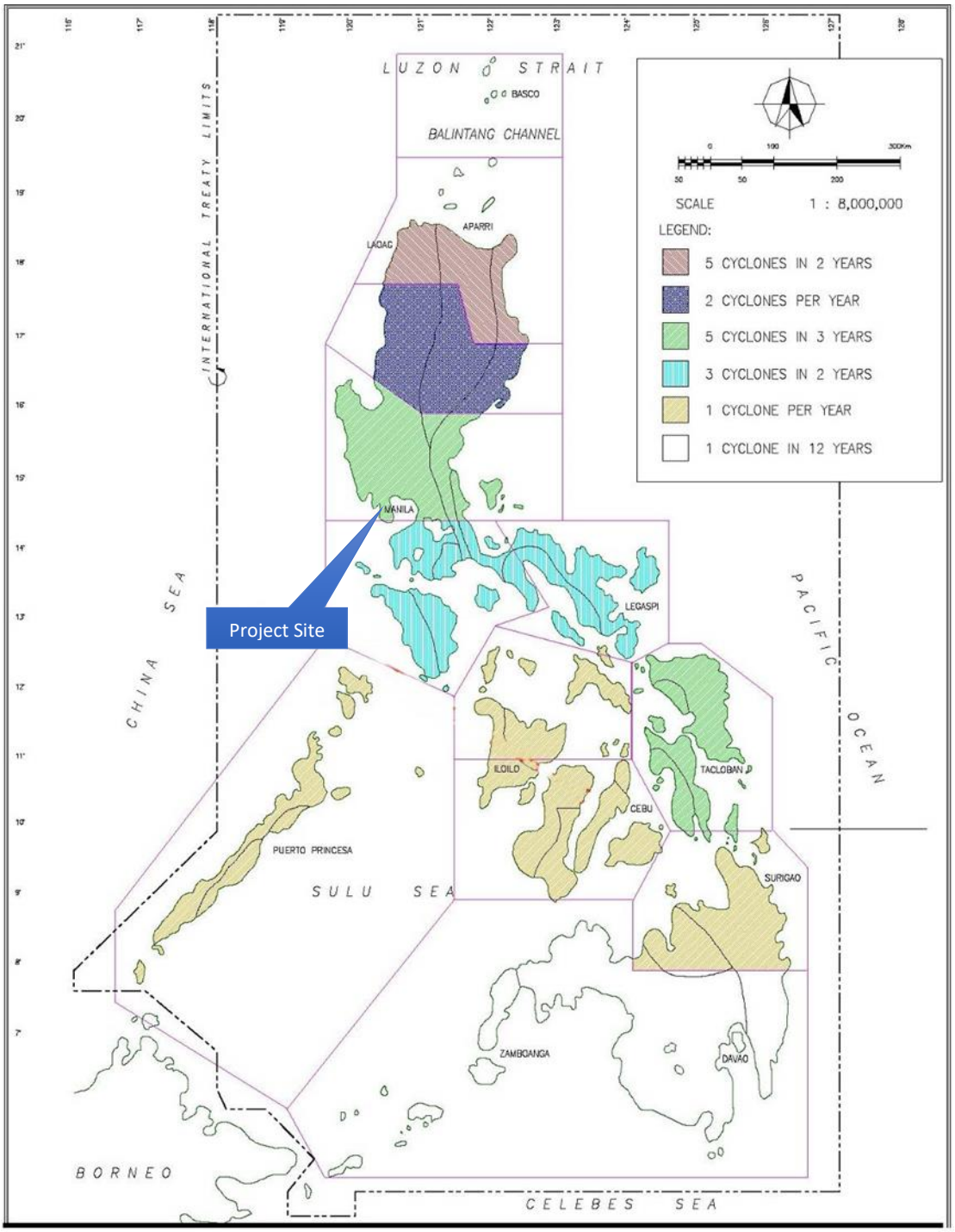


FIGURE NO.:	FIGURE TITLE:	
2-36	**FREQUENCIES OF TROPICAL CYCLONES IN VARIOUS REGIONS OF THE COUNTRY**	
PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
ASTURIAS INDUSTRIES INC	**3.0 MMTPY CEMENT PLANT COMPLEX WITH QUARRY** Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas	**LCI ENVI CORPORATION**

Table 2-26: Climatological Normals in Ambulong, Batangas (1981-2010)

CLIMATOLOGICAL NORMALS																
STATION: AMBULONG, BATANGAS												LATITUDE: **14º05'24.29"N**				
PERIOD: 1981 - 2010												LONGITUDE: **121º03'18.88"E**				
												ELEVATION: **11m**				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16a)	(16b)
MONTH	RAINFALL		TEMPERATURE						VAPOR PRESS. (mbs)	RH (%)	MSLP (mbs)	WIND		CLOUD AMT. (okta)	NO. OF DAYS W/	
	AMOUNT (mm)	NO. OF RD	MAX (°C)	MIN (°C)	MEAN (°C)	DRY BULB (°C)	WET BULB (°C)	DEW POINT (°C)				DIR (16pt)	SPD (mps)		TSTM	LTNG
JAN	22.7	5	30.4	22.2	26.3	25.9	23.1	22	26.3	79	1013	NE	2	5	0	0
FEB	16	3	31.6	22.1	26.9	26.4	23.3	22.1	26.5	77	1013	NE	2	4	0	0
MAR	21.5	3	33.2	22.9	28.1	27.7	24.1	22.8	27.5	74	1012	NE	2	4	1	1
APR	35	4	34.5	23.9	29.2	29	25.1	23.8	29.2	73	1010	NE	1	4	5	5
MAY	116.6	10	33.9	24.6	29.2	29.1	25.7	24.6	30.7	76	1009	NE	1	5	13	14
JUN	228.7	16	32.5	24.6	28.6	28.4	25.6	24.7	30.9	80	1008	SW	1	6	15	15
JUL	329.6	19	31.4	24.1	27.8	27.6	25.3	24.5	30.6	83	1008	SW	1	6	17	16
AUG	286.9	18	31	24.3	27.6	27.5	25.3	24.5	30.7	84	1008	SW	2	6	12	12
SEP	255	17	31.4	24.1	27.8	27.5	25.3	24.5	30.7	84	1009	SW	1	6	14	14
OCT	218.4	15	31.6	23.9	27.7	27.4	25.1	24.3	30.3	83	1009	NE	1	6	9	14
NOV	144.7	13	31.4	23.6	27.5	27.1	24.6	23.7	29.2	81	1010	NE	2	5	2	6
DEC	92	9	30.2	22.8	26.5	26.2	23.6	22.6	27.3	80	1012	NE	2	5	0	1
ANNUAL	**1767**	**132**	**31.9**	**23.6**	**27.8**	**27.5**	**24.7**	**23.7**	**29.2**	**80**	**1010**	**NE**	**2**	**5**	**88**	**98**

Source: PAGASA

Table 2-27: Climatological Extremes in Ambulong, Batangas (As of 2017)

CLIMATOLOGICAL EXTREMES

STATION: AMBULONG, BATANGAS — LATITUDE: **14º05'24.29"N**

YEAR: AS OF 2017 — LONGITUDE: **121º03'18.88"E**

ELEVATION: **11m**

MONTH	TEMPERATURE (ºC)				GREATEST DAILY RAINFALL (mm)		STRONGEST WINDS (mps)			SEA LEVEL PRESSURES (mbs)			
	HIGH	DATE	LOW	DATE	AMOUNT	DATE	SPD	DIR	DATE	HIGH	DATE	LOW	DATE
JAN	34.9	01-03-1958	16.0	01-09-1985	118.1	01-01-1960	20	ENE	01-29-1989	1022.1	01-30-1998	1004.1	01-05-1999
			16.0	01-24-2014									
FEB	37.2	02-28-1985	16.1	02-03-1976	92.7	02-21-2013	24	NE	02-06-1982	1022.2	02-01-1962	1003.7	02-08-1985
										1022.2	02-14-2017		
MAR	38.0	03-30-1984	16.2	03-03-1963	60.6	03-24-1980	22	ENE	03-10-1989	1021.3	03-30-1958	1002.9	03-27-2001
APR	38.3	04-05-1987	17.5	04-05-1963	57.0	04-23-1996	18	SE	04-25-1989	1019.4	04-04-1998	1001.5	04-06-1994
MAY	38.8	05-15-1921	20.0	05-21-1974	499.2	05-21-1976	41	SW	05-17-1989	1015.8	05-02-1998	987.3	05-17-1989
JUNE	38.0	06-14-1983	20.6	06-18-1976	301.5	06-27-1961	40	SW	06-23-1984	1016.2	06-07-1997	987.4	06-29-1964
JULY	36.8	07-15-1999	19.2	07-19-2014	218.5	07-13-2010	75	W	07-15-1983	1019.5	07-19-2017	972.1	07-04-2001
	36.8	07-23-2016											
AUG	36.7	08-23-1969	19.0	08-31-2015	283.6	08-24-1990	40	NNE	08-12-1987	1015.3	08-23-1999	995.2	08-12-1987
SEP	35.7	09-14-1984	19.5	09-04-1991	273.1	09-11-2017	54	SSW	09-09-1982	1015.7	09-05-1953	987.7	09-09-1982
	35.7	09-07-2016											
	35.7	09-09-2017											
OCT	37.3	10-11-1975	18.9	10-31-1969	183.2	10-28-2000	70	S	10-11-1989	1017.3	10-28-1960	977.4	10-10-1989
NOV	36.5	11-02-1956	18.3	11-29-1974	277.2	11-03-1995	45	NE	11-25-1987	1020.0	11-27-2001	978.6	11-03-1995
			18.3	11-22-1975									
DEC	35.3	12-25-1962	16.8	12-16-1960	151.9	12-09-1971	54	NE	12-30-1950	1024.2	12-27-2001	996.2	12-05-1993
ANNUAL	**38.8**	**05-15-1921**	**16.0**	**01-09-1985**	**499.2**	**05-21-1976**	**75**	**W**	**07-15-1983**	**1024.2**	**12-27-2001**	**972.1**	**07-04-2001**
			16.0	**01-24-2014**									
Period of Record	**1919-2017**				**1949-2017**		**1950-2017**			**1949-2017**			

Figure 2-37: PAGASA Climate Projection for 2020 and 2050 covering Batangas Province

Table a: Seasonal temperature increases (in °C) in 2020 and 2050 under medium-range emission scenario in provinces in Region 4-A

	OBSERVED BASELINE (1971-2000)				CHANGE in 2020 (2006-2035)				CHANGE in 2050 (2036-2065)			
	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON
Region 4-A												
BATANGAS	24.2	26.5	25.9	25.6	1.0	1.2	0.9	1.0	1.9	2.2	1.8	1.9
CAVITE	25.7	28.2	27.3	26.9	1.0	1.2	0.9	1.0	2.0	2.2	1.8	1.9
LAGUNA	25.0	27.5	27.5	26.7	0.9	1.1	1.0	0.9	1.8	2.1	1.9	1.9
QUEZON	25.1	27.2	27.6	26.7	0.9	1.1	1.0	0.9	1.8	2.1	2.0	1.8
RIZAL	25.4	27.9	27.6	26.8	0.9	1.1	0.9	1.0	1.9	2.1	1.8	1.9

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

	OBSERVED BASELINE (1971-2000) mm				CHANGE in 2020 (2006-2035)				CHANGE in 2050 (2036-2065)			
	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON
Region 4-A												
BATANGAS	231.0	280.4	856.5	746.4	-29.9	-24.1	9.1	0.5	-11.1	-23.1	17.2	6.3
CAVITE	124.9	242.8	985.7	579.0	-26.1	-28.2	13.1	0.4	-19.1	-30.5	24.2	5.9
LAGUNA	629.2	386.8	845.0	1066.5	-20.2	-31.5	2.9	2.9	0.1	-34.8	6.8	0.4
QUEZON	827.7	382.7	670.0	1229.3	-6.5	-18.6	2.9	5.2	6.6	-20.6	6.5	0.9
RIZAL	262.4	241.5	1001.3	821.8	-13.1	-30.7	12.4	-0.9	-11.5	-39.8	24.8	-0.8

Table c: Frequency of extreme events in 2020 and 2050 under medium-range emission scenario in provinces in Region 4-A

Provinces	Stations	No. of Days w/ Tmax >35 °C			No. of Dry Days			No. of Days w/ Rainfall >200mm		
		OBS (1971-2000)	2020	2050	OBS	2020	2050	OBS	2020	2050
BATANGAS	Ambulong	928	8010	8016	8226	6081	6049	6	14	9
CAVITE	Sangley	630	1697	2733	7352	6635	6565	6	9	9
QUEZON	Alabat	53	132	733	6629	7025	7042	20	58	70
	Tayabas	22	791	1434	6771	4717	4668	17	9	12
	Casiguran	575	1720	2768	6893	4520	4887	23	54	57
	Infanta	350	378	1112	5903	4006	4015	22	39	34

SOURCE: PAGASA

FIGURE NO.:	FIGURE TITLE:	
2-37	**PAGASA Climate Projection for 2020 and 2050 covering Batangas Province**	
PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
ASTURIAS INDUSTRIES INC	**3.0 MMTPY CEMENT PLANT COMPLEX WITH QUARRY** Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas	**LCI ENVI CORPORATION**

2.3.1.2 Contribution in terms of greenhouse gas emissions (IPCC Guidelines)

323 Volumes 2 and 3 of the Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories was used to quantify the greenhouse gas emissions of the proposed project.

324 Given that the project is divided in three phases, GHG emissions per phase were quantified.

Phase 1: Potential GHG Emissions from 1.5 MMTPY Cement Grinding Facility

325 To consider all potential GHG emission sources, the following emission scopes were considered:

- **Scope 1 Emission Sources:** Hot Gas Generator
- **Scope 2 Emission Sources:** 12,000kWh power requirement (to be purchased)
- **Scope 3 Emission Sources:** Panamax Vessels, Delivery Trucks

326 The Tier 1 equation was used to compute for the potential Scope 1 CO_2 emissions, particularly the hot gas generator. **Table 2-32** shows the input data, as well as the potential CO_2 emissions per year. The hot gas generator consumes 2,000 L/day of diesel fuel, which converts to 0.077 TJ/day. The emission factor of 74,100 kg CO_2/TJ was taken from Chapter 2, Volume 2 of the IPCC Guidelines. An estimated 2,082,580 kg of CO_2 will be emitted by the hot gas generator per year.

Tier 1 Equation for Greenhouse Gas Emissions from Stationary Combustion

$$\boldsymbol{Emissions_{CO_2\ Diesel\ Oil} = Fuel\ Consumption_{Diesel\ Oil}\ x\ Emission\ Factor_{CO_2\ Diesel\ Oil}}$$

Table 2-28: Phase 1, Scope 1 Potential Emission Data

INPUT DATA		POTENTIAL EMISSIONS PER YEAR
Fuel Consumption[1] (TJ/day)	**Emission Factor[2] (kg CO_2/TJ)**	(kg CO_2/year)
0.077	74,100	2,082,580
[1] – Fuel consumption data provided by Asturias Industries, Inc. [2] – Emission factor taken from Chapter 2, Volume 2 of Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas		

327 The emission factor from the World Bank Greenhouse Gas Emissions Inventory Management Plan for Internal Business Operations (2010) was used to compute for the Scope 2 Emission Sources. The given country-based emission factor for the Philippines is 989.34 lb CO_2/MWh, which is equal to 0.45 kg CO_2/kWh. The power requirement of the cement grinding facility is 12,000 kWh. Given these data, the Scope 2 CO_2 emissions from the cement grinding facility is 1,970,000 kg CO_2 per year **(Table 2-29)**.

Equation for Estimating Potential Scope 2 Emissions

$$\boldsymbol{Emissions_{CO_2\ Purchased\ Electricity} = Power\ Requirement\ x\ Emission\ Factor}$$

Table 2-29: Phase 1, Scope 2 Potential Emission Data

Input Data		Potential Emissions per year (kg CO_2/year)
Power Consumption[1] (kWh) per day	**Emission Factor[2] (kg CO_2/kWh)**	
12,000	0.45	1,970,000
[1] – Power consumption data provided by Asturias Industries, Inc. [2] – Emission Factor taken from World Bank Greenhouse Gas Emissions Inventory Management Plan for Internal Business Operations (2010)		

328 Volume 2, Chapter 3 of the IPCC Guidelines was used to estimate Scope 3 emissions. Tier 1 equation for water-borne navigation and road transportation were used to estimate emissions from the Panamax vessels and the delivery trucks, respectively. The fuel consumption of one Panamax vessel is assumed to be 0.14 TJ/day, while the estimated fuel consumption of 100 delivery trucks was 0.19 TJ/day. The data shows that the project may potentially emit an estimated 9,226,123 kg of CO_2 per year.

Equation for Estimating CO_2 Emissions from Road Transport

$$Emissions_{CO_2} = Fuel\ Consumed\ x\ Emission\ Factor$$

Table 2-30: Phase 1, Scope 3 Potential Emission Data

POTENTIAL EMISSION SOURCE	INPUT DATA		POTENTIAL EMISSIONS PER YEAR (kg CO_2/year)
	Fuel Consumed[1] (TJ/day)	**Emission Factor[2] (kg CO_2/TJ)**	
1 Panamax Vessel	0.14	77,400	3,995,330
100 Delivery Trucks	0.12089	74,100	5,230,793
		Total	**9,226,123**
[1] – Power consumption data provided by Asturias Industries, Inc. [2] – Emission factor taken from Chapter 2, Volume 2 of Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas			

329 The total projected CO_2 emissions from Phase 1 of the project is 13,278,703 kg CO_2/year, as summarized in **Table 2-31**.

Table 2-31: Potential Emissions per Year from Phase 1 Operations

Scope	Potential Source	Potential Emissions per Year (kg CO_2/year)
1	Hot gas generator (cement grinding)	2,082,580
2	Power consumption	1,970,000
3	1 Panamax Vessel	3,995,330
	100 delivery trucks	5,230,793
	Total	**13,278,703**

Phase 2: Potential GHG Emissions from 1.5 MMTPY Cement Plant

330 The following emission scopes were considered:

- Scope 1 Emission Sources: CO_2 emissions from clinker production and hot gas generator
- Scope 2 Emission Sources: 25,739 kWh power requirement (to be purchased)
- Scope 3 Emission Sources: Panamax Vessels, Delivery Trucks, Heavy Equipment for Quarrying

331 The Tier 1 equation was used to compute for the potential Scope 1 CO_2 emissions, particularly the hot gas generator and clinker production. **Table 2-32** shows the input data, as well as the potential CO_2 emissions (Tons CO_2/year). The cement plant will produce 1,500,000 tons of cement per year, 85% of which is clinker. The emission factor of 0.52 ton CO_2/ton clinker was taken from Chapter 2, Volume 3 of the IPCC Guidelines. An estimated 663,000 tons of CO_2 will be emitted by the clinker production per year. Emissions caused by diesel fuel use for the hot gas generator is 2,082,580 kg CO_2/year. The total Scope 1 emissions from Phase 2 of the project is 665,082,580 kg CO_2/year.

Tier 1 Equation for Greenhouse Gas Emissions from Cemente Production

$$Emissions_{CO_2} = Mass\ of\ Cement\ Produced\ x\ Clinker\ Fraction\ of\ Cement\ Type\ x\ Emission\ Factor\ for\ Clinker$$

Table 2-32: Phase 2, Scope 1 Potential Emission Data (Cement Production)

Input Data			Potential Emissions per year
Mass of Cement Produced[1] (Ton cement/year)	**Clinker Fraction of Cement Type[1] (Ton clinker/ton cement)**	**Emission Factor for Clinker[2] (ton CO_2/ton clinker)**	
1,500,000	0.85	0.52	663,000 Tons CO_2/year
			663,000,000 kg CO_2/year
Potential Emissions from Hot Gas Generator			2,082,580kg CO_2/year
Total			665,082,580 kg CO_2/year

[1] – Fuel consumption data provided by Asturias Industries, Inc.
[2] – Default Emission factor taken from Chapter 2, Volume 3 of Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas

332 The emission factor from the World Bank Greenhouse Gas Emissions Inventory Management Plan for Internal Business Operations (2010) was used to compute for the Scope 2 Emission Sources. The given country-based emission factor for the Philippines is 989.34 lb CO_2/MWh, which is equal to 0.45 kg CO_2/kWh. The estimated power consumption of the cement plant per day is 50,000 kWh, but this figure is reduced due to the operation of a 15,000 kWh waste heat recovery facility. A consumption of 50,000 kWh may potentially emit 8,312,500 kg CO_2 per year; this figure may be reduced to 5,748,750 kg CO_2 per year with the use of waste heat recovery system. **(Table 2-33)**.

Equation for Estimating Potential Scope 2 Emissions

$$Emissions_{CO_2\ Purchased\ Electricity} = Power\ Requirement\ x\ Emission\ Factor$$

Table 2-33: Phase 2, Scope 2 Potential Emission Data

Input Data		Potential Emissions per year (kg CO_2/year)
Power Consumption[1] (kWh) per day	**Emission Factor[2] (kg CO_2/kWh)**	
17,500[3]	0.45	2,874,375

[1] – Power consumption data provided by Asturias Industries, Inc.
[2] – Emission Factor taken from World Bank Greenhouse Gas Emissions Inventory Management Plan for Internal Business Operations (2010)
[3] – Power consumption of cement plant (25,000 kWh) is reduced by 7,500 kWh with the use of waste heat recovery system.

333 For the potential Scope 3 emissions from Phase 2 operations, it is assumed that the same number of vehicles as phase 1 will be used to deliver raw materials and finished products to and from the cement plant.

Equation for Estimating CO_2 Emissions from Road Transport

$$Emissions_{CO_2} = Fuel\ Consumed\ x\ Emission\ Factor$$

Table 2-34: Phase 2, Scope 3 Potential Emission Data

Potential Emission Source	Input Data		Potential Emissions per year (kg CO_2)
	Fuel Consumed[1] (TJ/day)	**Emission Factor[2] (kg CO_2/TJ)**	
1 Panamax Vessel	0.14	77,400	3,995,330
100 Delivery Trucks	0.19	74,100	5,230,793
		Total	9,226,123

[1] – Power consumption data provided by Asturias Industries, Inc.
[2] – Emission factor taken from Chapter 2, Volume 2 of Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas

334 The total projected CO_2 emissions from Phase 2 of the project is 667,183,078 kg CO_2/year, as summarized in **Table 2-35**. The operation of kiln will contribute to the significant increase of CO_2 emissions per year.

Table 2-35: Potential Emissions per Year from Phase 2 Operations

Scope	Potential Source	Potential Emissions per Year (kg CO_2/year)
1	Hot gas generator (cement grinding)	2,082,580
	Kiln (cement manufacturing)	663,000,000
2	Power consumption	2,874,375
3	1 Panamax Vessel	3,995,330
	100 delivery trucks	5,230,793
	Total	**677,183,078**

Phase 3: Potential GHG Emissions from 3.0 MMTPY Cement Plant

335 Since the operations will double in Phase 3, the emissions will also double, with an estimated potential emissions of 1,354,366,156 kg CO_2/year.

336 Results of potential CO_2 emissions were compared to the Second National Communication on Climate Change (Philippines). As shown in **Table 2-36**, the projected emissions from the Phase 3 operations of **Asturias Industries, Inc**. is 1,352 Gg CO_2/year, compared to the projected 100,402 Gg CO_2/year emitted in the Philippines in the year 2020. Emissions from Asturias is 1.3% of the annual CO_2 emission of the Philippines in 2020.

Table 2-36: CO_2 Emissions from Asturias Industries

Yearly Emissions	Gg CO_2/yr
Second National Communication on Climate Change (Philippines)	
2000	69,667
2020	100,402
Asturias Industries, Inc.	
Phase 1 Emissions	**13**
Phase 2 Emissions	**677**
Phase 3 Emissions	**1,354**

2.3.1.3 Emission Inventory (US EPA AP-42 Guidelines)

337 Chapter 11.6 of the Fifth Edition of US EPA AP-42 Compilation of Air Pollutant Emission Factors was used to estimate the particulate and gaseous emissions from each phase of the cement plant.

338 **Table 2-37** lists the particulate emission sources from Phase 1, Phase 2, and Phase 3, as well as the corresponding US EPA AP-42 emission factors (kg/ton) and the estimated emissions (kg/year). The highest possible estimated particulate emissions is 998,953 kg/year, which will come from Phase 3 operations.

339 Phases 2 and 3 of the project will have gaseous emissions coming from the kiln and the preheater/precalciner **(Table 2-38)**; Phase 1 will not have gaseous emissions since finish mills, which will be the main component of Phase 1, only have particulate emissions. It is expected that Phase 3 will result to 16,200,000 kg SO_2 (sum of emissions from kiln and preheater/precalciner), 9,000,000 kg NO_x, and 330,000 kg CO per year.

Table 2-37: Estimated Particulate Emissions

	Emission Factor (kg/ton)	Total Output (tons/year)	Estimated Emissions (kg/year)
Phase 1			
Finish grinding mill with fabric filter	0.0042	1,500,000	6,300
Finish grinding mill feed belt fabric filter	0.0012	1,500,000	1,800
Finish grinding mill weigh hopper fabric filter	0.0047	1,500,000	7,050
Finish grinding mill air separator fabric filter	0.0140	1,500,000	21,000
		Total	36,150

	Emission Factor (kg/ton)	Total Output (tons/year)	Estimated Emissions (kg/year)
Phase 2			
Primary limestone crushing with fabric filter	0.0005	2,333,192	1,167
Primary limestone screening with fabric filter	0.0001	2,333,192	233
Limestone transfer with fabric filter	0.000002	2,333,192	3
Secondary limestone screening and crushing	0.0002	2,333,192	373
Raw mill with fabric filter	0.0062	1,500,000	9,300
Raw mill feed belt with fabric filter	0.0016	1,500,000	2,400
Raw mill weigh hopper with fabric filter	0.0100	1,500,000	15,000
Raw mill air separator with fabric filter	0.0160	1,500,000	24,000
Dry process kiln with fabric filter	0.1000	1,500,000	150,000
Preheater kiln with fabric filter	0.1300	1,500,000	195,000
Clinker cooler with fabric filter	0.0680	1,500,000	102,000
		Total	499,477
Phase 3			
Primary limestone crushing with fabric filter	0.0005	4,666,384	2,333
Primary limestone screening with fabric filter	0.0001	4,666,384	467
Limestone transfer with fabric filter	0.000002	4,666,384	7
Secondary limestone screening and crushing	0.0002	4,666,384	747
Raw mill with fabric filter	0.0062	3,000,000	18,600
Raw mill feed belt with fabric filter	0.0016	3,000,000	4,800
Raw mill weigh hopper with fabric filter	0.0100	3,000,000	30,000
Raw mill air separator with fabric filter	0.0160	3,000,000	48,000
Dry process kiln with fabric filter	0.1000	3,000,000	300,000
Preheater kiln with fabric filter	0.1300	3,000,000	390,000
Clinker cooler with fabric filter	0.0680	3,000,000	204,000
		Total	998,953

Table 2-38: Estimated Gaseous Emissions

	Output (tons/year)	SO2		NOx		CO	
		EF (kg/ton)	EE (kg/year)	EF (kg/ton)	EE (kg/year)	EF (kg/ton)	EE (kg/year)
Phase 2							
Kiln	1,500,000	4.9	7,350,000	3.0	4,500,000	0.11	165,000
Preheater/ precalciner with spray tower	1,500,000	0.5	750,000	ND	-	ND	-
Phase 3							
Kiln	3,000,000	4.9	14,700,000	3.0	9,000,000	0.11	330,000
Preheater/ precalciner with spray tower	3,000,000	0.5	1,500,000	ND	-	ND	-
EF - Emission Factor EE - Estimated Emissions							

2.3.2 Air Quality (& Noise)

340 To assess the potential impact on air quality, ambient air sampling was conducted to establish the baseline air quality in the area. Air dispersion modelling was also done to predict the potential impact of the project on the overall air quality in the area.

341 According to the baseline air quality data, all the parameters measured were within the standard limit of the NAAQS. The observed noise level in the area were also within the NPCC standards.

342 The project is expected to emit gases such as CO, NO2, and SO2 due to its nature. Furthermore, TSP and PM10 are expected primarily because of the limestone crushing, finish milling, and quarrying activities. According to the results of the modelling, TSP and PM10 levels should be lower than the NAAQS, even without mitigating measures such as bag filters.

2.3.2.1 Degradation of air quality

343 To assess the baseline ambient air quality and noise levels at the proposed project site and the adjacent communities, sampling was conducted on 6 July 2018 at four stations situated along the main road of the proposed site. The photos and coordinates of the monitoring stations are provided in **Figure 2-38**. The location map is shown in **Figure 2-39**.

344 One-hour monitoring was conducted in each station. Field sampling and laboratory analysis were performed by CRL Calabarquez Corporation, a DENR-recognized laboratory based in Laguna.

345 Ambient air quality monitoring results are compared with the National Ambient Air Quality Standards (NAAQS) as per the Implementing Rules and Regulations (IRR) of the Philippine Clean Air Act of 1999 or Republic Act 8749 (DAO 2000-81), while noise level monitoring results are compared with the appropriate guideline values stipulated under the National Pollution Control Commission (NPCC) Memorandum Circular No. 002, Series of 1980.

346 The observed 1-hour ambient air concentrations and noise level propagations at the monitoring stations are summarized in **Table 2-39**.

347 As presented, the four sampling stations showed acceptable ambient air conditions, with the values way below the specified NAAQS limits. The air quality can be attributed to lack of any anthropogenic activities within the area.

348 The observed noise level propagation is also within the NPCC standards.

Table 2-39: Results of Ambient Air Quality and Noise Level Propagation Analysis

STATION	LOCATION	TIME	OBSERVED 1-HOUR AMBIENT AIR CONCENTRATIONS, µg/Ncm				OBSERVED 1-HOUR AMBIENT NOISE LEVEL PROPAGATION db(A)
			TSP	***PM_{10}***	***NO_2***	***SO_2***	
1	**Base No. 2 Guard House**	1045H – 1145H	**28.1**	**18.6**	**ND**	**ND**	**50.36**
2	**Near Third Waiting Shed (Brgy. Baha)**	1215H – 1315H	**29.5**	**17.4**	**ND**	**ND**	**46.54**
3	**First Waiting Shed (Brgy. Baha)**	1530H – 1630H	**34.8**	**22.0**	**12.0**	**ND**	**48.35**
4	**Near Base Water Station**	1340H – 1440H	**34.8**	**25.5**	**ND**	**ND**	**52.69**
NAAQS (1-hour sampling)			**300[A]**	**200[A]**	**260[A]**	**340[A]**	**70[B]**

NOTE: ND = Not detected / below detection limit (NO_2 = 0.26µg; SO_2 = 0.75µg)
REFERENCES: DENR Administrative Order No. 2000-81 (IRR of Republic Act 8749), NPCC Memorandum Circular No. 1980-002
[A] NAAQS 1-hr sampling
[B] NPCC Class C (Light Industrial Areas)

Figure 2-38: Photographs and Coordinates of Air Sampling Sites

Station 1: Base No. 2 Guard House

Station 1: 13.860804°, 120.720605°

Station 2: Near Third Waiting Shed (Brgy. Baha)

Station 2: 13.875061°, 120.707499°

Station 3: First Waiting Shed (Brgy. Baha)

Station 3: 13.883872°, 120.698766°

Station 4: Near Base Water Station

Station 4: 13.890908°, 120.695772°

FIGURE NO.:	FIGURE TITLE:
2-38	**PHOTOGRAPHS AND COORDINATES OF AIR SAMPLING SITES**

PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
ASTURIAS INDUSTRIES INC	**3.0 MMTPY CEMENT PLANT COMPLEX WITH QUARRY** Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas	**LCI ENVI CORPORATION**

Figure 2-39: Air Sampling Map

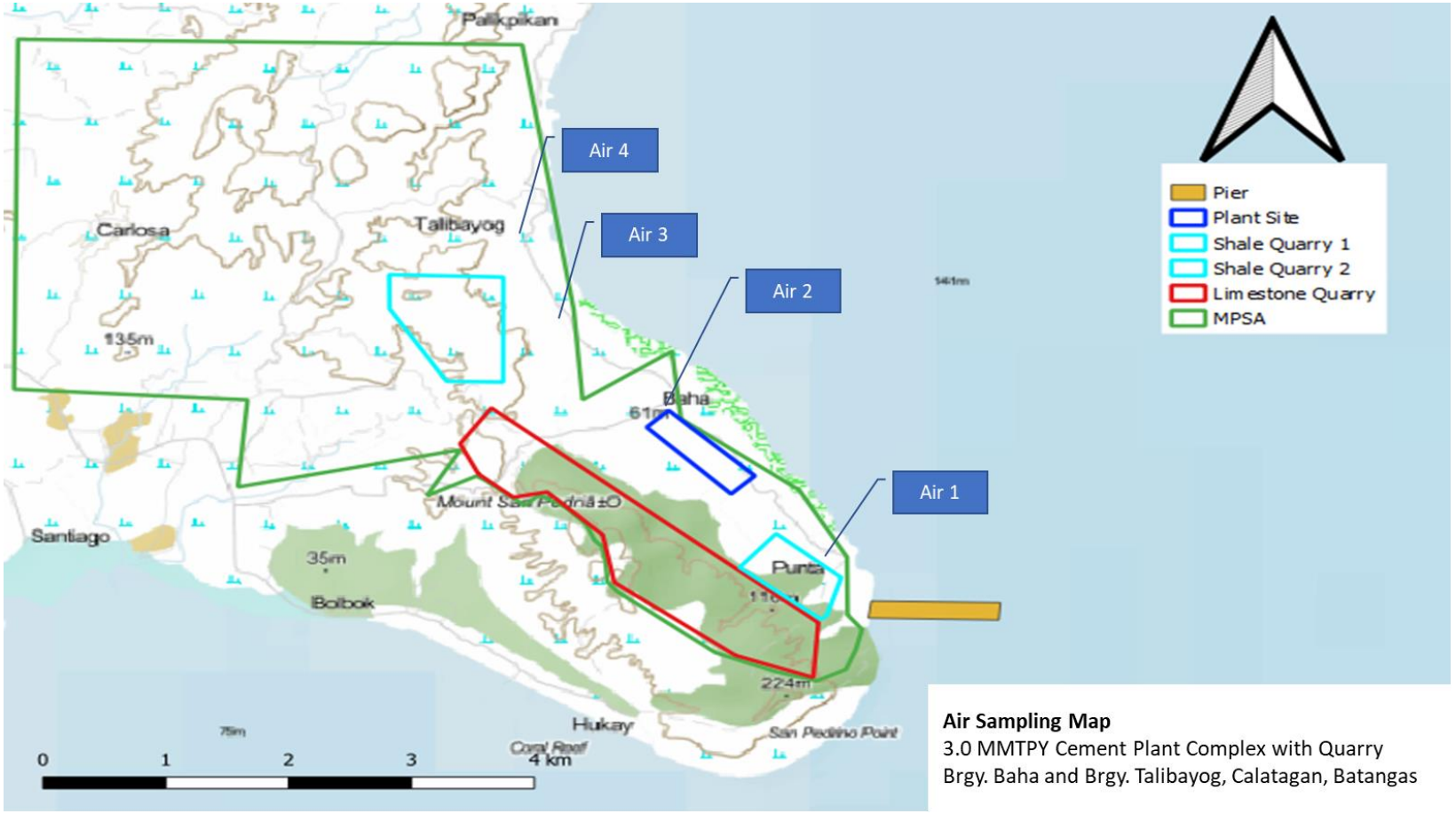


FIGURE NO.:	FIGURE TITLE:	
2-39	**AIR SAMPLING MAP**	
PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
ASTURIAS INDUSTRIES INC	**3.0 MMTPY CEMENT PLANT COMPLEX WITH QUARRY** Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas	**LCI ENVI CORPORATION**

Air Dispersion Model

349 A steady state Gaussian plume dispersion model was applied to evaluate the air pollution impact on the local air quality from the proposed **Asturias Cement Plant**. The modeling domain that contains the study area is 10 km by 10 km grid centered on the stack locations (N 13°52'21.79" E120°42'23.39") as shown in **Figure 2-40**.

350 The primary air pollutant to the air quality of the study area will be particulates emitted from the cement line production and the quarrying sites. Gaseous air pollutants will also include Carbon Monoxide (CO), Nitrogen Dioxide (NO_2) and Sulfur Dioxide (SO_2) primarily from cement line production.

351 AERMOD, the US EPA's recommended model for most small scale regulatory applications, was then used for predicting the ground-level concentrations (GLC) of the said air pollutants. AERMOD, also known as the AERMIC (American Meteorological Society/EPA Regulatory Improvement Committee) Regulatory Model, is an advanced next-generation air dispersion model that incorporates concepts such as planetary boundary layer (PBL) theory and advanced methods for handling complex terrain. Such model has undergone thorough model evaluation procedures yielding reasonably accurate modeling results provided that the appropriate input data are used.

352 In this first level of analysis, it is assumed that the pollutants do not undergo any physico-chemical transformations and that there is no pollutant removal by dry deposition. The emission rate of the pollutants from a stack (point source) in a reasonable worst-case scenario was estimated based from the following equation:

$$\textit{Emission rate (g/s) = Max Limit (mg/Nm}^3\textit{) x Stack volumetric flowrate (Nm}^3\textit{/s) x 10}^{-3}$$

353 The maximum concentrations of CO, NO_2 and SO_2 from the stack in the cement line production are assumed to be 500, 500, and 200 mg/Nm^3, respectively. The point sources of these gaseous pollutants will be primarily from the raw mill-kiln and coal mill system. Note that these maximum concentrations are based on the limits indicated in the National Emissions Standards for Source Specific Air Pollutants (NESSAP) (Table 2, Sect.1, Rule XXV of DAO 2000-81).

354 As for particulates, the maximum concentration is set to 150 mg/Nm^3 to stacks of cement line production. It is also assumed that sixty five percent of the Total Suspended Particulates (TSP) will be PM_{10} for the worst-case scenario.

355 Another potential source of particulates as fugitive dust is from the crushing plant which is assumed to have an emission rate of 0.2 g/s. As in most model runs, the emission rate of area source used in the report was taken from EPA AP-42. The value was calculated based on emission rates from quarries and massive drilling and construction sites, which is 1 x 10^{-5} g/s-m^2. This emission rate was used in the report. As suggested by Emission Inventory Improvement Program (EIIP) of the US EPA, there are several activities that have impacts on the emission rates in quarry. Some activities that were considered during quarrying are blasting, truck loading, transport through haul roads, and truck unloading. Fugitive dust emissions from crushing plant and quarry site are modeled as a 100m-length volume source and a 100m-radius circular area source, respectively.

356 The proposed facility is in an area where regional meteorological condition and terrain would have a significant effect on the predicted ground-level concentration (GLC) of its air emissions. The meteorological data used for the model was derived from a 3-year mesoscale regional meteorological model (MM5) for the said area. The summarized wind frequency data for the three-year MM5 data as shown in the wind rose diagram (**Figure 2-41**) indicates that the prevailing wind direction in the area is in northeasterly, southwesterly, and southeasterly sectors with a wind speed range between two to eleven meters per second. The MM5 data was processed by AERMET, the meteorology data processor for AERMOD. The terrain elevation data was obtained from high resolution database of Earth's topography collected during the Shuttle Radar Topography Mission (SRTM). The elevation data was then processed (**Figure 2-42**) by AERMAP, the terrain preprocessor for AERMOD air dispersion study, to calculate the hill height scale and elevations for receptors within the model domain of 10 km x 10 km grid with a 500 m resolution of the uniform Cartesian grid receptor.

357 On the other hand, physical stack parameters of the identified point sources used in the model including the stack volumetric flowrate are summarized in Table 2-40. The volumetric flow rate is based on typical values of the plant equipment.

Table 2-40: Description of the stacks from the proposed project

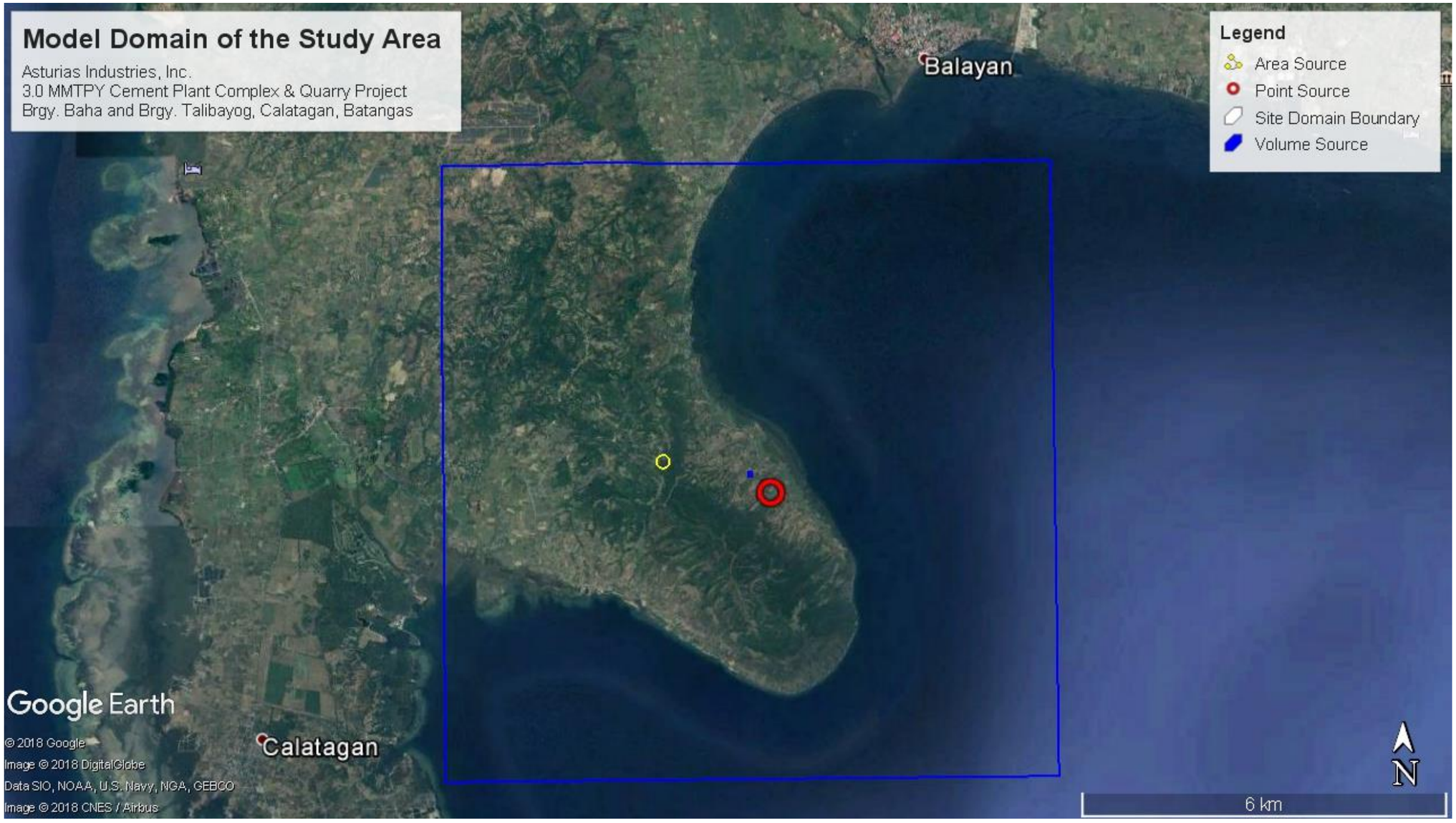
Point source	Stack height (m)	Stack Diameter (m)	Exit Stack Gas Temp (K)	Volumetric flow (Nm^3/s)	Number of Stacks
Raw mill-kiln	60	3.5	423	195.7	2
Coal mill	30	1.5	393	16.9	2
Clinker cooler	30	3.5	473	70.0	2

358 The estimated emission rates in g/s are shown in Table 2-41. All parameters are based on typical values applicable for cement plant equipment.

Table 2-41: Emission rates (g/s) from the stacks

	TSP	NOx	SOx	CO	PM_{10}
Raw Mill-Kiln	29.4	58.7	39.1	97.8	19
Coal Mill	2.5	5.1	3.4	8.4	1.64
Clinker Cooler	10.5	0.0	0.0	0.0	7
Total	**40.7**	**63.8**	**42.5**	**106.3**	**26**

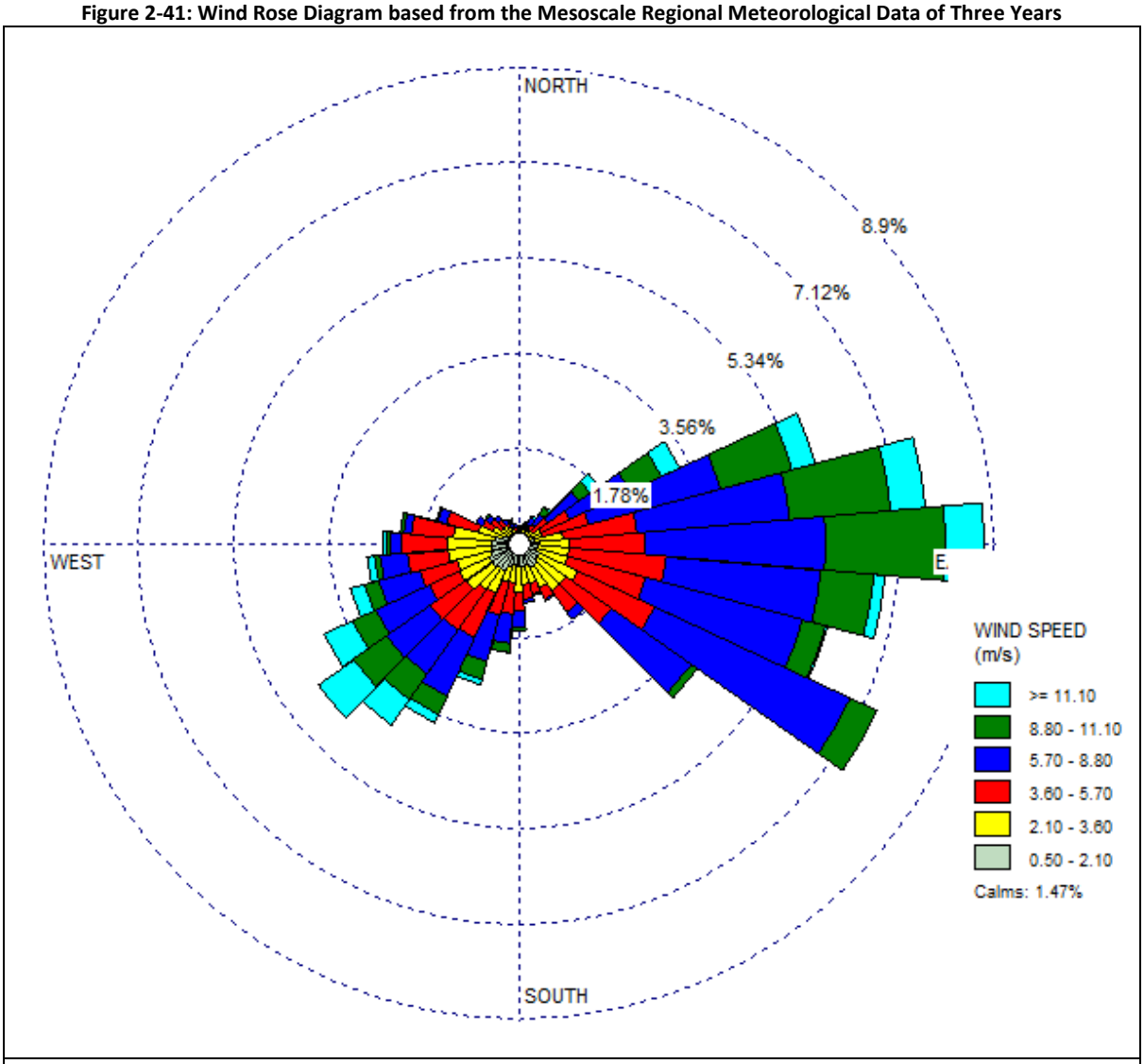
Figure 2-40: Model Domain of the Study Area



Source: LCI Envi Corporation

FIGURE NO.	FIGURE TITLE	
2-40	**MODEL DOMAIN OF THE STUDY AREA**	
PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
ASTURIAS INDUSTRIES INC	**3.0 MMTPY CEMENT PLANT COMPLEX WITH QUARRY** Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas	**LCI ENVI CORPORATION**

Figure 2-41: Wind Rose Diagram based from the Mesoscale Regional Meteorological Data of Three Years



Source: LCI Envi Corporation

FIGURE NO.	FIGURE TITLE	
2-41	**WIND ROSE DIAGRAM BASED FROM THE MESOSCALE REGIONAL METEOROLOGICAL DATA OF THREE YEARS**	
PROJECT PROPONENT: **ASTURIAS INDUSTRIES INC**	PROJECT TITLE & LOCATION: **3.0 MMTPY CEMENT PLANT COMPLEX WITH QUARRY** Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas	REPORT PREPARER: **LCI ENVI CORPORATION**

Figure 2-42: Digitized Terrain Map of the Study Area

Source: LCI Envi Corporation

FIGURE NO.	FIGURE TITLE	
2-42	**DIGITIZED TERRAIN MAP OF THE STUDY AREA**	
PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	REPORT PREPARER:
ASTURIAS INDUSTRIES INC	**3.0 MMTPY CEMENT PLANT COMPLEX WITH QUARRY** Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas	**LCI ENVI CORPORATION**

Air Dispersion Modeling of Suspended Particulates

359 The following sources were considered for the air dispersion modeling of particulates:

- Two cement lines operating (3.0 MMTPY total), with particulate emissions coming from stacks of Raw Mill Kiln, Coal Mill, and Clinker Cooler.
- Minerals crushing (2 crushers within the cement plant)
- Limestone & shale quarrying

360 **Figure 2-43** shows the estimated location of the point, volume, or area source of particulates from the stacks, crushing operation, and quarrying area.

361 **Table 2-42** summarizes the modeling results for each scenario describing the predicted incremental maximum ground level concentration (GLC) of particulates at different averaging times. Moreover, the isopleths for the long-term annual incremental GLC of the said criteria pollutant are also shown in **Figure 2-44** to **Figure 2-45**. It should be noted that these concentrations are the predicted maximum increase in the existing ambient air levels.

362 The predicted concentrations of emissions from the sources exceeded the National Ambient Air Quality Guideline Values (NAAQGV) stipulated in DAO 2000-81, the Implementing Rules and Regulation (IRR) of RA 8749, the Philippine Clean Air Act (CAA) of 1999. Assuming the worst-case scenario, indications suggest the uncontrolled fugitive dust emissions from the quarry site have significant impact on the air quality of the study area in particular to suspended particulates. **Figure 2-44** to **Figure 2-45**suggest the major impact of the plume is in northeasterly and northwesterly direction as influenced by the predominant wind condition and terrain in the area.

363 The proponent must install and operate “Best and Available Control Technology” (BACT) including the continuous opacity monitoring system (COMS) to reduce the emission rate of particulates and ensure that the impact of the operation will not be detrimental to air quality of the area. **Table 2-42** also presents the predicted scenarios if the emissions are controlled using different air pollution control devices such as bag filters. Assuming that the equipment used are at 90% efficiency, all parameters in all scenarios will be well below the standards stipulated in DAO 2000-81.

Figure 2-43: Source of Particulate Matter from Study Area

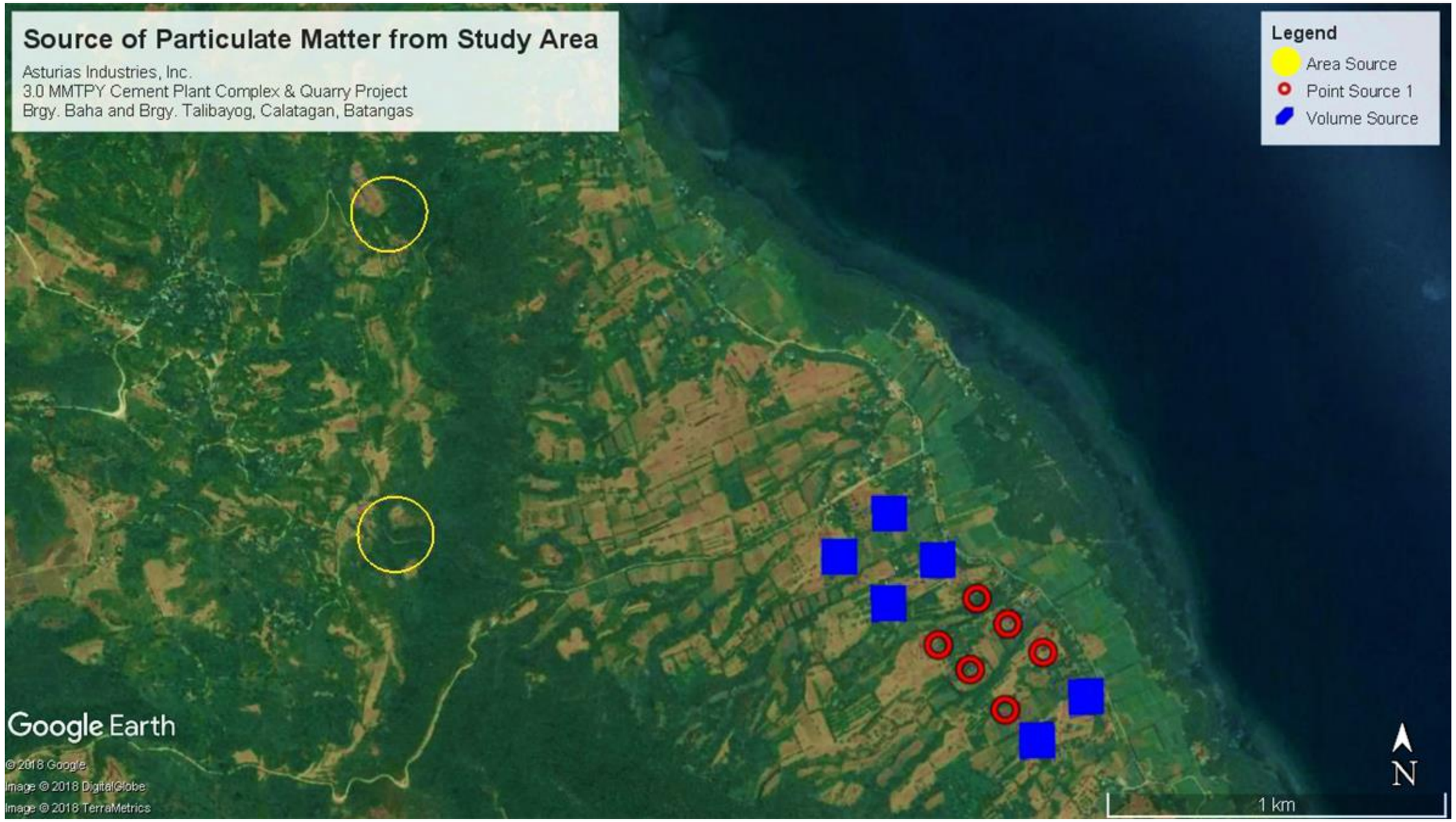


FIGURE NO.:	FIGURE TITLE:	
2-43	**Source of Particulate Matter from Study Area**	
PROJECT PROPONENT:	NAME OF PROJECT:	EIA PREPARER:
ASTURIAS INDUSTRIES, INC.	**3.0 MMTPY Cement Plant Complex & Quarry Project** *Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas*	**LCI ENVI CORPORATION**

Table 2-42: Predicted incremental maximum GLC of particulates in the study area

Averaging time	Uncontrolled Scenario		Controlled Scenario (90% efficiency)		NAAQSGV		UTM East (m)	UTM North (m)
	TSP Maximum GLC[a] (µg/m^3)	PM_{10} Maximum GLC[a] (µg/m^3)	TSP Maximum GLC[a] (µg/m^3)	PM_{10} Maximum GLC[a] (µg/m^3)	TSP (µg/m^3)	PM_{10} (µg/m^3)		
1-hr	1,755	1,141	175.5	114.1	300	200	252739	1534569
24-hr	629	465.9	62.9	46.6	230	150	252739	1534569
Annual	128	97.8	12.8	9.7	90	60	252739	1534569

Figure 2-44: Isopleth of the incremental 98th percentile annual average TSP concentration (µg/m³)

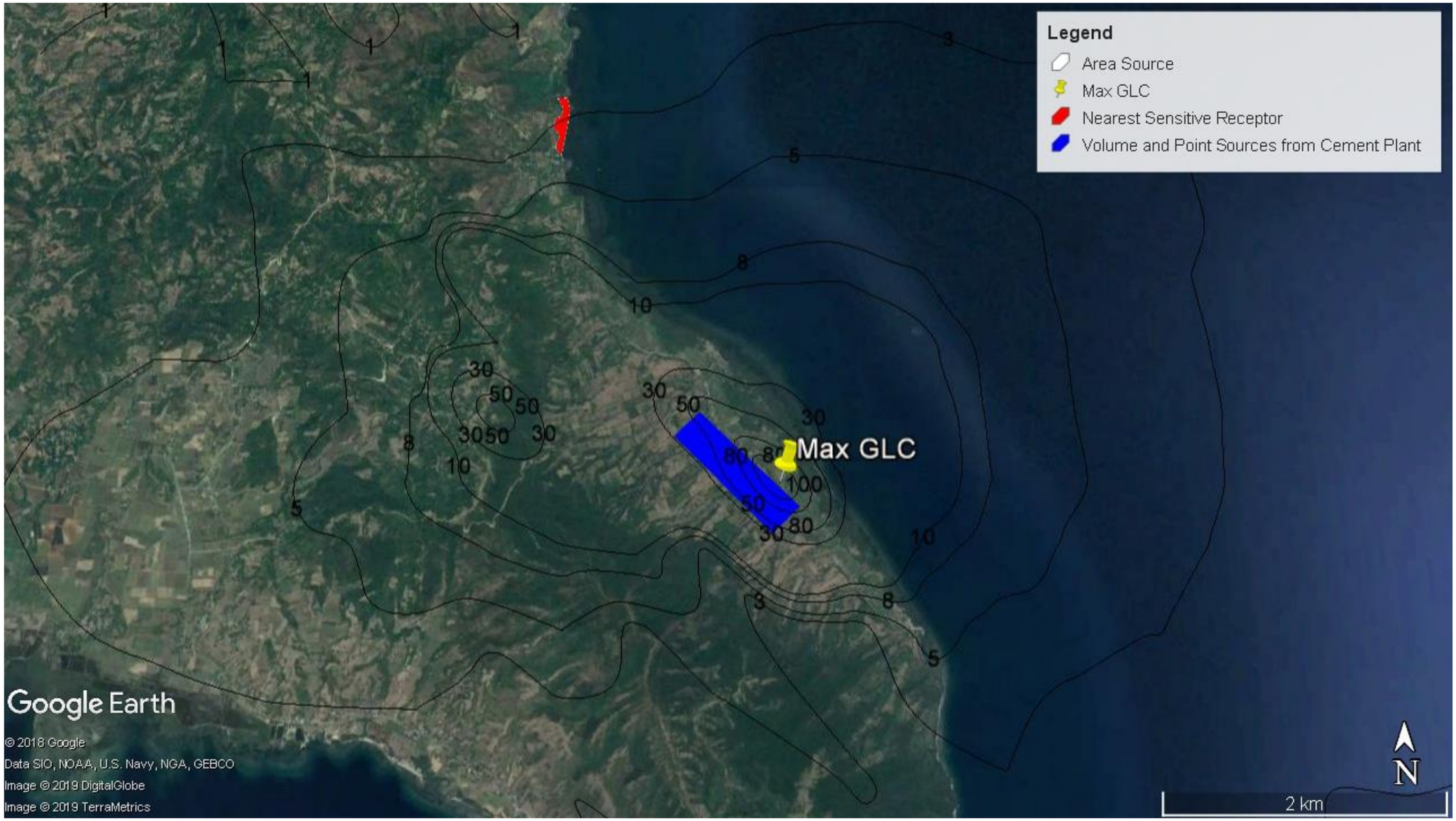


FIGURE NO.:	FIGURE TITLE:
2-44	**Isopleth of the incremental 98th percentile annual average TSP concentration (µg/m³)**

PROJECT PROPONENT:	NAME OF PROJECT:	EIA PREPARER:
ASTURIAS INDUSTRIES, INC.	**3.0 MMTPY Cement Plant Complex & Quarry Project** *Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas*	**LCI ENVI CORPORATION**

Figure 2-45: Isopleth of the incremental 98th percentile annual average PM10 concentration (µg/m3)

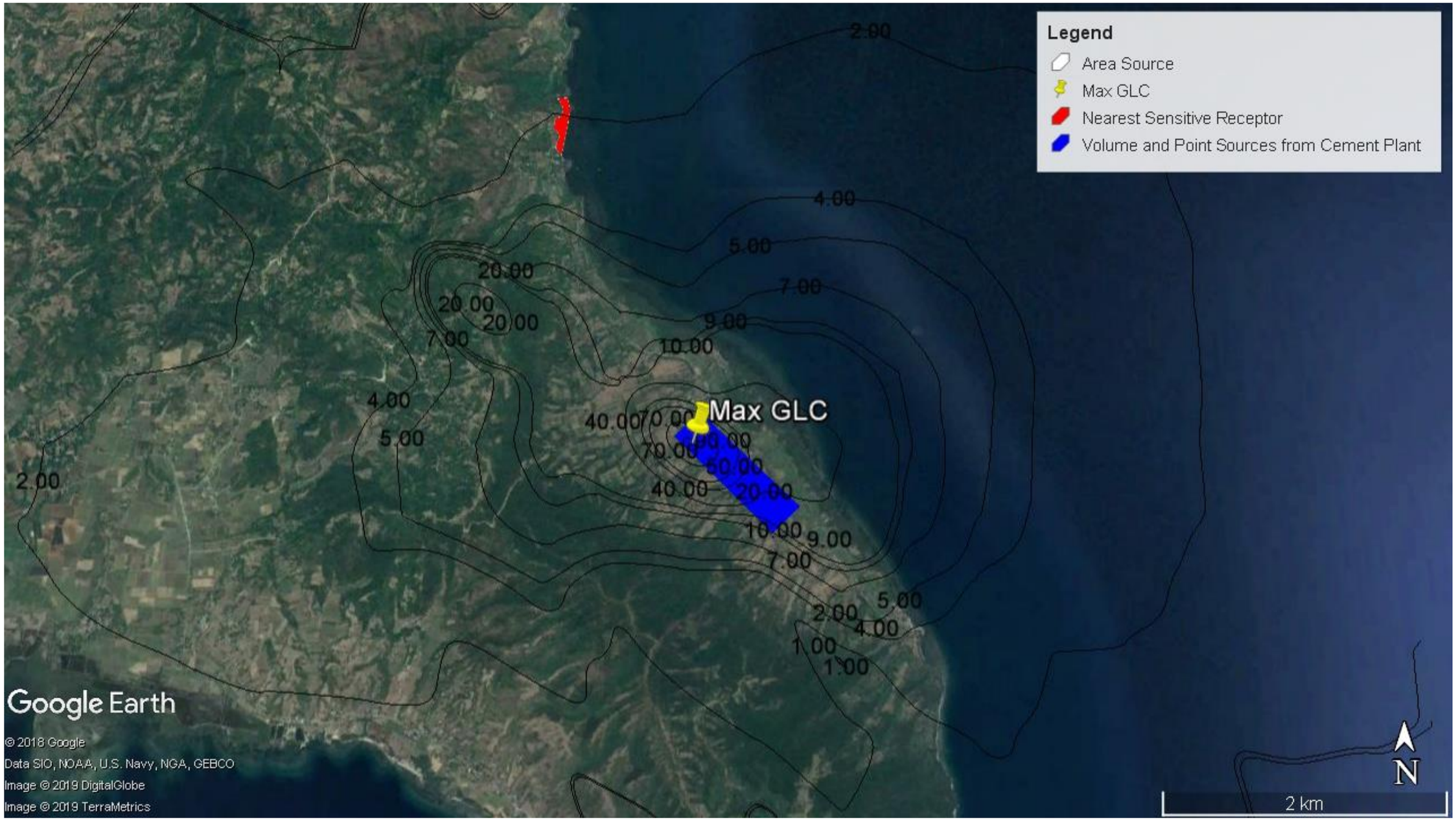


FIGURE NO.:	FIGURE TITLE:	
2-45	**Isopleth of the incremental 98th percentile annual average PM10 concentration (µg/m³)**	
PROJECT PROPONENT: **ASTURIAS INDUSTRIES, INC.**	NAME OF PROJECT: **3.0 MMTPY Cement Plant Complex & Quarry Project** *Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas*	EIA PREPARER: **LCI ENVI CORPORATION**

Air Dispersion Modeling of Gaseous Air Pollutants

364 Operation of gaseous emissions sources, which are the kiln and the coal mill, was considered for the air dispersion modeling of CO, NO_2, and SO_2.

365 **Table 2-43** summarize the modeling results for each scenario describing the predicted incremental maximum ground level concentration (GLC) of these criteria air pollutants at different averaging time. The isopleths for the 24-hr average GLC of CO and annual average GLC of NO_2 and SO_2 are also shown in **Figure 2-46, Figure 2-44** and **Figure 2-48**. It should be noted that these concentrations are the predicted maximum increase in the existing ambient air levels.

Table 2-43: Predicted incremental maximum GLC of gaseous emissions in the study area

Pollutant	Averaging time	Maximum GLC ($\mu g/m^3$)	UTM East (m)	UTM North (m)	CAA Standards ($\mu g/m^3$)
CO	1-hr	5,108	250616	1534341	35,000[a]
	8-hr	2,611	250616	1534341	10,000[b]
NO_2	1-hr	114	250616	1534341	260[a]
	24-hr	101	252616	1533341	150[b]
	Annual	14	250616	1534341	40[c]
SO_2	1-hr	80	250616	1534341	340[a]
	24-hr	66	252616	1533341	180[b]
	Annual	9.45	250616	1534341	80[b]

[a] Section 1, Rule XXVI Source Specific Ambient Air Quality Standards (DAO 2000-81)

[b] Section 1, Rule VII National Air Quality (DAO 2000-81) [c] WHO guidelines [d] 98th percentile value

366 Results from both scenarios indicate that these predicted incremental GLC of NO_2, CO, and SO_2 are well below the prescribed limit stipulated in DAO 2000-81, the Implementing Rules and Regulation (IRR) of RA 8749, the Philippine Clean Air Act (CAA) of 1999.

367 The pattern of 98th percentile isopleth shown in **Figure 2-46** to **Figure 2-44** also suggests the impact of the plume is in northeasterly and northwesterly direction as influenced by the predominant wind condition in the area. The predicted maximum GLCs of pollutants were also observed to be within the cement plant complex.

368 The existing operation of the cement plant does not warrant control devices for CO, NO_2, and SO_2. It was anticipated that the environmental limits of these gaseous pollutants will not be exceeded as the sources are minimal. As predicted by the model GLCs are within CAA Standards.

369 To ensure that pollutant concentrations in the area are kept below standards, **Table 2-44** lists the best available control technology (BACT) that should be applied by Asturias.

Table 2-44: Best Available Control Technology (BACT) for each pollutant

Pollutant	BACT
SO_2	Highly alkaline conditions in cement kiln is maintained to enable it to capture up to 95% of the possible SO_2 emissions
CO	Ensures complete combustion to reduce CO emissions by regular monitoring and continuous auto regulation of fuel and air by automatic combustion control system
NO_x	Reduced through stable kiln operation, as this reduces long term NO_x emissions.

Figure 2-46: Isopleth of the incremental 98th percentile 8-hr average CO concentration (µg/m3)

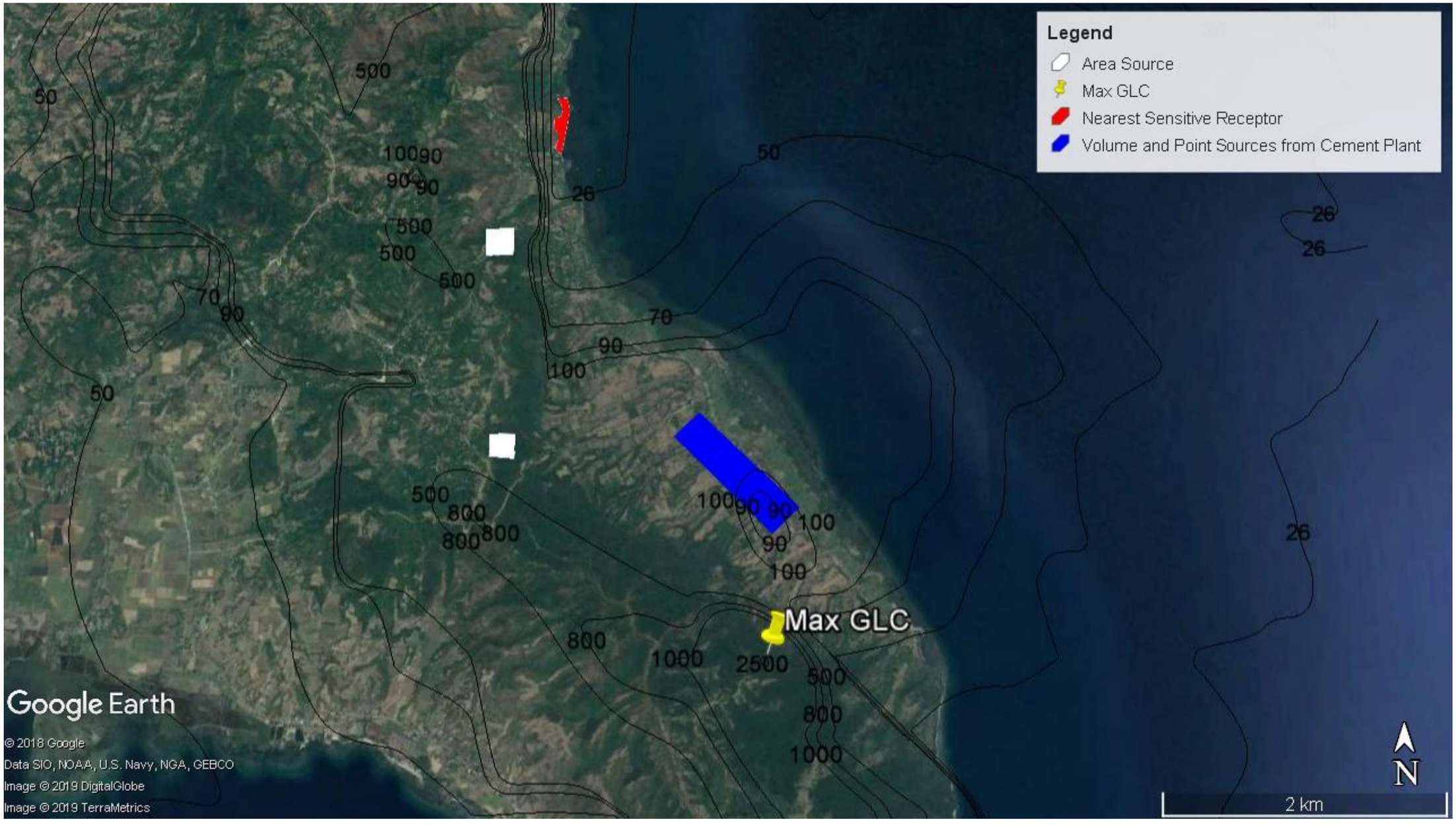


FIGURE NO.:	FIGURE TITLE:
2-46	**Isopleth of the incremental 98th percentile 8-hr average CO concentration (µg/m³)**

PROJECT PROPONENT:	NAME OF PROJECT:	EIA PREPARER:
ASTURIAS INDUSTRIES, INC.	**3.0 MMTPY Cement Plant Complex & Quarry Project** *Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas*	**LCI ENVI CORPORATION**

Figure 2-47: Isopleth of the incremental 98th percentile annual average NO2 concentration (µg/m3)

FIGURE NO.:	FIGURE TITLE:
2-47	**Isopleth of the incremental 98th percentile annual average NO_2 concentration (µg/m³)**

PROJECT PROPONENT:	NAME OF PROJECT:	EIA PREPARER:
ASTURIAS INDUSTRIES, INC.	**3.0 MMTPY Cement Plant Complex & Quarry Project** *Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas*	**LCI ENVI CORPORATION**

Figure 2-48: Isopleth of the incremental 98th percentile annual average SO2 concentration (µg/m3)

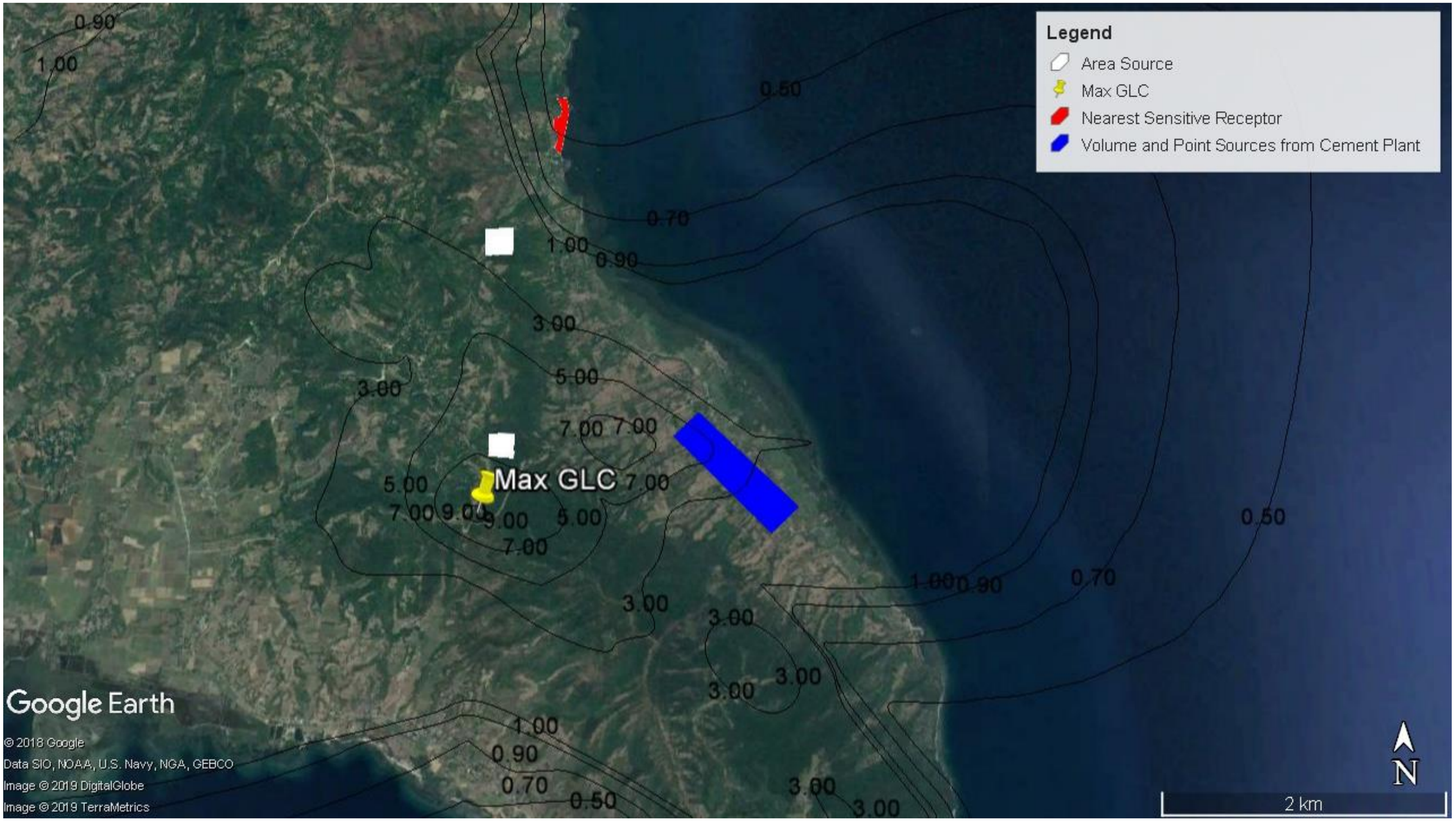


FIGURE NO.:	FIGURE TITLE:
2-48	**Isopleth of the incremental 98th percentile annual average SO_2 concentration (µg/m³)**

PROJECT PROPONENT:	NAME OF PROJECT:	EIA PREPARER:
ASTURIAS INDUSTRIES, INC.	**3.0 MMTPY Cement Plant Complex & Quarry Project** *Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas*	**LCI ENVI CORPORATION**

2.3.2.2 Increase in ambient noise level

370 Noise is expected to be generated by heavy equipment during construction. **Table 2-45** presents the expected noise levels of construction equipment, which is expected to attenuate with distance. The loudest construction equipment to be used are pile drivers, which emits about 77 dB of noise at 240m away from the source. The closest residential area to the pile driving activities is approximately 2 km away.

371 The proponent must implement mitigating measures to control noise. Some measures that the proponent will apply are proper maintenance of engines and other mechanical parts of the heavy equipment, installation of exhaust mufflers, and installing enclosures surrounding the project site. The proponent will maintain and enhance the existing vegetation surrounding the quarry site which will act as natural noise barriers. The proponent will also limit activities during normal working hours.

372 Noise will be generated by the cement plant once it is operational. The equipment will be housed to control the noise. Vegetation, which will serve as natural noise barriers, will be maintained around the perimeter of the quarry site.

Table 2-45: Expected Noise Levels from Heavy Equipment, db(A)

EQUIPMENT	DISTANCE (M)				
	15	**30**	**60**	**120**	**240**
Front Loader	75	69	63	57	51
Backhoes	85	79	73	67	61
Graders	88	82	76	70	64
Trucks	91	85	79	73	67
Concrete Mixers	82	79	73	67	61
Cranes	83	77	71	65	59
Generators	78	72	66	60	54
Compressors	81	75	69	63	57
Pumps	76	70	64	58	52
Pile Drivers	101	95	89	83	77
Jackhammers	88	82	76	70	64

Source: Larry W. Canter, Environmental Impact Assessment, New York, 1977

Figure 2-49: Noise Generation 240m from Project Activities

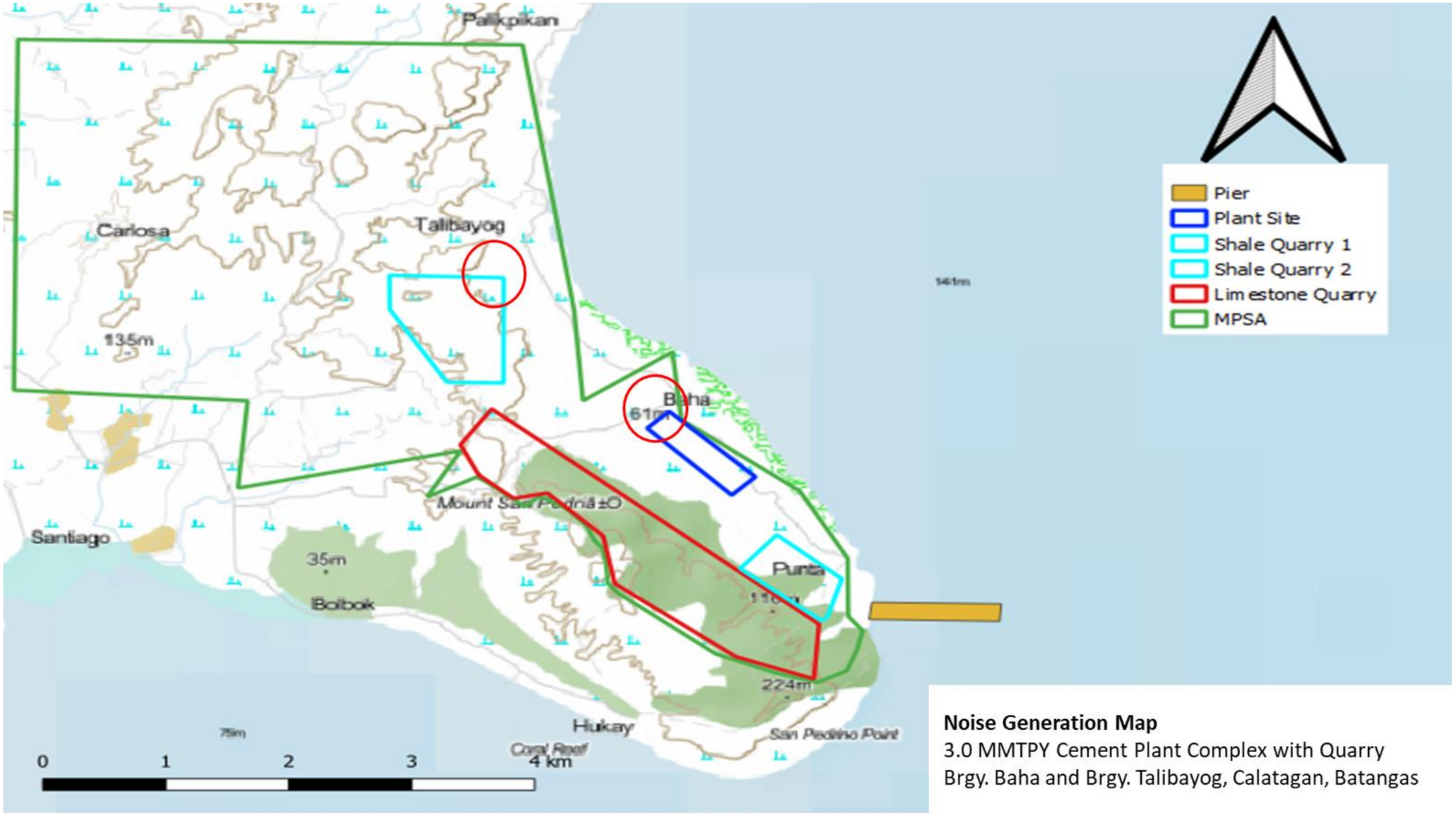


FIGURE NO.:	FIGURE TITLE:	
2-49	Noise Generation 240m from the Project Area	
PROJECT PROPONENT:	NAME OF PROJECT:	EIA PREPARER:
ASTURIAS INDUSTRIES, INC.	3.0 MMTPY Cement Plant Complex & Quarry Project *Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas*	LCI ENVI CORPORATION

2.3.3 Summary of Baseline Findings Impacts and Mitigation on Air and Noise

373 The following table lists the impacts and mitigation on Air and Noise.

Table 2-46: Summary of Significant Baseline Findings and Potential Impacts and Mitigation on Air and Noise

Summary of Baseline Findings on Air:

- **Meteorology**
  - The proposed project area mainly belongs to Type I climate under the modified Coronas classification (two pronounced seasons, dry from December to May and wet from June to November).
  - Temperature is highest in April and May and lowest in February.
  - The rainiest months are from June to October with mean monthly rainfall values ranging from 228.7 to 218.4mm. The driest month in the area is February with only 16.0 mm of rainfall and 3 rainy days.
  - The prevailing surface wind in the area is northeastern from October to April and southwestern from June to September.
  - An average of 3 cyclones passes through the area every two years.
- **Ambient Air Quality and Noise**
  - All sampling stations showed acceptable ambient air and noise conditions, with the values way below the specified NAAQS and NPCC limits, respectively.

POTENTIAL IMPACTS	PROJECT PHASES	DESCRIPTION	MITIGATING MEASURES
AMBIENT AIR QUALITY AND NOISE			
Impact on Air Quality	Construction	NO_x, SO_2, and CO emissions from heavy equipment that will be used during construction	Proper maintenance on heavy equipment.
	Operation	TSP and PM_{10} emissions from the cement manufacturing facility and quarry sites is of primary concern	Installation of bag filters that will control at least 99% of the emissions from the cement manufacturing facility including electrostatic precipitators for the 2 lines. Road watering within the plant site to control dust
		Gaseous emissions are expected from the kiln and the coal mill.	Proper maintenance of equipment to ensure efficiency
Increase in Ambient Noise Level	Construction/ Operation	Noise will be generated by heavy equipment during construction The cement plant will generate noise	Maintenance of engines and other mechanical parts of the equipment Installation of exhaust mufflers Constructing enclosures surrounding the project site Maintenance of vegetation surrounding the area to serve as natural noise barriers Quarry operations limited during daytime

2.4 The People

Land Area

374 The Municipality of Calatagan has a total land area of 10,528 hectares. Within its boundaries are 4 urban barangays and twenty-one rural barangays. Barangay Baha and Barangay Talibayog are classified as rural barangays with total land areas of 856 ha and 396 ha, respectively.

Demography

375 Calatagan has a total population of 56,449 people with a total number of households of 13,337 at an average household size of 4.2 as of 2015 census by the National Statistical Coordination Board (NSCB).

376 The data presented on **Table 2-47** shows that rural population (8,657 people) greatly outnumbers the population of urban barangays (47,792 people). Lucsuhin has the highest population with 4,528 residents while Luya has the lowest population of only 664. Barangay Baha, has a total population of 1,509 people, while Barangay Talibayog has a population of 1,980.

Table 2-47: Population of Calatagan per Barangay, 2015

BARANGAY	POPULATION
1. Poblacion I	3,433
2. Poblacion II	1,408
3. Poblacion III	953
4. Poblacion IV	2,863
Sub-total	**8,657**
1. Bagong Silang	2,270
2. Baha	1,509
3. Balibago	3,377
4. Balitoc	3,023
5. Biga	2,849
6. Bucal	965
7. Carlosa	1,414
8. Carretunan	1,504
9. Encarnacion	1,327
10. Gulod	3,127
11. Hukay	2,120
12. Lucsuhin	4,528
13. Luya	664
14. Paraiso	1,346
15. Quilitisan	2,176
16. Real	1,588
17. Sambungan	1,975
18. Sta. Ana	3,209
19. Talibayog	1,980
20. Talisay	2,617
21. Tanagan	4,224
Sub-total	**47,792**
Total	56,449

Source: 2015 NSO Survey on Population

Population Density

377 Given the total land area and 2015 population of the Municipality of Calatagan, every square kilometer is inhabited by more or less 536 people.

Population Growth Rate

378 The total population of the municipality has significantly increased with 27,578 in 1980 to 56,449 by 2015 **(Table 2-48)**.

Table 2-48: Population Growth, 1970 to 2015

Year	Population	Growth Rate
1980	27,578	+3.12%
1990	35,543	+2.57%
1995	40,707	+2.57%
2000	45,068	+2.21%
2007	51,544	+1.87%
2010	51,997	+0.32%
2015	56,449	+1.58%

Source: Philippine Statistics Authority, 2015

Housing

379 Most of the households in Calatagan are stay in houses and lots that they own as shown in **Table 2-49.** It comprises 64.39% of the total households in the municipality. Additionally, 23.90% of the households were determined to live in houses they own in rent-free lots but with the consent of the owner. These houses are commonly made with concrete or half concrete and half wood as the main outer wall material as summarized in **Table 2-50.**

Table 2-49: Type of Building/House and Tenure Status of Lot, 2015

STATUS	TOTAL HH	PERCENTAGE
Own or owner like possession of house and lot	8,833	**64.39%**
Rent house/room including lot	368	**2.68%**
Own house rent lot	35	**0.26%**
Own house rent-free lot with consent of owner	3,279	**23.90%**
Own house rent-free lot without consent of owner	274	**2.00%**
Rent-free house and lot with consent of owner	911	**6.64%**
Rent-free house and lot without consent of owner	17	**0.12%**
Total	13,717	**100.00%**

Source: Philippine Statistics Authority, 2015

Table 2-50: Type of Building/House By Outer wall Construction Materials, 2015

STATUS	TOTAL HH	PERCENTAGE
Concrete/brick/stone	9,039	67.77%
Wood	627	4.70%
Half concrete/brick/stone and half wood	1,837	13.77%
Galvanized iron/aluminum	87	0.65%
Bamboo/sawali/cogon/nipa	1,643	12.32%
Asbestos	2	0.01%
Glass	-	0.00%
Makeshift/salvaged/improvised materials	47	0.35%
Trapal	25	0.19%
Others	5	0.04%
No walls	3	0.02%
Not Reported	22	0.16%
Total	13,337	100.00%

Source: Philippine Statistics Authority, 2015

Power Supply

380 Data from PSA (2015) shows that of the 13,717 households in Calatagan, 13,169 use electricity for lighting. Other households use kerosene, LPG, and solar lamps **(Table 2-51)**.

Table 2-51: Type of Lighting Used in Calatagan, 2015

Number of Households	Fuel for Lighting							
	Electricity	**Kerosene**	**LPG**	**Oil (vegetable animal and others)**	**Solar panel**	**Solar lamp**	**Others**	**None**
13,717	13,169	442	3	2	1	40	27	33

Source: Philippine Statistics Authority (2015)

Water Supply

381 **Table 2-52** shows the sources of cooking and drinking water of households. Most households buy bottled water for drinking. Also, households in Calatagan use either their own or shared deep well sources for cooking water.

Table 2-52: Number of Households by Main Source of Water Supply for Cooking and Drinking, Calatagan, 2015

Intended Use	Cooking	Drinking
Number of Households	13,717	13,717
Own use faucet community water system	1,990	1,103
Shared faucet community water system	440	271
Own use tubed/piped deep well	4,571	2,733
Shared tubed/piped deep well	5,279	4,139
Tubed/piped shallow well	665	189
Dug well	212	168
Protected spring	128	232
Unprotected spring	3	3
Lake river rain and others	-	1
Peddler	18	350
Bottled water	221	4,497
Others	190	31

Source: Philippine Statistics Authority (2015)

2.4.1 Displacement of settler/s

382 The industrial park where the cement plant complex and quarry operations is proposed to be constructed and operated is already fenced and owned by Asturias Industries, Inc. All the residents inside the property were successfully relocated by Asturias last December 2017. Financial assistance were provided to the affected families. A total of 700 households were relocated. Attached in the annex are the Municipal and Barangay Certification given to Asturias confirming the relocation of the displaced settlers. The following is a concise summary of the relocation:

- Total number of relocated houses: 700
- Total number of relocation sites: 22
    - Relocation Sites in Balayan, Batangas: 10
        - Barangay Santol: 10
        - Barangay Dalig: 6
        - Barangay Palikpikan: 2
        - Barangay Caloocan: 2
        - Barangay Sambat: 1
    - Relocation Sites in Calatagan, Batangas: 1
        - Barangay Talibayog: 1

2.4.1.1 Displacement/disturbance of properties

383 The project will not displace nor cause disturbance to nearby properties. All the structures inside the property are owned by Asturias.

2.4.1.2 Change/conflict in land ownership

384 The project will not result to any change or conflict in land ownership. The whole property of the industrial park, where the project will be located, is owned by Asturias Industries Inc.

2.4.1.3 Change/conflict on Right-of-Way

385 Road networks will be constructed within the perimeter of the project site for easier access and transportation.

2.4.1.4 Impact of Public Access

386 In terms of impact to public access, the project will not utilize the existing barangay road near the project area. Two main access roads will be developed for easier access to the project site. One is the existing route from Zobel highway in Calatagan wherein the provincial toad will be connected to the barangay road within the project site. This road will be widened and concreted. The second one will the construction of a new road that will connect the Balayan highway to the project site.

2.4.2 In-migration

387 An estimated 500-750 manpower will be required during the project construction and 250-300 for the operation. **Asturias Industries, Inc.** will prioritize employment of qualified workers from Brgy. Baha and Brgy. Talibayog, and the Municipality of Calatagan to mitigate the negative effects of in-migration.

388 If migrant workers are hired, **Asturias Industries, Inc.** will coordinate with the host LGU for the issuance of certificates containing pertinent information about the new employees. Furthermore, employees who are not from the host barangay or municipality will be housed within the compound to ensure their safety.

2.4.2.1 Proliferation of informal setters

389 Proliferation of informal settlers is not expected to result from the project as **Asturias Industries Inc.** intends to prioritize employment of qualified workers living within Brgy. Baha and Brgy. Talibayog and the Municipality of Calatagan.

2.4.2.1.1.1 Cultural/Lifestyle Change (especially on Indigenous People, if any)

390 There are no known indigenous peoples residing near or within the project area. Hence, cultural and lifestyle changes are not expected to result from the proposed project.

391 In terms of lifestyle change, increased local income from the project may introduce and expose workers and the community to vices that tend to undermine the morality of the people. Hostelry areas, such as videoke bars, nightclubs, gambling places, and prostitution, among others may proliferate with demand. If not properly handled, addiction to such vices may contribute in social problems, such as destruction of family and values and increase in crime rate.

392 **Asturias Industries, Inc.** commits to work closely with the both the municipal and barangay LGUs and PNP to regulate law to avoid vice-related problems in the community. In addition, **Asturias Industries, Inc.** will strictly implement a drug- and alcohol-free work environment.

2.4.3 Impacts on Physical Cultural Resources

393 An archeological impact assessment was conducted in the project site. The aim is to identify possible archeological resources that may be affected or disturbed during the development project implementation. In doing so, mitigation and the management scheme can be implemented to minimize the damage on the archeological cultural heritage.

394 The result of the archeological survey and test excavation shows that some areas have archeological resources. It is highly recommended that if chance discoveries of any archeological remains are found, these should be reported immediately to the National Museum as mandated by R.A. 4846 as amended by PD 374, otherwise known as the “Cultural Properties Protection and Preservation Act” and the RA 8492 “An Act Establishing A National Museum System, Providing for its Permanent Home and for other purposes.”

2.4.4 Threat to Delivery of Basic Services/Resource Competition

395 If skills are not available in the locality, **Asturias Industries, Inc.**, or its contractors, may bring in skilled personnel from outside of the host municipality. Although their residency is temporary, transient workers will have needs that are similar to the permanent residents in the area. Hence, competition for food, shelter, power, water, and other local resources may be expected. Such additional needs will therefore exert pressure to the resources of the community. **Asturias Industries, Inc.** and its contractors must provide shelter for its workers. Food, power, and water will be available in the housing facilities.

2.4.5 Threat to Public Health and Safety

396 Given the nature of the project, dust may cause negative health effects, especially in the respiratory system, to the community members and workers if not properly mitigated. **Asturias Industries Inc.** will conduct medical missions and regular check-ups to its workers and the host barangay. In addition, there will be constant coordination with the Municipal Health Officer (MHO) and barangay health units to address health-related needs of the community.

397 Crime incidence may also increase in the local community. With available money at hand, proliferation of vices that tends to undermine the morality of the people in the barangay is potentially expected. Videoke bars, clubs, gambling places, prostitution, and others can rise in due time when workers in the project site could be attracted to such offering and indulge in activities that may destroy family values.

398 Furthermore, drinking may result to the commission of crimes if not properly handled. It is anticipated therefore that social problems may arise as an aftermath of a fluid local economy. **Asturias Industries, Inc.** will regularly coordinate with the barangay officials to ensure peace and order among the workers and the community members. In addition to this, there will be minimal interaction among the workers and the community members, as most of the times, the workers are in the plant premises.

2.4.6 Generation of Local Benefits from the Project

399 In terms of generation of local benefits, the proposed project will generate positive impacts. The project will not adversely affect the employment, livelihood, and income of the residents; on the contrary, it may even provide income opportunities. The positive impacts of the project are the following: 1) generation of additional source of income and livelihood; 2) additional revenue for the local government; 3) increased basic social services; and 4) addition and improvement of local residential dwellings. These benefits may be further enhanced through the implementation of social development programs responsive to local needs in the impact area.

2.4.7 Traffic Congestion

400 In terms of project accessibility, Barangay Baha can be reached from the Municipality of Balayan through barangay roads connecting the town proper of Balayan to Sitio Punta in Barangay Baha, Calatagan where the proposed site is located. Traffic flow in Calatagan is generally light and smooth at all times.

401 During construction and operation of the proposed project, it is expected that trucks will be coming in and out of the proposed site. This may affect the current traffic condition of the area. To mitigate this concern, Asturias Industries, Inc., in coordination with DPWH, will construct additional roads that will connect the proposed site to the Municipality of Balayan. Two main access roads will be developed for easier access to the project site. One is the existing route from Zobel highway in Calatagan wherein the provincial road will be connected to the barangay road within the project site. This road will be widened and concreted. The second one will the construction of a new road that will connect the Balayan highway to the project site.

402 Also, to mitigate the said impact, **Asturias Industries Inc.** commits to develop a traffic management plan with the LGU of Calatagan. The following measures shall be included in the plan:

- Coordination with LGU of Calatagan;
- Lane designation and speed limit;
- Regulation of truck deployment;
- Provision of safety barriers, warning signs and lights, traffic marshals within the vicinity of project sites, and adequate parking spaces;
- All deliveries of construction materials and heavy equipment, either inbound or outbound of the facility may be done during off-peak hours and at designated delivery hubs located near the Project area to prevent blockage of traffic flow along public roads; and
- Assistance of security personnel in directing traffic of vehicles coming in and out of the facility.

2.4.8 Social Acceptability and Perception

403 **Figure 2-50** and **Figure 2-51** summarize the social acceptability and perception of the 100 respondents from former residents of Brgy. Baha regarding the proposed project.

Respondents' Profile

404 The respondents are former inhabitants of Brgy. Baha that were relocated to Brgy. Santol, Brgy. Palikpikan, and Brgy. Sta. Caloocan. There were more female respondents (48%) than male ones (46%). Majority of the respondents are married (74%). The respondents are predominantly Roman Catholic (95%). 96% of the respondents have lived in their respective barangays from one to four years, given that they were relocated from another barangay. 75% of the respondents earn a maximum of Php5,000 per month. 56% of the respondents finished elementary school, while 31% finished high school. The livelihood of respondents are mainly farmers, fishermen, private employees, and business-owners.

Perception Survey Results

405 92% of the respondents are aware of the proposed cement plant in the area. 39% of the respondents acquired their information on the proposed project from meetings about the project, while 35% of the respondents learned this information from the proponent; this proves that the information, education, and communication campaigns of Asturias are quite effective.

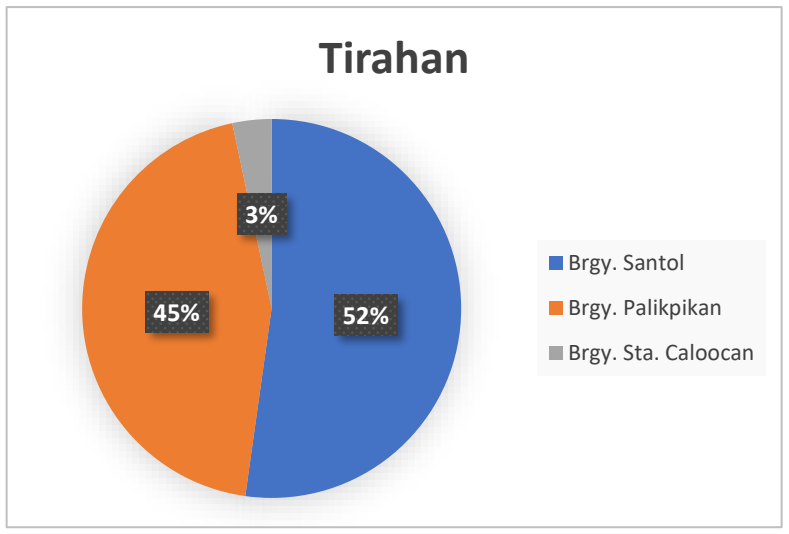
406 Majority of the respondents think that the project will have positive effects on the community (67%) because of the employment opportunities presented by the proposed project. It must be noted that only 5% of the respondents reacted negatively regarding the proposed project. 27% did not offer any opinion on whether the project will be good for the local community.

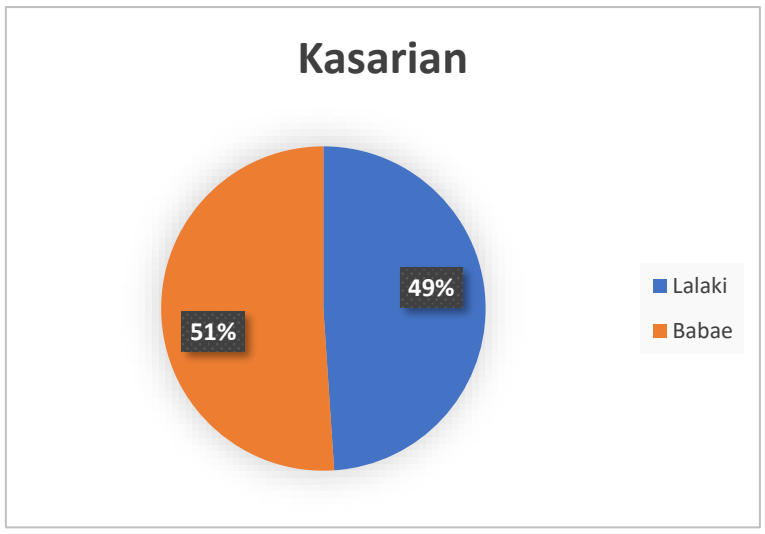
407 Majority of the respondents (54%) believe that the main benefit of the project is provision of job opportunities. 23% think that the project presents business opportunities, while 22% of the respondents think that the community will benefit from the local taxes that will be collected once the facility is operational.

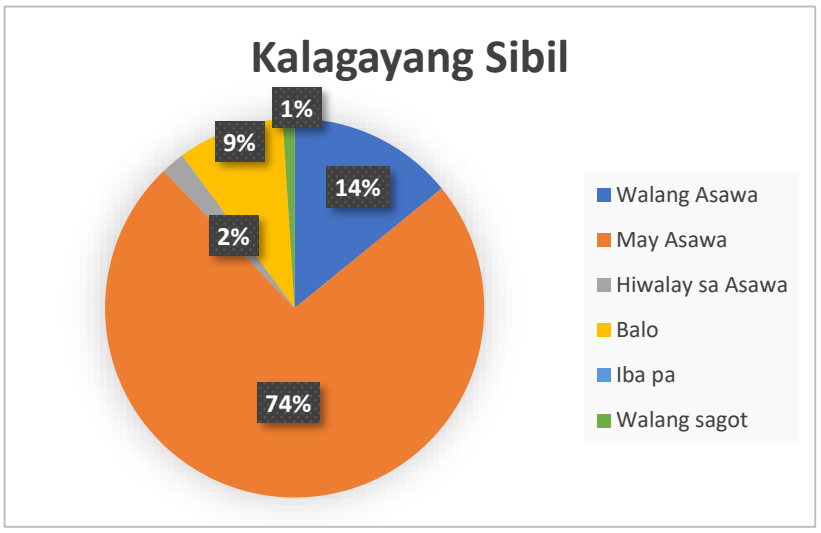
408 While most respondents think that the project will have positive effects on the community, they are also wary of some negative impacts such as air pollution (39%), noise (19%), and impacts on the body of water (2%).

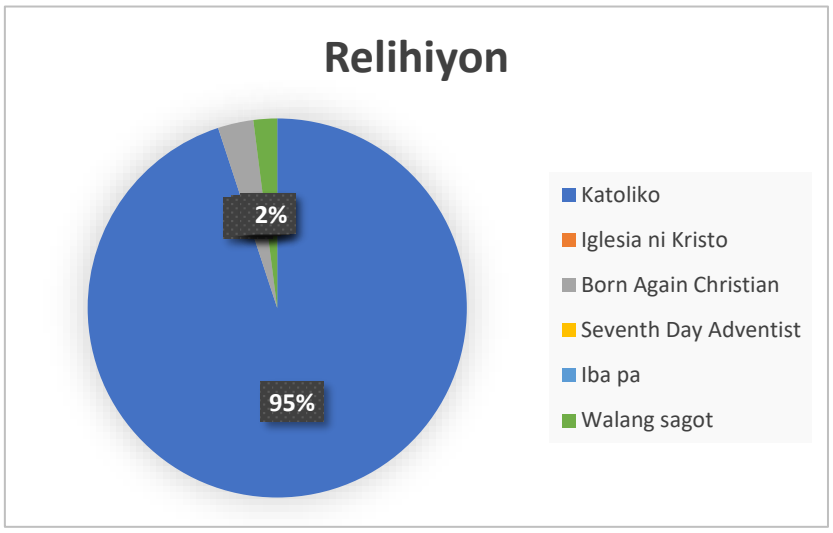
409 Some of the concerns that the respondents would like Asturias to be aware of are air pollution mitigation (43%), water pollution mitigation (24%), and local benefits for the barangay (26%).

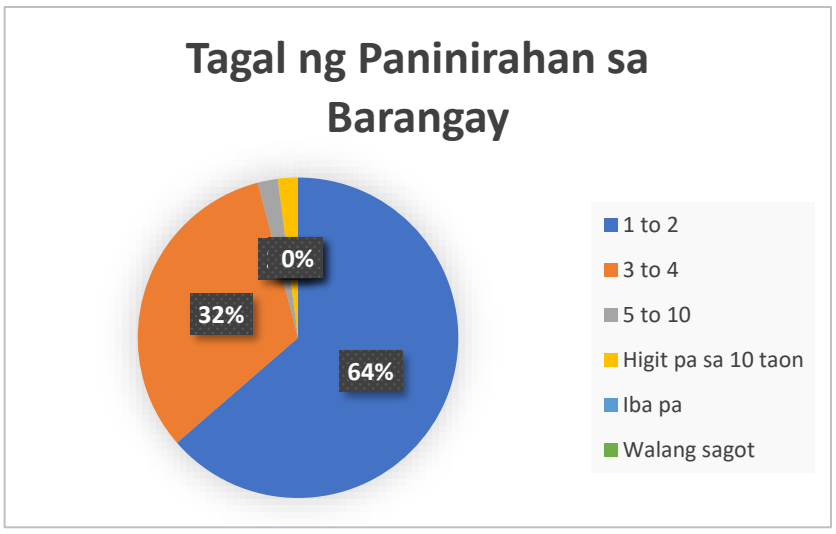
Figure 2-50: Summary of the Respondents' Profile

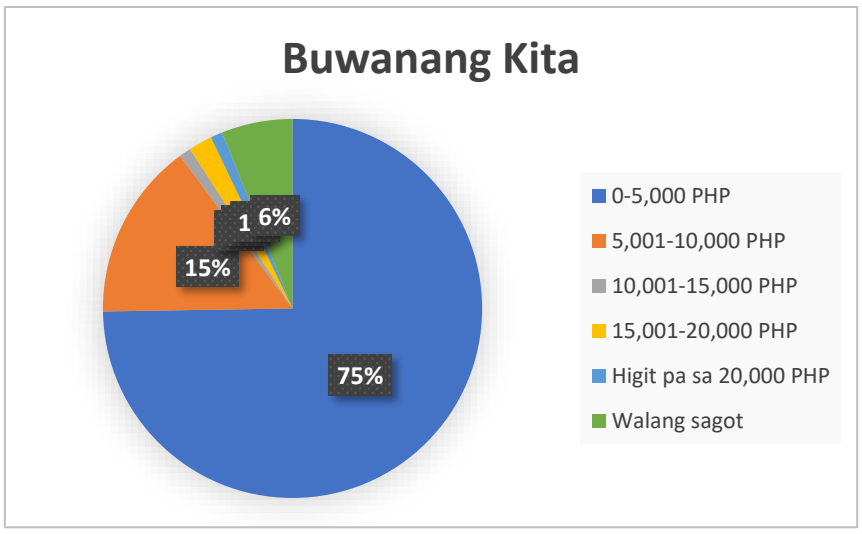


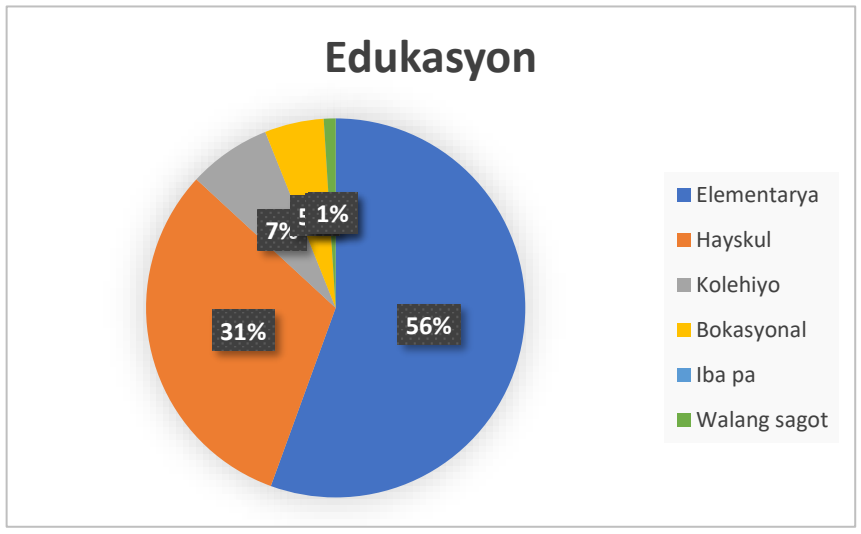


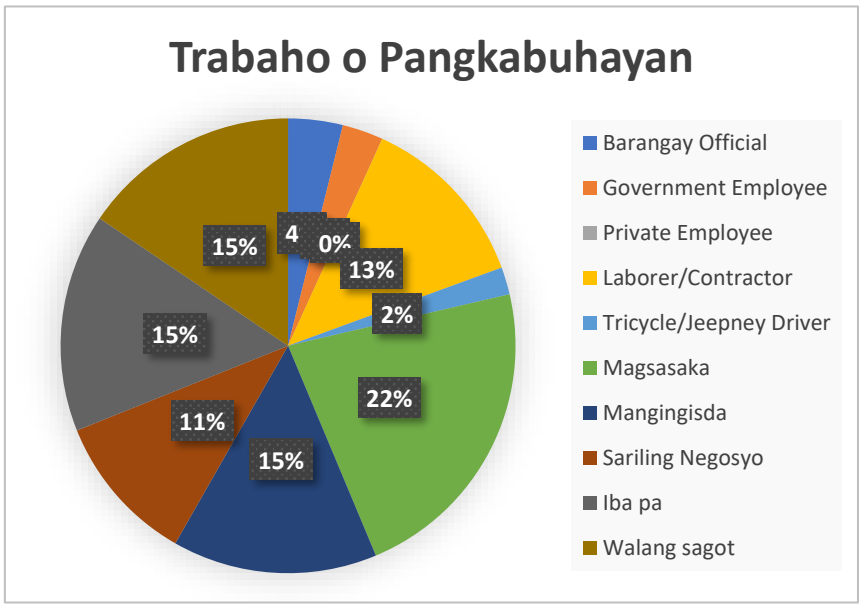








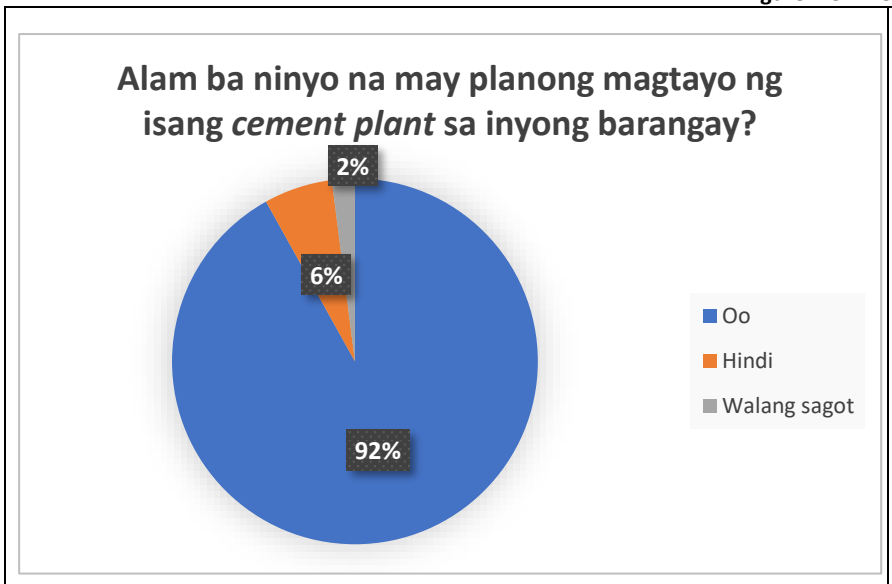


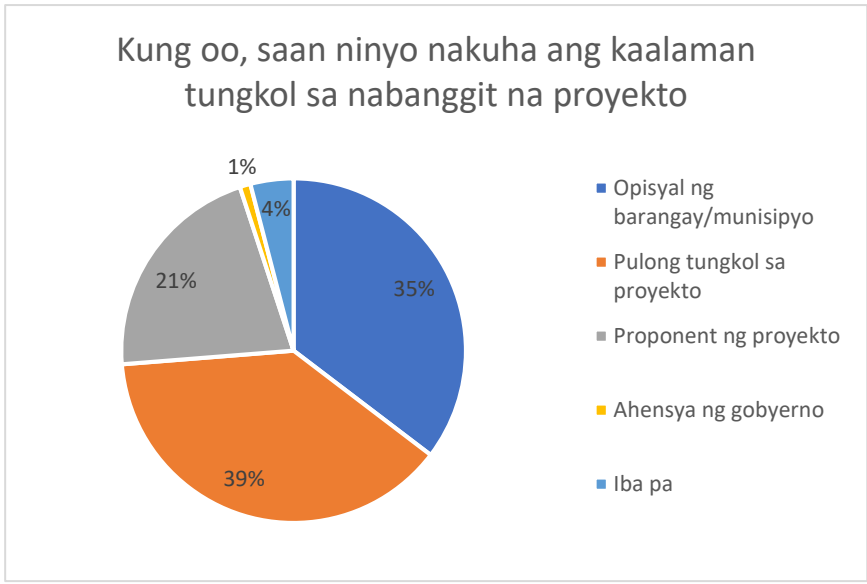


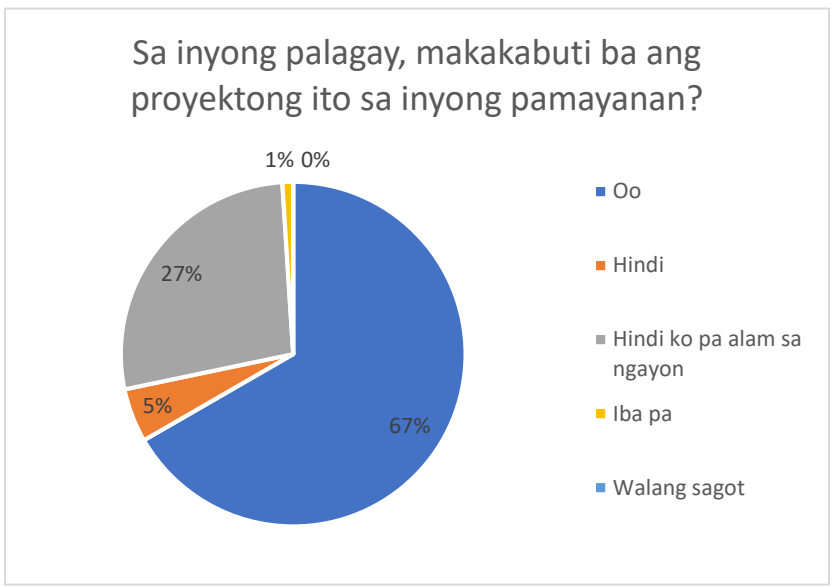
Source: LCI Envi Corporation

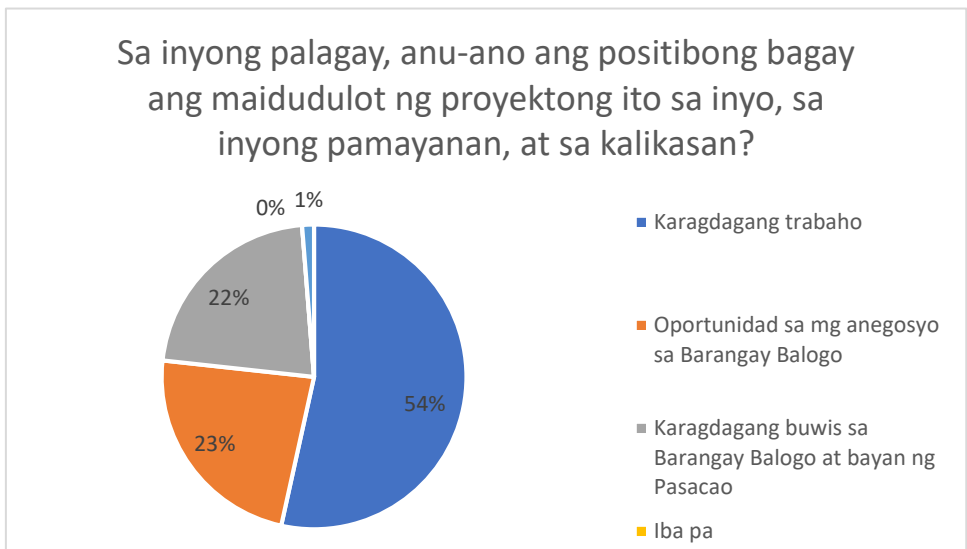
FIGURE NO.	FIGURE TITLE	
2-50	**SUMMARY OF THE RESPONDENTS' PROFILE**	
PROJECT PROPONENT: **ASTURIAS INDUSTRIES, INC.**	NAME OF PROJECT: **3.0 MMTPY Cement Plant Complex & Quarry Project** *Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas*	EIA PREPARER: **LCI ENVI CORPORATION**

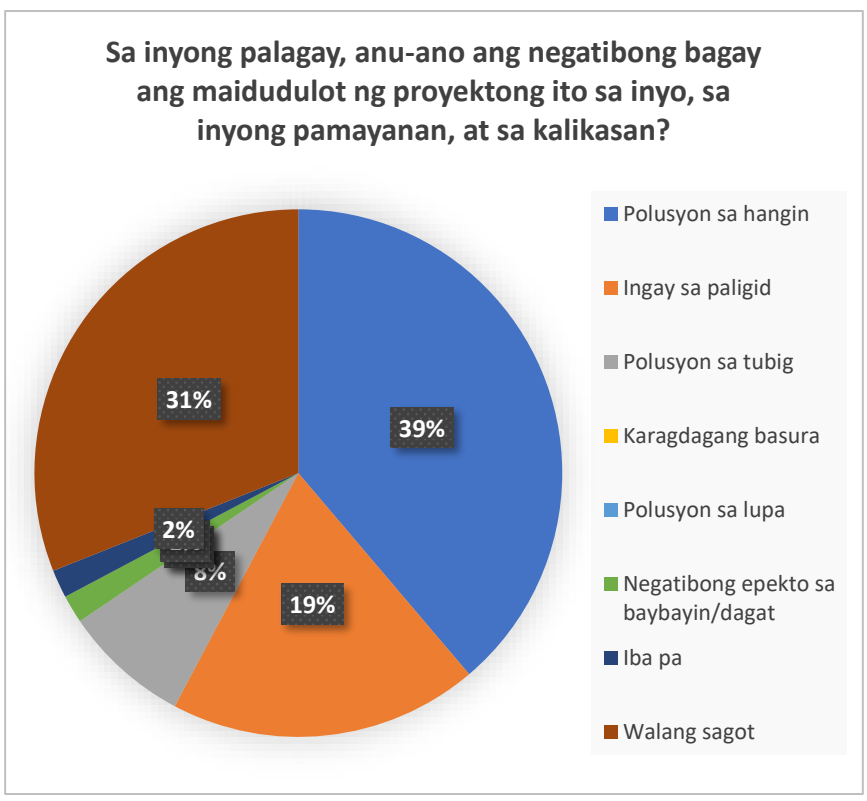
Figure 2-51: Perception Survey Results

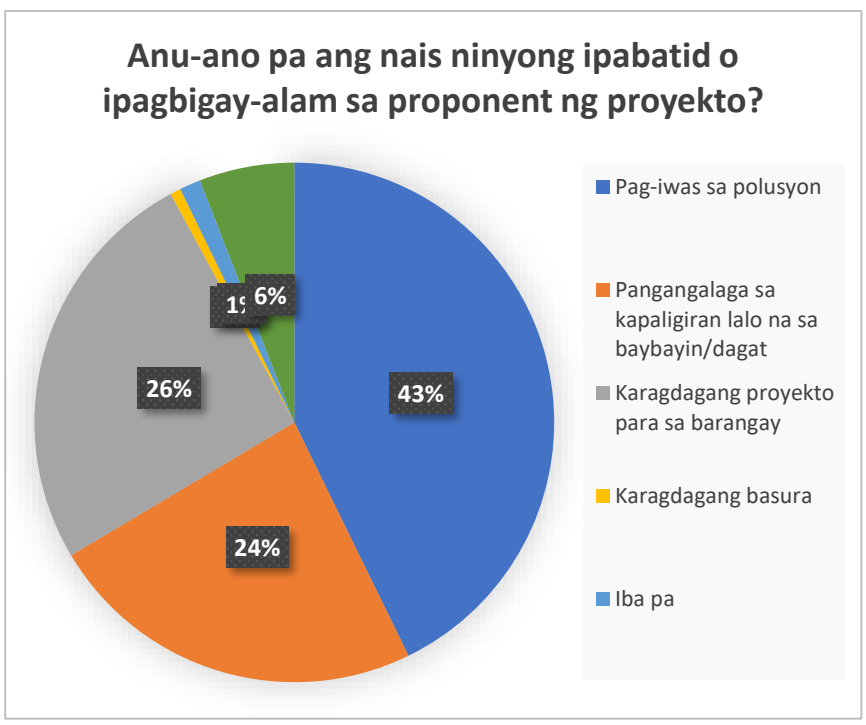












Source: LCI Envi Corporation

FIGURE NO.	FIGURE TITLE	
2-48	**PERCEPTION SURVEY RESULTS**	
PROJECT PROPONENT: **ASTURIAS INDUSTRIES, INC.**	NAME OF PROJECT: **3.0 MMTPY Cement Plant Complex & Quarry Project** *Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas*	EIA PREPARER: **LCI ENVI CORPORATION**

2.4.9 Summary of Baseline Findings, Impacts and Mitigation on People

410 The following table lists the impacts and mitigation on People.

Table 2-53 Summary of Significant Baseline Findings and Potential Impacts and Mitigation on People

Summary of Baseline Findings on People:

- Residents of Brgy. Baha were successfully relocated in Balayan, Batangas and other parts of Calatagan.
- Based on the perception survey, (92%) of the 100 respondents have prior knowledge about the proposed project. A good portion (67%) of the respondents believed that the proposed project would be beneficial, while (5%) believed otherwise; 27% were undecided. The most cited potential positive impact of the project is employment generation (54%), followed by business opportunities (23%) and tax revenues (22%). Conversely, the most cited potential negative impact of the project is air pollution (39%), followed by noise pollution (19%) and impacts on the sea (Baayan Bay) (2%).

POTENTIAL IMPACTS	PROJECT PHASES	DESCRIPTION	MITIGATING MEASURE
In-migration	N/A	The project only requires 200 manpower for construction and 50 manpower in operation	Prioritization of hiring qualified local workers
Cultural/Lifestyle Change	Operation	No known IPs residing near or within the project area, hence no perceived cultural and lifestyle changes (for IPs) expected to result from the project Increase in income can introduce and expose workers and community to vices that tend to undermine morality	Coordination with barangay LGUs and PNP to enforce law to avoid vice-related problems in the community Strict implementation of a drug and alcohol-free work environment Installation of CCTVs in strategic places
Threat to Delivery of Basic Services/ Resource Competition	Construction Operation	The project will have minimal effect in terms of resource competition with nearby households. Project's water requirement is for maintenance and domestic use. There will be a construction of a new deep well for the project. The project will be served by Davao Light and Power Company to power the offices and utilities to be constructed within the project area	N/A
Threat to Public Health and Safety	Construction Operation	Dust may cause negative health effects (i.e., respiratory) to the community and workers if not properly mitigated Crime incidence may also increase in the local community	Conduct of medical missions and regular check-ups to workers and host barangay Coordination with Municipal Health Officer (MHO) and barangay health units to address health-related needs of the community

POTENTIAL IMPACTS	PROJECT PHASES	DESCRIPTION	MITIGATING MEASURE
			Coordination with barangay officials to ensure peace and order among workers and community members
Generation of Local Benefits from the Project	Operation	Generation of additional source of income and livelihood Additional revenue for the local government Increased basic social services Addition and improvement of local residential dwellings	Implementation of social development programs that are responsive to local needs in the impact area
Traffic Congestion	Construction Operation	Increase in traffic generation in the area due to delivery trucks coming in and out of the Plant	Coordination with LGU on scheduling and handling the flow of traffic near the project area

SECTION 3

ENVIRONMENTAL MANAGEMENT PLAN

3.1 Impacts during Construction Phase

3.1.1 Land

411 The major impacts during construction phase are solid waste production, soil erosion, and possible soil contamination.

3.1.1.1 Solid Waste

412 Solid waste is expected to be produced during the construction of the proposed cement plant complex. Construction wastes such as fill materials, empty cement bags, wood, steel and other construction spoils are expected to be generated during the construction of the proposed cement plant complex. Aside from this, the construction workers will be generating domestic solid wastes. A solid waste management plan will be developed and implemented by the contractors with the supervision of Asturias. A temporary storage area for the solid wastes will be provided on site. All the solid wastes prior to hauling out will be segregated properly. Haulinh out of the solid wastes for disposal will be done by accredited service providers. Details that shall be considered in the development of the waste management plan are discussed in Section 3.5.

3.1.1.2 Hazardous Waste

413 Hazardous wastes such as used oil, grease, aerosols, paint containers and used bulbs will also be potentially generated during the construction. Hazardous wastes must be managed and disposed in accordance to RA 6969. A temporary hazardous waste storage area will also be provided in the site. All hazardous wastes will be properly sealed to ensure that there will be no leakage in the environment. Only DENR-accredited waste service providers must collect the hazardous wastes in the project site.

3.1.1.3 Soil Erosion

414 Construction of project components and auxiliary structures may necessitate significant amount of soil to be displaced, which may cause soil erosion. During rain, soil may be carried and deposited by stormwater to nearby drains and may cause siltation. Siltation will reduce the drainage capacity and may lead to flooding of nearby areas. Mitigation measures must be undertaken to avoid this impact

415 To minimize soil erosion, grading and leveling may be restricted to exact locations where earth moving is necessary. Furthermore, to prevent erosion hazard at the onset of rain, it is advised to pile the bulk of excavated soil on low-lying areas and to construct barriers, such as batter boards, that avert soil movement.

416 Excavated topsoil may be set aside for future greening purposes. Hedgerow growing of indigenous grasses, crops, and other appropriate plant species that can abate soil erosion is also advised.

3.1.1.4 Soil Contamination

417 Since heavy equipment will be used during construction, there is a risk of soil contamination due to possible oil spills during maintenance activities of the heavy equipment. It is advisable to use sawdust, rice hulls, or coir dusts to absorb accidental oil spills.

3.1.2 Water

Coastal Water Contamination

418 During construction, the nearby coastal water maybe affected by the by sediments and dusts from earth moving activities. Slopes must be stabilized prior to construction activities through the construction of embankment. Constant watering of soil piles or provision of covering, such as tarpaulin, can mitigate this impact. Silt traps and erosion barriers will also be installed around the site.

419 The construction of the cement plant complex will require 50 m^3/day for the water usage of the workers and 50 m^3/day for construction activities, both will be supplied by deepwells. To suppress the dust generation during the construction, 300 m^3 of water day will be used for regular water spraying of the site and will be sourced from the coastal water.

420 Domestic wastewater will be generated by the construction workers. Wastewater, if untreated prior to disposal, can cause water pollution and may pose health hazards to the nearby communities. Temporary sanitation facilities (e.g., toilet, bathing facilities) to be provided by the Contractor at the construction site shall be regularly maintained by assigned construction workers or hired service crew.

3.1.3 Air

421 Potential sources of air pollution are hauling activities and equipment operation within the construction sites.

Dust

422 Excavation activities will generate dusts especially during dry season. Dust can cause nuisance, reduction of visibility and may cause respiratory diseases. Periodic watering and sprinkling of soil piles and of dirt roads being passed by delivery trucks and equipment must be done to lessen re-suspension of dust particles. If water is scarce, alternative soil covering, such as tarpaulin, may be utilized. Furthermore, excavated soil materials must be promptly transferred to and compacted in the designated area.

423 Wash areas inside the project site will also be provided for the trucks and other equipment before leaving the construction site to avoid the spreading of dust and dirt along the road.

Gaseous emissions

424 Aside from dust, gaseous emissions from heavy equipment and generators used in the construction site will produce short-term impacts on the ambient air quality. An increased concentration of carbon monoxide (CO), sulfur dioxide (SO_2), and nitrogen dioxide (NO_2) may be realized in the ambient air. This impact may not be a primary concern, since the construction phase will only take several months until project completion. Nevertheless, heavy equipment must be kept in prime condition at standard air and fuel ratio in order to

limit gaseous emissions, particularly total suspended particulates (TSP). Diesel fuel products emit TSP, SO_2 and nitrogen oxides (NO_x) due to the hydrocarbon and sulfur content. If possible, all heavy equipment shall be fitted with exhaust mufflers.

3.1.3.1 Noise and Vibration

425 Noise may also be generated by construction operations and equipment. Although construction works are expected to occur regularly, the impacts may be considered temporary.

Table 3-1: Expected Noise Levels from Heavy Equipment, db(A)

EQUIPMENT	DISTANCE (M)				
	15	**30**	**60**	**120**	**240**
Front Loader	75	69	63	57	51
Backhoes	85	79	73	67	61
Graders	88	82	76	70	64
Trucks	91	85	79	73	67
Concrete Mixers	82	79	73	67	61
Cranes	83	77	71	65	59
Generators	78	72	66	60	54
Compressors	81	75	69	63	57
Pumps	76	70	64	58	52
Pile Drivers	101	95	89	83	77
Jackhammers	88	82	76	70	64

Source: Larry W. Canter, Environmental Impact Assessment, New York, 1977

Table 3-2: DENR Standards for Noise Levels in General Areas, db(A)

TIME	CATEGORY AREA				
	AA	A	B	C	D
Day Time (9am-6pm)	50	55	65	70	75
Morning/Evening (5am-9am) & (6pm-10pm)	45	50	60	65	70
Night Time (10pm-5am)	40	45	55	60	65
Note: Area AA:	Section or contiguous area which requires quietness, such as an area within 100 meters from school sites, nursery school, hospitals, and special homes for the aged.				
Area A:	Section or contiguous area which is primarily used for residential purposes.				
Area B:	Section or contiguous area which is primarily a commercial area.				
Area C:	Section primarily reserved as a light industrial area.				
Area D:	Section which is primarily reserved as a heavy industrial area.				
Source: UP NCTS Environmental Text Series					

426 Mitigating measures that can be employed are: 1) proper maintenance of motor engines and other mechanical parts of heavy equipment; 2) installation of exhaust mufflers to the equipment; and 3) putting up of enclosures at the construction site. As much as possible, construction activities shall be concentrated during normal working hours, particularly at sites near built-up areas.

427 The impact of vibration is less serious than, but related to, that of noise. Although only few structures may be affected by vibration, it is the people's interest that is of concern. To minimize vibrations, machines should be mounted on shock-absorbing mountings, such as cork or reinforced concrete foundation or a floating isolated foundation set on piles,

depending on the machinery. Reduction of working hours and/or introduction of short breaks during working days may also lessen the consequences of vibrations.

3.1.4 Biological Environment

428 The project development will require removal of vegetation communities and associations. The removal of vegetation will also result to reduction in the population of the plant species growing within the disturbance area. Future vegetation will face a great threat during the clearing activity. This activity will hinder the opportunity of these regenerants to grow and replace the vegetation in the area.

429 The project will require land clearing resulting to the removal of portions of remaining vegetation's to give way for the construction of proposed cement plant complex and quarry. This entails to further disturbance of wildlife, loss of habitats and reduction to biodiversity composition of the area. Further loss of vegetation cover as a result of land clearing may encourage movement/migration of wildlife species in the area aggravated by the loss of habitat and remaining sources of food for survival.

430 Anthropogenic movements, noise, and vibrations may also drive wildlife away from the ecosystem, may cause temporary or permanent migration of the faunal species in other or nearby areas/habitat where disturbance is less. Ecosystem conservation and rehabilitation are recommended prior to and after construction and operation. Assistance from specialists must be secured in identification of wildlife.

431 Natural noise buffer/natural perimeter along the project development and access road using fruit bearing trees and indigenous species may also be established This method could also help provide a natural abode to some wildlife as well as source of food.

3.1.5 Socio-Economy

3.1.5.1 Accessibility and Circulation Concerns

432 Traffic is not an issue in the project area at present. However, heavy equipment mobilization may affect travel time and road condition. Early notice to the public of upcoming activities is an obligation of the Contractor. Installation of early warning device installations is a part of this mitigating measure. In the instance where roads are starting to deteriorate, the Contractor should immediately provide fillings to the potholes created by hauling trucks and other heavy equipment. Excavated materials shall be placed in a suitable location that will not cause severe disruption to road traffic.

3.1.5.2 Local Economy

433 The project is expected to have a positive impact on the local economy of the host community with an increase in business opportunities, such as food retail, housing rental, and other services to the construction workers. This is in addition to the employment opportunities that will be available to the local workforce.

3.1.5.3 Population

434 A temporary increase in population may occur during the construction phase as workers are brought into the area. Local labor will be sourced to meet the work force required by the construction. However, there may be cases were transient settlers may opt to stay in Barangay

Baha and Brgy. Talibayog permanently (e.g. marriage, work opportunities, and etc.), thus increase in population may be realized. Consequently, there may be need for improved basic social services in the area.

3.1.5.4 Peace and Order

435 Presence of outsiders (i.e., migrant workers) can bring about difference in views and perspectives and new influence changing attitudes and bias. Peace and order may be upheld through strict law enforcement, regular patrolling, and apprehension of erring individuals.

3.1.6 Health and Safety

436 Construction may pose danger to vehicles, equipment, and even people. Accidents can be prevented through the installation of enclosures, early warning devices, and other protective means within and around the working area. The Contractor will be required to submit an Occupational Safety and Health Plan (OSHP), based on the Department of Labor and Employment (DOLE) DO No. 13 Series of 1998, that covers the safety of the workers and the community.

437 Potential health and safety risks may also arise from dust, pollutants, noise and vibration to be generated from construction activities. Workers, particularly those operating heavy equipment, must be provided with personal protective equipment (PPE), such as earmuffs,

3.2 Operational Phase

3.2.1 Land

3.2.1.1 Solid Waste

438 The operation of the cement plant will be generating domestic solid wastes from the workers. All solid wastes must be properly segregated and disposed to minimize its impact to the environment.

3.2.1.2 Hazardous Waste

439 Possible hazardous wastes that may be generated by the project are used bulbs, oil and grease, empty chemical containers and others. These wastes should be disposed in accordance to RA 6969. The Proponent will also secure a Hazardous Waste Generator ID to DENR to facilitate the transfer and disposal of hazardous wastes generated. It is estimated that about ~1,400 MT of hazardous waste will be generated per year.

3.2.2 Water

3.2.2.1 Coastal Water Contamination

Oil Spill

440 Oil spills from vehicle and equipment repair and maintenance may impact the ambient quality of the nearby coastal water during the operational phase. Since the operation of the cement plant complex will also be utilizing the pier facility of the industrial park for the delivery of materials or products, potential oil spill from the vessel will be a primary concern. Oil spill may cause damage to the aquatic ecosystem within the project site.

441 As a preventive measure, repair and maintenance are being done in a designated area with concrete flooring and canals constructed to channel any oil spills. Oil spills can also be contained by absorption using sawdust, rice hulls, or coir dust. Oil spill contingency plan must be developed and implemented by Asturias.

Siltation

442 The quarry operation, especially during blasting, will also generate soil sediments that may be carried to the nearby coastal water during heavy rain. This may increase the sediment yields of the receiving body of water. Increase in turbidity reduces the penetration of sunlight, thus inhabiting photosynthesis of the primary producers in the marine ecosystem. Increased suspended sediment levels and turbidity may also cause marine species in the area to migrate to other suitable areas.

443 Siltation ponds will be constructed at the various areas within the quarry areas to pre-treat the surface run-off. The ponds will be regularly maintained and desilted to prevent water pollution.

Domestic Wastewater Generation

444 Workers of the cement plant will also generate domestic wastewater. Untreated domestic wastewater when discharged may cause water pollution., affecting the marine ecosystem in the nearby coastal water. With this, sanitation facilities will be provided on-site and a sewage treatment plant will be operated to ensure compliance of the cement plant's discharges to the national standards.

3.2.2.2 Ground subsidence

445 The quantity of water supply may also be affected during the operational phase of the project. Since the water supply is mainly from a deep well, ground subsidence may occur from excessive pumping, especially during dry seasons where lowering of groundwater table is normally experienced.

3.2.3 Air and Noise

3.2.3.1 Dust

446 Dusts may be generated during the quarry operation, the transport of quarried minerals to the cement plant and the operation of the cement plant specially in the bagging section. Too much exposure to dusts presents serious risks to human health. Dusts may cause irritation of the eyes, coughing and sneezing. Partulcate matters when inhaled can also cause respiratory and cardiovascular diseases.

447 Covers will be provided to the delivery trucks and regular sprinkling of the dirt roads will also be implemented to minimize the dust emissions. Utilizing high-efficiency equipment with baghouse filters can minimize and contain the fugitive dusts to be generated in the operational phase. During bagging of cement, dust generation can be diminished through the use of baghouse filters. The bag filters will be designed (a) with much larger capacities than usually estimated using accepted industry practices and (b) the bag filters will be composed of modules or compartments which can be isolated from the operating compartments, for periodic preventive or even corrective maintenance.

3.2.3.2 Gaseous emissions

448 Combustion of diesel fuel from the operation of heavy equipment for the quarry as well as and cement plant equipment may emit pollutants such as CO, SO_2 and NO_x. All heavy equipment must be properly and regularly maintained to minimize their potential pollution emissions.

3.2.3.3 Noise and Vibration

449 Noise and vibration maybe observed during the blasting activity in the quarry area. However, this impact will only be temporary because the noise will only occur for a split second during the blasting and a few seconds after the blasting due to the falling of rocks.

450 The operation of the heavy equipment and the machines may generate noise and vibration. Continuous exposure to high noise intensity can cause hearing impairment which is irreversible. To reduce the occurrence and intensity of the noise and vibration, suppressers or mufflers will be installed.

3.2.4 Biological Environment

3.2.4.1 Vegetation

451 Areas that have been cleared of its natural vegetation may either regenerate original or similar species from residual plant parts. Access roads leading to cement plant facility will pave way to further encroachment of people in search of possible livelihood and other activities. Vegetation succession about the project site shall sporadically grow with or without anthropogenic assistance.

452 Vegetation may be allowed to grow in the vicinity or structures unless they may promote system malfunction or are hazardous to people. Plant species with intrusive roots, moss, molds, lichens, and others that can cause damage to the structures installed for the excellent operation of the facilities should be removed and re-planted to a designated location if these species have economic, aesthetic, and ornamental importance.

3.2.4.2 Wildlife

453 Wildlife may find habitat in built structures in the long run. Unless the animals sighted pose danger, damage, or malfunction to the facility, structures must be maintained to encourage biological diversity succession. Constant monitoring and evaluation of species survival within identified habitat and those residing in the project site shall be conducted.

3.2.5 Socio-Economy

3.2.5.1 Local Economy

454 Old business establishments may expand resulting to increased employment opportunities. From agricultural- and forest-based income generation, local residents may now find employment in the cement plant facility as a source of income. The project may create various opportunities for retailing, services, buy and sell, and others. The basic needs of the community continue to grow, and these needs must be met. This is where the law of supply and demand comes in. Enterprising residents of the surrounding barangays can therefore look at the needs of the new occupants of the project and their dependents so that they can prepare what appropriate investment response will they adopt to earn some income.

455 The cement plant facility will also provide additional revenues for the local government in terms of taxes and dues. Laws and ordinances on tax collection and land registration must be properly implemented.

3.2.5.2 Population

456 Transient settlers may opt to stay permanently thus increase in population may be realized. Continuous improvement of infrastructures and support services for local constituents and in coming visitors is advised.

3.2.5.3 Peace and Order

457 Partiality between local residents and newcomers or migrant workers may occur. Peace and order may be upheld through strict law enforcement, regular patrolling, and apprehension of erring individuals.

3.2.6 Unavoidable and Residual Impacts

458 Implementation of the proposed mitigating measures discussed in previous sections is expected to leave residuals, which should not adversely affect the people and the vicinity. Noise and vibration generated by the machines and equipment are attendant consequences. However, these can be reduced to tolerable levels by the use of suppressers or mufflers and other measures identified in the preceding pages. Noise and vibration residuals should be as low as possible so as not to cause nuisance to workers and the public.

459 Stacks of the cement plant will also emit air pollutants. However, with proper design of the stack and the installation of air emission control devices, the impacts will be reduced.

3.3 Summary Matrix of Environmental Impact and level of Significance

460 **Table 3-3** details the matrix summary of the mitigating and enhancement measures with the corresponding environmental aspects and impacts for the different phases of its development. This matrix summary also includes the responsible parties, estimated costs, and guarantees involved.

461 **Asturias Industries, Inc.** also commits to submit an Environmental Protection and Enhancement Program as complement to the requirements of the ECC. The EPEP will provide comprehensive and strategic environmental management of the expected and considered impacts of the mining activities. The EPEP will also describe the environmental protection and enhancement strategies that will be implemented by the proponent all throughout the mining life of the proposed project.

462 To ensure the implementation of the approved EPEP, Asturias Industries Inc. will submit an Annual Environmental Protection and Enhance Program (AEPEP) to MGB Region IVA office. The AEPEP will be based on the approved EPEP and will be implemented on the year of its submission.

Table 3-3: Summary Matrix of Environmental Impacts and Mitigating Measures

ENVT'L ASPECT	ENVT'L COMPONENT LIKELY TO BE AFFECTED	POTENTIAL IMPACT	OPTIONS FOR PREVENTION OR MITIGATION OR ENHANCEMENT	SCHEDULE OF IMPLEMENTATION	ESTIMATED COST	RESPONSIBLE ENTITY	GUARANTEES
PRE-CONSTRUCTION PHASE							
Acquisition of applicable permits and licenses	The People	Disclosure of project components and activities	• Submission of complete requirements for processing of all permits	Prior to construction	Minimal	Asturias Industries Inc	Pre-construction expenses
Local sourcing of labor	The People	Employment opportunities	• Priority hiring within Brgy. Baha and Brgy.Talibayog • Local labor requirement to be announced and posted in barangay hall and public areas.	Prior to construction	Minimal	Asturias Industries Inc	Pre-construction expenses
CONSTRUCTION PHASE							
Construction and installation, including site facilities	The Land	Accumulation of construction debris and other solid waste	• Implementation of the solid waste management program by the contractor • Regular transport of construction debris and other solid waste in the approved designated area by the DENR.	During construction	Covered by contract amount of Contractor PHP 40,000	Asturias Industries Inc	Contractor's EMP, Site Inspection Report
	The Land	Generation of hazardous wastes	• Collect, store and dispose hazardous wastes in accordance to RA 6969 • Treatment and dispose of hazardous wastes through DENR-accredited waste treaters				
	The Water	Possible siltation and surface runoff	• Establishment of sediment traps, erosion barriers, and silt curtains	During construction	PHP 50,000	Asturias Industries Inc	Contractor's EMP, Site Inspection Report

ENVT'L ASPECT	ENVT'L COMPONENT LIKELY TO BE AFFECTED	POTENTIAL IMPACT	OPTIONS FOR PREVENTION OR MITIGATION OR ENHANCEMENT	SCHEDULE OF IMPLEMENTATION	ESTIMATED COST	RESPONSIBLE ENTITY	GUARANTEES
		Possible clogging of drainage due to siltation	• Regular removal of silt and sediments				
	The Air	Generation of dust	• Regular watering of construction site • Apply canvas cover on construction materials to avoid long exposure to strong winds	During construction	PHP 30,000	Asturias Industries Inc	Contractor's EMP, Site Inspection Report
	The People	Health hazards from dust emissions	• Implement dust control management • Proper PPEs to workers				
Use of heavy equipment, during construction works	The Land	Ground vibration	• Apply non-vibration techniques during construction, if possible • Notify nearby residents about use of heavy equipment • For hauling trucks, comply with road weight limit standards to avoid ground vibration	During construction	Minimal	Asturias Industries Inc	Contractor's EMP, Site Inspection Report
	The Land/The Water	Coastal and groundwater contamination due to accidental oil spills/leaks	• Use sawdust, rice hulls, or coir dusts to absorb the oil spills • Maintain canal in the maintenance and repair area of vehicles and equipment	During construction	Minimal	Asturias Industries Inc	Contractor's EMP, Site Inspection Report
	The Air	Generation of Air Emissions and Noise	• Regular maintenance of heavy equipment • Perform noisy activities during daytime	During construction	Covered by contract amount of Contractor	Asturias Industries Inc	Contractor's EMP, Site Inspection Report

ENVT'L ASPECT	ENVT'L COMPONENT LIKELY TO BE AFFECTED	POTENTIAL IMPACT	OPTIONS FOR PREVENTION OR MITIGATION OR ENHANCEMENT	SCHEDULE OF IMPLEMENTATION	ESTIMATED COST	RESPONSIBLE ENTITY	GUARANTEES
			• Establish and maintain green zone to serve as natural noise barrier.				
	The People	Traffic congestion	• Provide early warning devices/road signs • Provide parking spaces within project site	During construction	Covered by contract amount of Contractor	Asturias Industries Inc	Contractor's EMP, Site Inspection Report
Influx of workers	The Land	Generation of solid waste	• Implement solid waste management plan • Hauling of discarded items by accredited haulers	During construction	Minimal	Asturias Industries Inc	Contractor's EMP, Site Inspection Report
	The Water	Ground and coastal water contamination from improper disposal of wastes, percolated wastewater, sludge and fecal matter.	• Provision of sanitation facilities for workers (e.g. toilets, showers, etc.)	During construction	PHP 30,000	Asturias Industries Inc	Contractor's EMP, Site Inspection Report
	The People	Occupational Health and Safety	• Proper training on construction safety • Provision of PPE • Proper supervision by trained professionals during construction activities	During construction	PHP 100,000	Asturias Industries Inc	Contractor's EMP
	The People	Employment opportunities	• Priority in hiring should be given to residents of host communities	Construction stage	-----	Asturias Industries Inc	SDP
OPERATION PHASE							
Quarrying Operation	The People	Increased occupational health and safety risks	• Proper storage of magazines	Operation stage		Asturias Industries Inc	Environmental Monitoring Report

ENVT'L ASPECT	ENVT'L COMPONENT LIKELY TO BE AFFECTED	POTENTIAL IMPACT	OPTIONS FOR PREVENTION OR MITIGATION OR ENHANCEMENT	SCHEDULE OF IMPLEMENTATION	ESTIMATED COST	RESPONSIBLE ENTITY	GUARANTEES
		because of explosives use	• Extensive training for selected personnel in handling and operating explosives • Issuance of alarms and warning devices prior to and during blasting operations				
	The Air	Dust generation during quarrying and transport of limestone	• Watering of quarry site and road. • Provision of covers of the trucks.	Operational stage			
	The Water	Run-off from quarry operations	• Provision of siltation ponds • Regular desilting	Operational stage			
Operation of cement plant facility	The Air	Increased levels of TSP Increased noise levels	• Regular ambient air monitoring • Operate and maintain bag filters • Daily road watering to avoid fugitive emissions from area sources • Assign sweepers to regularly remove dust in areas such as roads, parking areas, and other paved areas. • Implement speed limit in the vicinity of the plant site to avoid re-suspension of dust. • Raw material and product storage areas are enclosed • Raw material conveyor from pier to pant site is enclosed.	Operational stage	Php50,000	Asturias Industries Inc	Environmental Monitoring Report

ENVT'L ASPECT	ENVT'L COMPONENT LIKELY TO BE AFFECTED	POTENTIAL IMPACT	OPTIONS FOR PREVENTION OR MITIGATION OR ENHANCEMENT	SCHEDULE OF IMPLEMENTATION	ESTIMATED COST	RESPONSIBLE ENTITY	GUARANTEES
			• Use of pneumatic conveyors for fly-ash transfer • Trucks shall be required to have covers • Enhance and maintain green zones to serve as natural wind and noise barrier.				
	The Water	Runoff from plant operations Possible spillage of raw materials from pier Accidental oil spill from ship	• Installation and maintenance of drainage system within the plant and the pier • Coastal water monitoring • Oil spill contingency plan	Operational stage	Php100,000	Asturias Industries Inc	Environmental Monitoring Report
	The Land	Accumulation of hazardous waste	• Develop and implement a hazardous waste management plan that complies with RA 6969.	Operational stage	-----	Asturias Industries Inc	Environmental Monitoring Report
	The Land	Accidental oil spill from delivery trucks	• Use sawdust, rice hulls, or coir dusts to absorb the oil spills • Maintain canal in the maintenance and repair area of vehicles and equipment	Operational stage	-----	Asturias Industries Inc	Environmental Monitoring Report
	The Water	Ground and coastal water contamination from improper disposal of wastes, percolated	• Provision of sanitation facilities for workers (e.g. toilets, showers, etc.)	Operational stage	PHP 30,000	Asturias Industries Inc	Environmental Monitoring Report

ENVT'L ASPECT	ENVT'L COMPONENT LIKELY TO BE AFFECTED	POTENTIAL IMPACT	OPTIONS FOR PREVENTION OR MITIGATION OR ENHANCEMENT	SCHEDULE OF IMPLEMENTATION	ESTIMATED COST	RESPONSIBLE ENTITY	GUARANTEES
		wastewater, sludge and fecal matter.					
	The People	Occupational Health and Safety	• Proper training on safety • Provision of PPE	Operational stage	PHP 100,000	Asturias Industries Inc	Environmental Monitoring Report
Effect of operations on local economy	The People	Increased tax revenue	• Proper registration, tax contribution, land registration and other laws/ordinances shall be followed	Operational stage	------	Asturias Industries Inc	Tax collection certificate
		Increased employment opportunities	• Priority in hiring of personnel shall be given to residents in the impact areas (host LGUs)	Operational stage	------	Asturias Industries Inc	Municipal / Brgy. Development Plan / MOA
Influx of delivery trucks in the area	The Air	GHG emissions from delivery trucks	• Implement carbon sink programs such as tree planting to mitigate GHG emissions	Operational stage		Asturias Industries Inc	Environmental Monitoring Report
	The People	Traffic congestion	• Develop a traffic management plan together with the Municipality of Calatagan • Provide truck marshalling area within plant site • Provide early warning devices/road signs	Operational stage	------	Asturias Industries Inc	Environmental Monitoring Report
DECOMMISSIONING/ABANDONMENT PHASE							
Pull-out of equipment	The Air	Generation of air emissions and nose	• Regular maintenance of heavy equipment • Perform decommissioning during daytime	Decommissioning/ Abandonment	Covered by contract amount of Contractor	Asturias Industries Inc	EMP

ENVT'L ASPECT	ENVT'L COMPONENT LIKELY TO BE AFFECTED	POTENTIAL IMPACT	OPTIONS FOR PREVENTION OR MITIGATION OR ENHANCEMENT	SCHEDULE OF IMPLEMENTATION	ESTIMATED COST	RESPONSIBLE ENTITY	GUARANTEES
Abandonment of offices and other facilities	The People	Abandonment of facilities	• Possible donation to LGU	Decommissioning/ Abandonment	Minimal	Asturias Industries Inc	EMP
Termination of employment	The People	Loss of employment	• Provide 6 months' notice of impending termination of employment • Provide compensation to affected personnel • Provide training of personnel in preparation for other jobs	Prior to decommissioning/ abandonment	To be determined	Asturias Industries Inc	EMP

3.4 Construction Environmental Program

463 During the construction phase of the Project, the designated contractor for the Project shall implement and be responsible for its environmental program, under the supervision **Asturias Industries Inc**. The designated contractor will be required to implement the EMP, in accordance to the ECC conditions.

464 The implementation of the Construction Environmental Program shall be part for the scope of work of **Asturias Industries Inc.** in accordance with the conditions stipulated in the ECC. It shall include specific actions and measures such as:

- Provision of temporary lodging and sanitation amenities for workers, and liquid and solid waste handling/disposal facilities;
- Avoidance of unnecessary earth-movement;
- Worker and project site safety programs, including emergency response plans;
- Proper storage and disposal of hazardous wastes (i.e., used oils, oil-contaminated material, BFL etc.);
- Establishment of silt traps and erosion barriers around the project site;
- Regular removal of silts and sediments or as necessary;
- Worker and project site safety programs and emergency response plans;
- Provision of portable sanitation facilities to the workers and ensure safe disposal of wastewater generated;
- Proper segregation, storage, disposal of solid and hazardous wastes (i.e., used oils, etc.);
- Reduction or elimination of pollution sources by using pollution control measures (i.e., watering of project site, installation of noise reduction equipment such as mufflers, scheduling of work during day time, installation of septic tanks)
- Elimination/Reduction of occupational safety and risks through strict implementation of safety plans and procedures (i.e., use of PPEs, provide health stations and first aid kits, regular monitoring of work stations if still meet work standards).
- Proper demobilization procedures (i.e. clean-up of construction sites, replacement/re-planting of removed trees).

3.5 Waste Management

465 Solid wastes will inevitably be generated during the Construction and Operations phases of the project. To address this concern, **Asturias Industries Inc.** will adopt a solid waste management program (SWMP), which will target to reduce the solid waste generation during the different phases of its development. This program shall aim to decrease the amount of operational costs as a result of handling, storage, and disposal of solid wastes. To realize these targets, the proposed project will incorporate the following details to enhance its SWMP:

- Implementation of waste segregation (biodegradable and non-biodegradable) policy for all construction and operations personnel;
- Provision of solid waste handling and storage facilities, such as dumpsters, trash cans in common areas and strategic locations in the facility;
- The biodegradable wastes, such as discarded kitchen wastes and yard trimmings shall be composted;
- Implement a paper usage reduction program in the administration office by re-using paper for other similar purposes;

- The recyclable wastes, such as paper, plastics, and metals, shall be sorted accordingly and sold to waste service providers; and
- The residual and other general solid wastes shall be disposed in their appropriate bins and in accordance with the local solid waste collection schedule.

466 Although cement plant will not use any hazardous materials as part of the process, hazardous waste such as used oils, oil-contaminated materials, and BFLs will be produced. Proper storage and disposal of these hazardous materials shall be ensured by the proponent. Also, under RA 6969, the proponent will apply for a Hazardous Waste Generator ID to DENR prior to its construction.

3.6 Coastal Management Plan

3.6.1 Mangrove Protection and Reforestation

467 The mangrove area runs along the coastline of Brgy. Talibayog and Brgy. Baha. The condition of the mangrove in the area, however, is very poor since excessive cutting of mangrove species had been practiced since the early 70's when the area was still in good condition, as claimed by some residents.

468 At its present state, the mangrove forests in Brgy. Baha and Brgy. Talibayog need to be protected. Cutting and clearing of mangrove trees for any purpose shall not be allowed to preserve the mangrove forest. The project will therefore promote its protection and enhancement to maintain its natural function to the ecosystem as home to remaining flora and fauna species, carbon sink, and as natural buffer to extreme climate variabilities.

3.6.2 Coral Reef Protection

469 Restoration of a damaged coral reef is difficult. It may require years of substantial efforts from the people for the reef to recover and be restored to a healthy and productive state. Thus, the coral reef in Brgy. Baha and Brgy. Talibayog should be protected to maintain a habitat for fishes and ensure sustainable fishing around the area.

470 In order to compensate for loss of corals in the area, rehabilitation efforts such as creating new artificial hard substrate or artificial reef upon which coral can settle and reef eventually develop, and seeding of giant clams on adjacent coral reefs are recommended.

471 Establishment of artificial reefs (or recruitment blocks) is a rehabilitation structure or habitat enhancement and at the same time fish aggregating devices. These are constructed in flat, barren areas of relatively good visibility. The artificial reef project is community based, therefore endorsed to the people (Castañeda and Miclat, 1981).

472 Giant clam seeding program is also one of the reef rehabilitation and enhancement techniques that can be introduced in the area. Giant clams constitute a significant component of reef communities and play an important role in the ecological balance of the reef ecosystem. However, the critical success factors in giant clam seeding project are favorable conditions (suitable habitat conditions) and maintaining high level of protection for giant clam, as poaching can become a big problem.

3.6.3 Erosion Control Plan

473 To minimize silt load to the coastal area, erosion control should be implemented in areas which are highly susceptible to soil erosion.

474 Erosion should be managed and controlled in large exposed areas, otherwise, the seabed will become heavily silted and will cover the seagrass and corals causing it to deteriorate.

475 One way to control soil erosion is by diverting high runoff flows from upslope areas away from open areas. This can be accomplished by building berms to prevent inflow of runoff to the open areas or better yet, by constructing diversion canals. These canals can be vegetated with grass to minimize scouring of the canal.

476 Use of sediment ponds, silt fences, fiber rolls and geotextile liners and other applicable erosion control methods can be employed. Use of manufactured materials, however, is more expensive.

477 In shorelines with erosion problem, riprapping, installation of gabions or planting of mangrove trees can be done to prevent shoreline receding from action of tidal waves.

3.7 Occupational Health and Safety

478 **Asturias Industries Inc.** shall have an occupational health and safety policy that will be implemented in all the project phases. This policy will undergo continuous improvement to adapt to the existing conditions. Occupational health and safety policy is necessary since it will not just reduce the likelihood of injuries/fatalities that may affect its personnel, but also protect valuable equipment and properties against damages.

479 The following details are basic guidelines that **Asturias Industries Inc.** will be applying for the Project:

- All management, technical, and non-technical personnel shall undergo specialized training courses to familiarize themselves to the operations and maintenance of the Project's various facilities;
- Emergency response plan shall be updated regularly, and emergency drills shall be performed regularly to improve personnel's response technique and time;
- Audits shall be conducted by the management and personnel, with possible assistance from various safety consultants;
- Personnel shall undergo scheduled annual health check-ups;
- Safety signage, adequate illumination, anti-skid steps and guard rails, fire extinguishers, first-aid kits, and other safety features shall be established throughout the Project's facilities; and
- Personal protective equipment (PPE), which includes safety boots, hard hats, gloves, safety goggles (in some instances) shall be mandatory for construction workers (during Constructions phase) and personnel (during Operations phase) working on the Project.

3.8 Handling and Blasting Procedure

480 **Asturias Industries Inc.** will implement its own handling and blasting procedure, which provides consistent rules and procedures for blasting operations. The following discussion will be the blasting procedure that will be strictly implemented by **Asturias Industries Inc**.

Site Operating Procedure: Blasting Procedure

481 The purpose of the procedure is to provide consistent rules and procedures for blasting at any NACI Blasting operation. Prior to drilling, the shotfirer shall make sure the area is clean before marking the pattern. The pattern shall be marked out according to an agreed design which will include bit, size, bench height, and powder factory requirements. During the mark out, if any holes are set out on or next to obvious cracks in the ground, they should be moved away to ensure maximum fragmentation is achieved in the affected area.

Charging of Shots

482 There are appointed shotfirer, licensed blaster, or trainee shotfirer/blaster under supervision who are permitted to fire blasts. Explosives may only be handled by persons over the age of 18. The shotfirer has the responsibility to ensure that each person in the blast crew is adequately trained for the tasks they are required to perform with respect to particular blasting systems and materials being employed.

Priming

483 Shotfirer must delegate persons for the assembly and distribution of priming devices and the recovery of unused priming devices. Shotfirer will also determine the number of priming devices used in each blast hole and will be based upon the design. The number and type should take blasthole diameter, length of explosive column, the type of explosive, and the geology of the area into consideration. The general rule of thumb is one primer for up to 1 meters of charge length and two primers for 10 meters and over.

484 Priming devices should be located at the recommended position in the blast hole. They should be pulled up to 0.5 to 1 meter from the bottom of the whole. Each part of the column will include a priming device to ensure initiation of all the explosives in the hole. Charging of blast holes must not take place within eight (8) meters of drilling operations or within eight (8) meters of projected holes not drilled but intended in the design blast. Appendix A and a JSRA will need to be completed if it becomes necessary for equipment to come into the blast/shot area.

Loading of Blast Holes

485 Charging of blast holes will be carried out in accordance with an accepted blast design. Actual depth of blast holes and obstructions and presence of water are factors to be considered. The Shotfirer ensures holes are dipped to make sure the design stemming height is achieved once loading is complete and prior to stemming. If a blast hole is overloaded such that the length of stemming is inadequate, the Shotfirer will use a product extraction device to remove the excess explosive. The Shotfirer shall ensure that such hole is covered with as much stemming as is required and will take into account potential fly rock effects when firing the shot. Blast zone may need to be increased and consideration to be given to the positioning of equipment. Apart from explosive vehicles directly engaged in charging activities, no other vehicle may pass beside a charged hole unless a safe access has been established and such vehicles is under the direction of the Shotfirer or a person delegated to the task by the Shotfirer.

Fencing, Access, and Nearby Activities

486 Access to the blast area is to be restricted by the visual barrier adjacent to the shot including the bench or access way below and by reflective warning signs laces at entry points. All

vehicles, other than those directly involved with the shot firing activities, must remain outside the defined barriers. Any person wanting to gain entry to a shot must obtain permission from the Shotfirer. Where a mobile crib hut or similar facility is used, it will be located no closer than 300 meters from the edge of the shot.

Restriction on Personnel

487 The blast crew are the only personnel allowed within the perimeter of a shot. Person/s shall not be allowed in areas that has warning signs in place without the Shotfirer's permission. Any person wishing to enter a blast area must either make radio contact or visual contact with the Shotfirer from outside the perimeter of the blast area. A person can only enter a blast area once the Shotfirer has given permission immediately prior to entering. A visitor to the blast area must not touch or disturb any blasting accessories or equipment and notify the Shotfirer before leaving the area. Any trainee is to be directly under the Shotfirer's supervision.

Tying in of Shots

488 In a situation where a final wall is to be blasted or where vibration may be a problem, the pattern shall be tied up using industry best practice and previous on-site experience. Shots are to be tied together in strict accordance with the agreed initiation plan. Prior to initiating a shot, all surface connections made are to be visually inspected and the entire shot area checked in a systematic manner by the Shotfirer and anyone else involved in tying in the shot. The Shotfirer shall ensure the recommended practices for particular initiation devices are carried out strictly in accordance with the manufacturer's instructions. No holes shall be left tied up at the end of any work day.

Firing Procedures

489 At the start of each shift, the Shotfirer will write the blast location, firing time, and date on the blast boards located at the access roads to the minesite/quarry site. The Shotfirer will inform the mine/quarry officer/representative of the blast zone and time that personnel are required to be cleared from these areas. The mine/quarry officer/representative will inform their staff of the blast time and location. The Shotfirer will liaise with the mine/quarry officer/representative for additional blast guards if needed and their positioning as well as personnel for blast zone clearing run and ensure all areas inside the blast zone are physically checked for personnel. To keep the blast time to a minimum, the Shotfirer should seek assistance from the mine/quarry in performing the clearing run. A blast zone of 100 meters is to be maintained for each blast. It is the Shotfirer's responsibility to ensure all personnel within the blast zone including the Shotfirer are clear of the blast zone when firing. The duty of the blast guards is to ensure that non blasting personnel are removed from the blast affected area. Given this responsibility, only personnel trained as blast guards will be permitted to perform this duty. Blast guards are to be positioned to ensure all accessways to the blast zone within a 500 meter radius are blocked. Each blast guard is to position in a manner where they can see all approaching traffic. Each blast guard is to place a blast sign which reads – DANGER. NO ENTRY. BLASTING IN PROGRESS or other similar signs. The sign is to face in-coming traffic. Before the blast guards move into positions, the Shotfirer will announce on the radio that there will be a blast in approximately 15 minutes and state the location of the blast area. The Shotfirer will then ask the blast guards to block their roads. When the blast guards have confirmed stating their name and location and that they are in

position, the Shotfirer will commence the clearing run. The Shotfirer will confirm via radio with the mine/quarry officer/representative that the blast zone is clear. Once the Shotfirer is satisfied the blast zone is clear of personnel, he will confirm with the blast guards that they are in position and their respective area clear. Blast guards are to stay in position until the all clear has been given by the Shotfirer. The Shotfirer will then announce on the radio that the blast is about to take place. He will sound a siren three times on the radio before reconfirming blast guard positions then announcing "Firing Now". In case of an intruder, the blast guard will advise the shotfirer to hold firing. The Shotfirer will wait until gases have cleared then visually check the blast to ensure it has been initiated and determine if there are any environmental issues as a result of the blast. When the Shotfirer is satisfied the shot area is safe, he will announce the ALL CLEAR and request blast guards to open their roads. Blast guards will confirm that they have opened their roads. The Shotfirer will then walk the complete shot to ensure all holes have successfully initiated. If a misfire is discovered, the Shotfirer will then follow the Procedure for Managing a Misfire. If the blast fails to initiate, the Shotfirer will keep all blast guards in position until the blast round is secured and safe. The Shotfirer will then follow the Procedure of Managing a Misfire.

Safe Practices to be Observed During Priming and Charging

490 Smoking is prohibited in a blast area and only designated roads are to be used to gain access to the area. Driving over rills or through fences is not permitted and may result in disciplinary action being taken. All explosives delivered to a blast site shall be stored inside the clearly defined charging area. Explosives shall be conveyed from the magazine to the shot in the designated explosive vehicle. All unused explosives are to be returned to the magazine at the end of each day. A record of stock in and out of the magazine is to be kept.

Misfire Procedures

491 Handling misfire is potentially dangerous from both the possibility of accidental initiation of explosives and the hazards of the circumstances of newly broken ground. Observe all regulatory and common sense precautions for approaching the blast after firing, seek advice and suitably qualified support. Be aware that refiring of misfires has the likelihood of generating significant flyrock. Where mechanical excavation of misfires is attempted, wash out explosives with water with detergents or additives to enhance breakdown of explosives and take care to avoid impact and friction onto explosives, particularly the detonating cord, detonators, or boosters. If the cause if the misfire is not obvious, the Shotfirer shall wait a minimum of 15 minutes or more before making an inspection. If the misfire is to be attended to immediately, the Shotfirer shall notify guards to remain in position and treat the misfire in accordance with the following procedures: in the case of a non-electric, replace the surface line to the point at which the misfire occurred and refire; in the case of electric initiation, place an electric detonator at the point at which the misfire occurred and refire.

492 If the initiation is unsuccessful, clearly identify the location of the misfire by barricading and restrict entry of unauthorized persons. Wherever practicable, the location of any misfire shall be established by survey and/or marked on the plan by a surveyor. Excavation may take place in another part of the pit/quarry if the Shotfirer has determined that it is safe to do so. Excavation shall cease in the immediate area if uninitiated explosives are found during normal operations. The shotfirer shall undertake a detailed examination of the site and together with the mine/quarry supervisor, determine whether operations can continue in other part of the pit/quarry. If a misfire is suspected due to poor profile or other reasons, excavation is to be monitored and the operator fully informed of the circumstances and pay particular attention

for any signs of a misfire. Misfired blast holes shall be dealt with as soon as possible. Suspected misfire holes are to be delineated. Excavation/mining shall be carried out under the supervision of the Shotfirer and will normally be carried out during daylight hours. Provided suitable lighting is available, it may be done other than during daylight hours and under the supervision of the Shotfirer. Operators assisting in exposing a misfire are to be made fully conversant with all of the circumstances by the Shotfirer with respect to the type and quantity of explosives likely to be encountered, how to identify them, the method of initiation and the location of the holes. They are to be in continuous radio contact with the Shotfirer while carrying out this activity. In all cases where a misfire has been located or suspected, the Shotfirer shall make the mine/quarry supervisor in-charge fully conversant with all of the details.

Disposal of Non-Initiated Explosives

493 Non-initiated explosives associated with a misfire shall be disposed of by flushing out with water, initiating in-situ, initiating at a place remote from the area, or returned to the magazine for safe keeping until final disposal can be affected.

Sleeping Shots

494 All charged holes belonging to one shot shall be fired within the number of days specified by the product's technical data sheet. During the course of charging, all charged holes are to be adequately stemmed and loose explosive materials removes and returned to the magazine. No blast holes are to be tied together until prior to firing. Access to the area is to be restricted. Day and night supervisions shall be informed of the location of sleeping shots.

Record of Shots

495 The Shotfirer shall keep a daily record of the shots charged at the completion of their shift. The Shotfirer shall record the number of holes charged, total weights and type of explosive loaded, and location of sleeping shots.

496 In the event of a lightning, the Shotfirer shall withdraw all blast crew and any other personnel from the blast area if the lightning is considered to be too close to continue operations. The Shotfirer may recommend all personnel within 500m of the blast area be withdrawn until the lighting has passed.

497 Where it becomes necessary for equipment other than that used in the charging of the shot holes to be brought on the shot area e.g. equipment to repair a drill machine that has broken down, the following procedure shall be adhered to: the route to be taken will be set out by the Shotfirer and the equipment will travel under the Shotfirers direction; on completion of the work, the equipment shall be withdrawn under the direction of the Shotfirer; the Shotfirer shall carry out an inspection of the work site to ensure the area is safe before charging may resume in the area; Shotfirer shall authorize entry of any person or machine not associated with the Drill and Blast crew.

3.9 Air Emissions Management

498 Air emissions come from the operation activities such as processing operations, and repair and maintenance of vehicles and equipment. In order to reduce the air emissions associated with the Project, **Asturias Industries Inc.** employs some strategies which include:

- Installation of bag filters and electrostatic precipitators to prevent introduction of suspended particles in the air;
- Regular maintenance of standby generators to ensure efficient combustion of diesel fuel (includes emissions sampling);
- Equipping the generator set with mufflers to lessen noise levels during operation;
- Reminding of delivery trucks/visitors not to leave parked vehicles on long periods of idling; and
- Regular maintenance of equipment and vehicles.

499 Air emissions are expected during the construction phase as well. **Asturias Industries Inc.** will also employ air emissions management program to mitigate concerns on air emissions during construction of the cement plant complex.

3.10 Vehicular Traffic Management

500 Traffic impact along the road is expected due to the increase of vehicles coming from in and out of the proposed Project. To mitigate the said traffic **Asturias Industries Inc.** may implement the following measures:

- Coordination with the Calatagan LGU;
- Provision of safety barriers, warning signs and lights, traffic marshals within the vicinity of project sites, and adequate parking spaces;
- All deliveries of construction materials and heavy equipment, either inbound or outbound of the facility may be done during off-peak hours and at designated delivery hubs located near the Project area to prevent blockage of traffic flow along public roads; and
- Assistance of security personnel in directing traffic of vehicles coming in and out of the facility.

3.11 Oil Spill Contingency Plan

501 The project includes operation of a pier facility for the delivery of clinker, gypsum, and pozzolan via RORO and Panamax vessel. Accidental oil spill from the Panamax is of primary concern. **Asturias Industries Inc.** shall prepare an oil spill contingency plan that shall consider the following:

1) **Risk Area:** the risk area is limited to the docking station of the barge. This is an off-shore area.
2) **Activities and Risks:** oil spill risk may occur if an accident causes hull breach during docking. The priority area for protection is coastal area in the vicinity of the pier.
3) **Off-shore spill response strategy:**

Limiting and Adverse Conditions:

- Visibility during night time
- Turbulent waters
- Continuous rainfall
- Shipping traffic
- Availability of manpower and equipment

Containment and Recovery of Spilled Oil:

- Control sea traffic at waterfront
- Secure the area
- Deploy spill booms to contain oil
- Use skimmers to recover contained oil
- Apply dispersant with the permission of PCG
- Shore clean-up
- Disposal of recovered oil into tanks

3.12 Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA)

502 Climate change can affect the frequency of geohazards in the country. Higher temperatures will result in water shortages and droughts while increased rainfall may induce flooding and landslide. Considering these figures, appropriate precautionary climate change measures and adaptation strategies must be employed during the construction and operation phases of the project to avoid any complications in the long-run.

503 The project was designed to be resistant to natural disasters such as earthquake, typhoons and flooding. The project also included climate change mitigating measures in the design and construction and during its operation. Green and open areas is part of the features of the project. A sewage treatment plant will also be operated to treat the domestic wastewater that will be generated. Waste reduction and recycling will also be observed during the construction and operation of the project. All the wastes will be properly handled and disposed. The proponent will also be implementing water and energy saving practices during its operation

SECTION 4

ENVIRONMENTAL RISK ASSESSMENT & EMERGENCY RESPONSE POLICY AND GUIDELINES

4.1 Methodology

504 The general guidelines and outline for an Environmental Risk Assessment (ERA) preparation are prescribed in Annex 2-7e of DAO 2003-30. However, the guidelines focused more on the risks and hazards posed by activities and/or manufacturing methods that involve chemical storage, processing, and use. Although this is applicable for the proposed Project, this shall only form part of the overall ERA. Major environmental risks identified were the geological hazards posed on the proposed Project.

4.2 Risk Screening Level

505 A risk screening level exercise refers to specific facilities or the use of certain processes that has the potential to pose significant risks to people and its surrounding environment. The Plant is covered by the risk screening level exercise, as indicated in **Table 4-1**.

Table 4-1: Risk Screening Matrix

ACTIVITIES REQUIRING RISK SCREENING EXERCISE*	ERA APPLICABILITY TO THE PROJECT
1) Facilities for the production or processing of organic/inorganic chemicals using: Alkylation, Amination, Carbonylation, Condenstation, Dehydrogenation, Esterification, Halogenation, Hydrogenation, Hydrolysis, Oxidation, Polymerization, Sulphonation, Desulphurization, Nitration, Phosphorus prod., Distillation, Extraction, Solvation, Pesticides & pharmaceutical prod.	Not Applicable
2) Installations for distillation, refining, and other processing of petroleum products	Not Applicable
3) Installations for total or partial disposal of solid or liquid substances by incineration or chemical decomposition	Not Applicable
4) Installations for the production or processing of energy gases (e.g., LPG, LNG, SNG.)	Not Applicable
5) Installations for the dry distillation of coal or lignite	Not Applicable
6) Installations for the production of metals and non-metals by wet process or electrical energy	Not Applicable
7) Installations for the loading and unloading of hazardous materials as defined by RA 6969 (or DAO 1992-29)	Applicable
CONCLUSION	**Risk screening level exercise is applicable.**
NOTE: *- Based on Annex 2-7e of DAO 2003-30 Revised Procedural Manual	

4.3 Risk Identification and Analysis

506 The proposed Project entails risks that are natural, man-made, or a combination of both. Natural risks are hazards caused by phenomena such as earthquakes, geological instability

(e.g., sink holes, landslides), and typhoons. Meanwhile, man-made risks are caused by accidents such as fires, structural/equipment failure, spillages, and human error. Man-made risks could also be aggravated as a direct consequence of natural risks.

4.3.1 Natural Hazards

4.3.1.1 Seismicity

507 Intense or strong seismic activities may cause damage to the cement plant infrastructures. The construction and operational phase of the proposed project should then factor the potential for earthquake induced risks.

4.3.1.2 Typhoons

508 The mean annual number of typhoons that pass through the Philippine Area of Responsibility (PAR) is about 20, of which around 9.2 cross the country. If a typhoon directly hits the plant facilities, it could possibly bring extensive wind and rain hazards (i.e. strong wave currents and flooding). Regular weather monitoring should be done so that cement plant safety protocols can be done.

4.3.1.3 Flooding

509 The proposed project area is not prone to flooding. However, heavy rains may occur in times of extreme precipitation volume and intensity. During heavy rains, flooding may occur which may affect the cement plant operations. Emergency responses must be considered for possible occurrences.

4.3.2 Man-Made Hazards

4.3.2.1 Occupational Accidents

510 The project involves a variety of equipment and facilities which may possibly injure personnel and/or damage property if handled/operated improperly. These risks can be greatly reduced with scheduled maintenance checks. Also, personnel handling such equipment and operating the facilities will be properly trained and supervised and re-trained periodically.

4.3.2.2 Accidental Spills (e.g. fuel, engine lubrication oil, coolant)

511 Oil spillage that may come from engine maintenance or storage failure may be caused by several reasons such as faulty operational procedures, pipe deterioration, sabotage, and force majeure. It may result to anaerobic conditions since large spills may form a film on water surfaces impairing oxygen transfer. This scenario may be harmful to aquatic organisms. The fuel may be decomposed by micro-organisms, but degradation is selective and can result in sediment becoming enriched with aromatic hydrocarbons. Proper oil spill protocols should then be observed should this happen.

4.3.3 Air Pollutants Hazards

512 Considering the nature of the project, exposure to pollutants associated with cement plant may lead to potential health effects and other hazards. Regular maintenance of equipment and other air mitigating measures should be strictly done to avoid these risks. Potential air

pollutants associated with cement plant are particulate (TSP and PM_{10}) and gaseous (CO, NO_x, SO_x) emissions.

4.3.3.1 Particulate Matter

513 Particle matter (PM) is the term for a mixture of solid particles and liquid droplets found in the air. Airborne particulate matter varies in size and may be in different chemical constituents. Airborne particles can range in size from a few nanometers (nm) to around 100 micrometers (µm) in diameter. PM_{10} is the concentration of particles that are less than or equal to 10 µm in diameter; similarly, $PM_{2.5}$ describes the concentration of particles that are less than or equal to 2.5 µm in diameter.

514 Particulate matter comes from a variety of sources and contains primary components, which are emitted directly into the atmosphere, and secondary components, which are formed within the atmosphere because of chemical reactions. Primary sources include combustion sources (road vehicles and power stations), mechanical processes (e.g. quarrying and agricultural harvesting), and natural processes (e.g. entrainment of soil by the wind and generation of marine aerosol particles). Secondary particles form in the atmosphere because of chemical reactions that lead to the formation of substances of low volatility, which consequently condense into the solid or liquid phase, thereby becoming particles. The formation of secondary particulate matter takes hours or days and the air containing the pollution can travel long distances.

515 The “coarse particles” (such as those found near roadways and dusty industries) with diameters between 2.5 and 10 micrometers and “fine particles” (such as those found in smoke and haze) that are 2.5 micrometers in diameter or less are of concern due to their effect on human health. Both short and long-term exposure to these can cause increased respiratory symptoms (e.g., irritation of the airways, coughing, or difficulty breathing); decreased lung function; aggravated asthma; development of chronic bronchitis; irregular heartbeat; nonfatal heart attacks; and premature death in people with heart or lung disease.

516 The most serious health problems occur among susceptible groups with pre-existing lung or heart disease and the elderly and children. However, even healthy individuals may experience temporary symptoms from exposure to elevated levels of particle pollution.

4.4 Identification of Potential Emergencies

517 Emergencies are unforeseen events or episodes that are caused by natural forces and circumstances that may result to negative effects to people, property, and the surrounding environment. As a preliminary step in developing an effective emergency response policy, it is important to identify the potential emergency scenarios that would most likely occur. **Table 4-4** lists the most probable emergencies that could happen in future operation of the Project.

518 Emergency situations may also require different levels of classification and response procedures, depending on the degree of situations. These levels will be referred to as: 1) Incident; 2) Emergency; and 3) Crisis.

519 Incident situations present minor events that may require partial or total mobilization of the proposed Project’s resources to effectively deal with an accident. An episode may present very minimal injuries and/or partial damages to property.

520 Emergency situations require the utilization of all resources, with the assistance of local emergency responders, and additional resources from **Asturias Industries Inc.'s** main office. This episode may present serious injuries and some fatalities and could result to severe or total damage to the property.

521 Crisis situations are the worst conditions, which require the utilization of full resources, and possibly, assistance from the national government to address the event. An episode may present multiple fatalities, destruction of facilities, and severe/total damage to the surrounding community.

Table 4-2: Emergency Scenarios for the Project

TYPE OF EMERGENCY SITUATION	POSSIBLE CAUSES	POTENTIAL EFFECTS
Construction Phase		
Fire	• Electrical short-circuits, overloading of equipment • Accidental ignition of combustible materials	• Partial or total loss of equipment and property • Injuries and fatalities to personnel
Earthquakes	• Movement/rupture of nearby fault lines • Volcanic eruption	• Failure of concrete structures (i.e. collapse, dam breach, etc.) • Injuries and fatalities to personnel and downstream communities
Release of toxic substances	• Equipment malfunction • Accidental spillage • Man-made errors	• Health hazards to the employees, workers and nearby communities • Degradation of affected parameter (i.e. contamination of soil and water)
Occupational safety accidents	• Improper training and supervision of personnel • Equipment and facility failure • Lack of full understanding regarding the surrounding environment	• Injuries and fatalities to personnel • Partial and total loss of equipment
Flooding	• Heavy rainfall • Clogged drainage	• Damage to property • Stop operation
Operation Phase		
Fire	• Electrical short-circuits, overloading of equipment • Accidental ignition of combustible materials	• Partial or total loss of equipment and property • Injuries and fatalities to personnel
Explosion	• Blasting procedure malpractice • Power outrage • Equipment malfunction	• Partial or total loss of equipment and property • Injuries and fatalities to personnel
Earthquakes	• Movement/rupture of nearby fault lines • Volcanic eruption	• Failure of concrete structures (i.e. collapse, dam breach, etc.) • Injuries and fatalities to personnel and downstream communities
Release of toxic substances	• Equipment malfunction • Accidental spillage • Man-made errors	• Health hazards to the employees, workers and nearby communities • Degradation of affected parameter (i.e. contamination of soil and water)
Occupational safety accidents	• Improper training and supervision of personnel • Equipment and facility failure	• Injuries and fatalities to personnel • Partial and total loss of equipment

TYPE OF EMERGENCY SITUATION	POSSIBLE CAUSES	POTENTIAL EFFECTS
	• Lack of full understanding regarding the surrounding environment	
Flooding	• Heavy rainfall • Clogged drainage	• Damage to property • Stop operation
Landslide	• Heavy rainfall • Man-made errors	• Damage to property • Injuries and fatalities to personnel and downstream communities • Stop operation

4.5 Emergency Plan

522 The Emergency Plan is a management structure that is intended as a guide for the personnel during emergency situations. This structure may or may not be similar to the existing organizational/management hierarchy of the Project, although comparison on roles and responsibilities can be used as reference.

523 The implementation of the Emergency Plan is a standard practice that is currently being integrated as part of company policies. Its objective is to establish an orderly and systematic approach in addressing an emergency, and in turn, decrease further injuries/fatalities and loss of property.

524 Forming the Emergency Plan requires the Proponent to select among the different skills and knowledge of its personnel at the Project. The selection process will involve background checks, training and skills learning, and voluntary application of selected personnel. The proposed project will follow the schematic diagram and procedures presented in **Figure 4-1** and **Table 4-5**. The roles and responsibilities of each personnel involved in the Emergency Plan are listed in **Table 4-6**.

525 The designation of the personnel and their corresponding responsibilities may be changed during different types of emergency scenarios that were previously identified in this section. Therefore, if such case will exist, **Asturias Industries Inc.** will train and designate personnel appropriately to deal with each type of emergency.

Figure 4-1: Emergency Response Plan

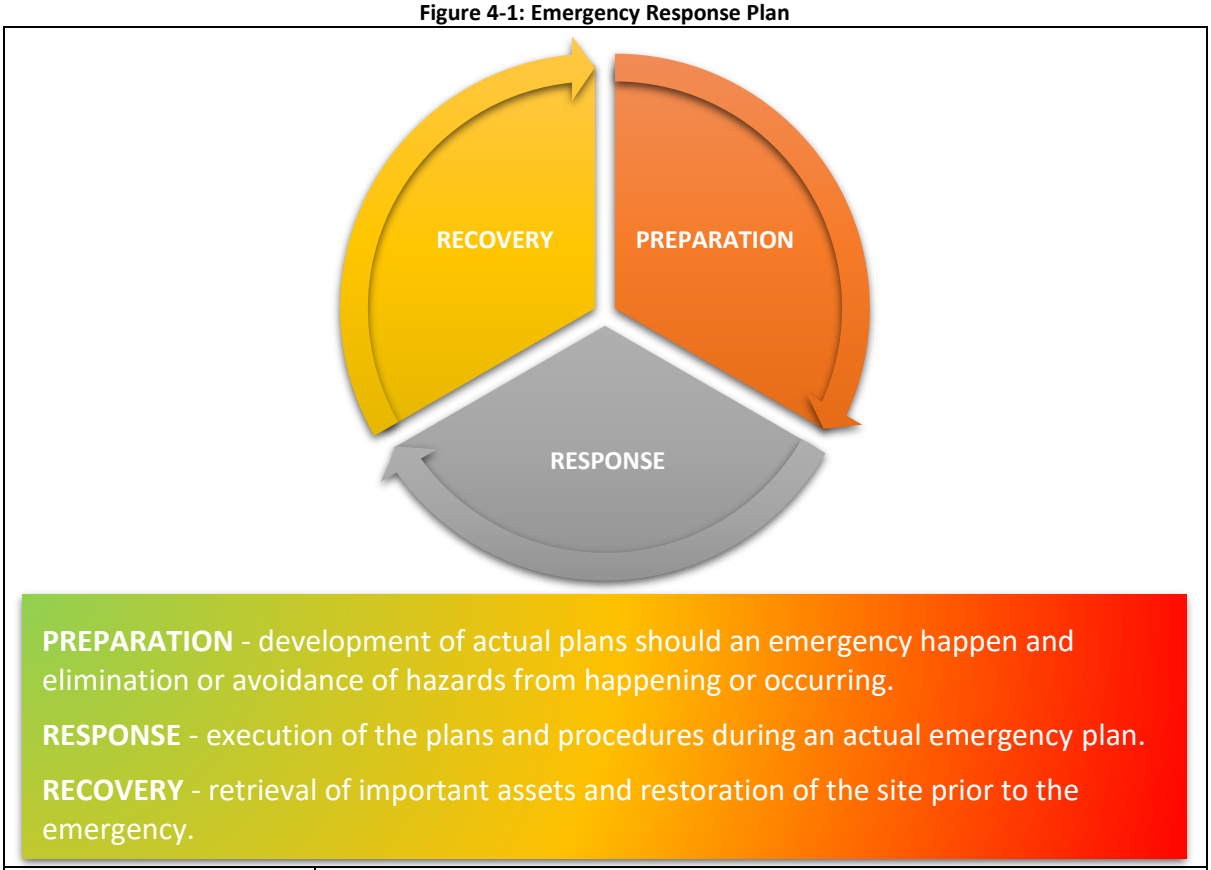


FIGURE NO.:	FIGURE TITLE:	
4-1	**EMERGENCY RESPONSE PLAN**	
PROJECT PROPONENT:	PROJECT TITLE & LOCATION:	EIA PREPARER:
ASTURIAS INDUSTRIES, INC.	**3.0 MMPTY CEMENT PLANT COMPLEX WITH QUARRY** Calatagan, Batangas	**LCI ENVI CORPORATION**

Table 4-3: Emergency Response Procedures for Different Scenarios

PREPARATION	RESPONSE	RECOVERY
A. Fire		
• Orientation and training of personnel on fire safety • Conduct of regular fire drills • Installation and regular testing of firefighting devices (i.e. fire hoses, fire extinguishers, smoke detectors, sprinkler system) • Regular inspection of electrical equipment and lines for any defect or malfunction, and replacement, as necessary • Securing of all flammable items in proper containers and storage facilities • Strict implementation of "No Smoking" policy in plant facilities	• Notice for personnel to keep calm and alert to prevent further injuries; to follow emergency evacuation procedures; and to report immediately any presence of smoke, spark, or open flame to authorized personnel • Immediate use of fire extinguishers, only if the fire can still be contained • Disconnection of electrical or fuel connections and shutdown of all affected equipment • Removal of all flammable materials from the fire scene to avoid further contact, if possible	• Prohibition of returning to the fire scene, as long as necessary, unless declared for safe entry • Checking for personnel that may be trapped, injured, or needs further assistance • Reporting of any important incident that require immediate attention • Securing of important items and equipment from unauthorized access from outsiders, after the building is declared safe for re-entry • If fire damage is minimal, or if facility is recoverable, implementation of necessary corrective measures to

PREPARATION	RESPONSE	RECOVERY
• Placement of emergency numbers and communication equipment in conspicuous areas for easier notification • Designation of emergency exits (free from obstruction) and evacuation procedures • Regular maintenance of plant equipment	• Wearing of proper fire protection attire (i.e. fire suit, boots, breathing apparatus) by responders • Prohibition of using or pouring of water over fuel or alcohol fires, and electrical fires	prevent the accident from re-occurring
B. Earthquakes		
• Conduct of necessary preparations, including equipment and facility checks, to prevent injuries in an event of an earthquake • Securing of all loose items to prevent falling • Placement of heavy materials near the ground • Storage of flammable items in designated safe areas • Orientation of personnel on safe locations, emergency response equipment, and evacuation routes	• Notice for personnel to keep calm and alert to prevent further injuries; to protect themselves by getting under sturdy structures and stay away from sharp, flammable, or heavy items; and to prepare for immediate evacuation of the facility, if necessary • Shutdown of all gas and electric equipment	• If there are no threats of aftershocks, checking for personnel that may be trapped, injured, or needs further assistance • Prohibition of returning to the facility if it is deemed structurally unstable, or declared unsafe • Thorough inspection of the facility premises for any unusual crack/gap in the ground or walls • Checking for possible fires and advise authorities for appropriate response • Securing of important items and equipment from unauthorized access from outsiders, after the building is declared safe for re-entry • Inspection of the facility for any major structural defect, crack, unstable item, and other potential hazards • If earthquake damage is minimal or facility is recoverable, implementation of corrective measures to prevent the further hazards from affecting personnel and property
C. Release of Toxic Substances (e.g. fuel)		
• Regular visual inspection for potential leaks and corrosion • Inspection of facilities, containers, and equipment for any sign of leaks or spills	• Notice for personnel to report the occurrence immediately to supervisor; to follow strictly instructions of supervisor in charge of cleaning operations • Ceasing of operations in the area affected by spillage and stop appropriate source • Stop vehicles' engines in the affected area	• Immediate clean-up of all spills using proper conditions, including stoppage and containment of spill or leak • Implementation of measures to prevent re-occurrence of the incident

PREPARATION	RESPONSE	RECOVERY
	• Ceasing of operations or any movement until clearance is given	
D. Occupational Hazards		
• Provision of basic PPEs. • Formation of an emergency response team for each department • Provision of first-aid kits and emergency equipment on critical workstations • Training of personnel on proper equipment handling and other safety practices • Posting of safety reminders on workstations • Provision of safety features, such as adequate lighting, guide rails, and safety signage	• Immediate reporting of any accident, especially those considered life-threatening • Immediate application of first-aid • Removal of affected personnel from the accident site • Bringing of affected personnel to the nearest first aid station or hospital if necessary	• Performing of corrective measures on equipment and procedures • Provision of additional safety procedures, equipment, and training
E. Flooding		
• Securing of all loose items (i.e. lamp post, roofs, loose planks, and other light materials) by adding extra guy wires or reinforcing materials • Removal of obstructions to the drainage system • In case of storm warning from PAGASA, monitoring of important weather forecast/ parameters, such as path and intensity of the storm	• Notice for personnel to avoid staying outdoors; to stay away from items that may be blown away by strong winds and from electrical mains • Continuous monitoring of the weather conditions • Shutdown of all gas and electric equipment	• Inspection of facility for any major structural defect, crack, unstable item, and other potential hazards • Repair of broken power lines, fuel lines, and other utilities, if necessary • Securing of important items and equipment from unauthorized access from outsiders, after the building is declared safe for re-entry
F. Landslide		
• Formation of an emergency response team for each department • Training of personnel on proper equipment handling and other safety practices • Orientation of personnel on safe locations, emergency response equipment, and evacuation routes	• Notice for personnel to avoid staying outdoors; to stay away from items that may have been affected by the event • Notice for personnel to keep calm and alert to prevent further injuries; and to prepare for immediate evacuation of the facility, if necessary • Shutdown of all gas and electric equipment • Bringing of affected personnel to the nearest first aid station or hospital if necessary	• Inspection of facility for any major structural defect, crack, unstable item, and other potential hazards • Repair of broken power lines, fuel lines, and other utilities, if necessary • Securing of important items and equipment from unauthorized access from outsiders, after the site is declared safe for re-entry • Assess damage from the incident. Conduct geotechnical investigation if necessary.

Table 4-4: Roles and Responsibilities in the Emergency Plan

EMERGENCY RESPONSE PERSONNEL	ROLES AND RESPONSIBILITIES
Incident Commander	• Overall in-charge of operations during an event of an emergency • Gives direction and orders to the response teams in managing the emergency
Safety Officer	• Supervises the daily safety performance of operations and maintenance procedures, including emergency response procedures
Liaison Officer	• Secures the necessary permits and training certification for the personnel
Public Information Officer	• Performs communication duties in behalf of **Asturias Industries Inc.** to the media, government officials, and the local population • Issues relevant warnings and advisories to concerned authorities
Operations Team	• Performs the actual response, rescue, and retrieval of personnel and equipment during an event of an emergency
Planning/Intelligence Team	• Devices programs and policies for proper response procedures • Informs the operations team regarding the nature and type of response procedure for the Operations Team • Identifies potential hazards and performs recommendations to authorities
Logistics Team	• Provides the necessary supplies and equipment for the Operations Team • Provides additional support/assistance to the Operations Team
Finance and Administration Team	• Provides the assessment of expenses and allocates the necessary financial resources for the other Teams • Performs the disbursement of claims and compensation for affected personnel, property and the community

4.6 Safety and Health Program

526 **Asturias Industries Inc.** gives priority on the safety of its employees and their working environment. It developed this program for accident and injury prevention through the implementation of plant rules and guidelines that shall involve management, supervisors, and employees in identifying and eliminating hazards that may develop during work process.

4.6.1 Leadership and Administration

527 The management will spearhead in the formation of a safety committee, develop a system for identifying/correcting hazards, prepare for foreseeable emergencies, provide appropriate trainings, and establish a disciplinary policy to ensure strict compliance.

4.6.1.1 Company Safety Policy

528 It is basic policy that no task is so important that an employee must take a risk of injury/illness or violate a safety rule. Active involvement in safety practices is then encouraged to make the area a safe place to work.

529 It is the daily duty of every employee to be cautious of unsafe conditions. In addition to this, supervisors or accountable managers are responsible in overseeing the actions of employees and to take prompt action in eliminating unsafe practices and hazards in the workplace.

4.6.2 Accident/Incident Investigation Reporting

530 It is very advantageous for every employee to be prepared for any emergency to prevent further injury, property damage, and loss of limb or even life. An emergency preparedness plan must then be prepared and strictly implemented.

4.6.2.1 Accident/Incident Investigation Reporting

531 Prevention of accidents by eliminating potential threats/hazards and anticipating other probable causes is an effective way of creating a safe and healthy environment.

Emergency Response Program

532 The emergency response program shall be implemented by an emergency response team composed of equipped and trained personnel who will be tasked to handle and manage the program, assist other employees to safety, and to prevent any damage or injury. Proper training and orientation of concerned team members will be accorded to prepare them in responding appropriately in any emergency they may encounter.

Personal Protective Equipment

533 The personal protective equipment (PPE) is a set of safety gear worn by personnel that is designed to provide sufficient safeguard against occupational-related illnesses and to prevent life-threatening injuries.

534 PPE, such as safety hats, safety shoes, gloves, dust mask, and ear plugs, will be provided as necessary. This is to ensure safe and protected personnel working in safe working environment. **Asturias Industries Inc.** will make the usage of PPE a mandatory policy for personnel working inside the Project premises. Guests and visitors will also be required to wear PPE as necessary.

4.6.2.2 Incident Response Procedure

535 Any accident, injury, or work-related illness should be reported and investigated on immediately so as to determine the appropriate action to be conducted.

Recording and Review

536 It is mandatory that employees are to report any injury or work-related illness to their immediate supervisor regardless of how serious. Minor injuries, such as cuts and scrapes, can be entered on the first-aid only log. More serious injuries are to be reported and recorded properly for future review.

Incident Investigation

537 It is imperative that an incident scene should not be disturbed except to aid in rescue or make the scene from further incidence. In case of an incident resulting in death or serious injuries, a preliminary investigation will be conducted by the immediate supervisor of the injured person(s), a person designated by management, an employee representative of the safety committee, and any other person whose expertise would help the investigation.

538 The investigating team will obtain written statements from witness, photograph the incident scene and machines/equipment involved. The said team will also document, as soon as possible after the incident, the condition of equipment and anything that may be relevant in the work area. A written "Incident Investigation Report" is necessary. The report should include a sequence of events leading up to the incident, conclusions derived from the incident and any recommendation to prevent a similar incident in the future.

Damage Control

539 Damage cost because of accident, in reality, is unquantifiable, especially when damage to life and limb is involved. Cost of properties, structure, and equipment including its effect on existing productivity is quantifiable.

540 Any employee may be subject to on-the-spot termination when a safety violation places the employee or co-workers at risk of permanent disability or death.

SECTION 5

SOCIAL DEVELOPMENT PLAN AND IEC PLAN

541 The following project stakeholders have been identified based on the stakeholder groups indicated in Section 5 of DENR Administrative Order No. 2017-15:

- **LGUs in areas where all project facilities are proposed to be constructed/situated and where all operations are proposed to be undertaken (a)**
  - Municipal LGU of Calatagan, Batangas (host municipality)
  - Brgy.Baha and Brgy. Talibayog (host barangays)

- **Government agencies with related mandate on the type of project and its impacts (b)**
  - DENR Region IV-A (CALABARZON)
  - Provincial Environment and Natural Resources Office (PENRO Batangas)
  - Municipal Environment and Natural Resources Office (MENRO Calatagan)
  - Bureau of Fisheries and Aquatic Resources (BFAR)
  - Philippine Coast Guard (PCG)

- **Interest groups, preferably those with mission/s specifically related to the type and impacts of the proposed undertaking (c)**
  - Women Organization
  - Talipapa Community
  - Tindahan ni Juan
  - Vegetable Farmers Association
  - Neighborhood Association
  - Senior Citizens

542 No "households, business activities, industries that will be displaced" (d) and "people whose socio-economic welfare and cultural heritage are projected to be affected by the project especially vulnerable sectors and indigenous populations" (e) have been identified for the project.

543 Other stakeholders for the proposed project include the local peace-and-order groups (i.e., PNP, Brgy. Police) and concerned non-government organizations (NGOs).

5.1 Community Development Program Accomplishment

544 **Asturias Industries Inc.** has already accomplished various community development activities with the stakeholders. Listed in **Table 5-1** are the activities conducted by Asturias Industries Inc. for 2017 and 2018. The community development programs support various projects that focus on education, IEC, skills development, and livelihood assistance.

Table 5-1: Accomplished Community Development Programs (2017-2018)

Project, Program, or Activity	Status	Beneficiaries
2017		
Provision of assistance with settling the following concerns: - **Claiming of Social Pension for senior citizens** - **Securing Pantawid Pamilya benefits for relocatees**	Completed	Relocatees
Allowance for students	Completed	100 (high school and college)
Alternative learning system for out-of-school youth	Completed	16 adults
Coastal and barangay clean-up	Completed	Community
Stress debriefing	Completed	Individuals with unstable emotions and are still hesitant to relocate
Financial assistance for medically needy	Completed	11 beneficiaries
Farm field school	Completed	79 people
Provision of farming tools and seeds for resettlers	Completed	Resettlers
Anti-rabies vaccination in relocation site	Completed	76 dogs
IEC on existing barangay laws for resettlers	Completed	Resettlers
Conducted orientations: - **Waste management** - **Disaster preparedness** - **Gender and Development** - **Financial Literacy** - **Livelihood enterprise** - **Capital loan assistance**	Completed	Relocatees
Job placement	Completed	55 applicants
Job counseling	Completed	Relocatees
Skills training (banana chips, bukayo, panutsa making)	Completed	Relocatees
Road improvement in Phase 2 Bukal ng Buhay and Bagong Pag-asa	Completed	Relocatees
Regular monitoring of relocation sites	Completed	Relocatees
Christmas gift giving	Completed	Relocatees
2018		
Skills Training - **Automotive** - **Computer Literacy** - **Welding** - **Massage Wellness** - **Heavy Equipment Operation**	Completed	More than 40 students, some of which are already employed by Emperador, URC, etc.
Livelihood Assistance for small scale businesses	Completed	13 women benefitted from loan assistance
Entrepreneurial Mindset Seminar	Completed	34 people

Project, Program, or Activity	Status	Beneficiaries
		- Balayan Bats - Sugarplanters Cooperative
Savings Mobilization and Utilization	Completed	40 women with ability to raise capital funds for rice retailing
Neighborhood and group enterprise	Completed	65 people with productive businesses
Fishermen, bantay dagat	Completed	52 Fishing Boat Donation
Assistance to Farmers	Completed	25 family heads with space for farming
Good Agricultural Practices	Completed	57 farmers with enhanced knowledge on agricultural technologies
Soil Sampling	Completed	1 farmland
Support for attendance to famers day held in Balayan capitol	Completed	4 groups with relocatee as president
Seed distribution	Completed	2 farmers
Advocacy on Cooperative Formation	Completed	15 farmers
Enhanced Farm Technology	Completed	22 farmers and community benefitting from installation of solar irrigation
Job Placement	Completed	45 gainfully employed
Training on community building towards entrepreneurship and sustain bayanihan among relocatees	Completed	75 people
Policy making and team building	Completed	25 women
Educational assistance	Completed	School allowance for 166 high school students and 26 college students
Coastal and barangay clean-up	Completed	400 individuals participated
Tree planting	Completed	628 migrants planted the following: - 400 guyabano - 400 calamansi - 300 lemon - 500 carabao mango - 300 rambutan
Feeding of underweight children	Completed	45 children
Deworming	Completed	33 children
Vitamin-A supplementation	Completed	40 children
Cataract surgery	Completed	1 elderly
CT Scan	Completed	1 elderly
Financial assistance for burial	Completed	7 beneficiaries
Financial assistance for medically needy	Completed	7 beneficiaries

5.2 Social Development Program (SDP)

545 An indicative community-based Social Development Plan (SDP), as presented in **Table 5-1**, has been developed by **Asturias Industries Inc.** through a series of consultation with various stakeholder representatives in the project impact area. The SDP presented outlines the plans of Asturias in the next five years.

546 The objectives of the SDP include the following:

- Identify the basic needs and welfare of the host community as basis for the framework of social development program of the Project;
- Prepare an indicative sustainable plan based on the Barangay Development Plans and the mandated support of **Asturias Industries Inc.**; and
- Establish a working relation with **Asturias Industries Inc.** and the various community stakeholders with the goal of improving the quality of life of the project-affected communities by instilling self-reliance.

547 The community-based consultation and survey during the development of the SDP also provides an opportunity for identifying the following:

- Addressing key issues and concerns by the various stakeholders;
- Identifying and designing the recommend measures in response to the issues and concerns that were raised;
- Identifying the lead agency or organization responsible in implementing the measures; and
- Setting of timelines in implementing these measures consistent with the plans and programs of the lead agencies.

Table 5-2: Matrix of Social Development Plan

CONCERN	PROGRAM/PROJECT/ACTIVITY	RESPONSIBLE COMMUNITY MEMBER/ BENEFICIARY	GOVERNMENT AGENCY/NON-GOVERNMENT AGENCY AND SERVICES	PROPONENT	INDICATIVE TIMELINE	SOURCE OF FUND
Livelihood and Employment	Sustainable Livelihood Programs - Financial literacy - Basic bookkeeping - Facilitating and handling meetings - Minutes writing - Conflict resolution - Group registration with proper authority for legal identity	Relocatees of Brgy. Baha Brgy. Talibayog	CSR Department of Asturias Industries, Inc. Calatagan LGU Brgy. Baha LGU Brgy. Talibayog LGU	Asturias Industries, Inc.	2019-2023	Asturias Foundation, Inc.
	Skills training - Pipefitting - Industrial Electricity - Housekeeping - Sewing - Hollow blocks making - Heavy equipment operation (bulldozer, grader, road roller, backhoe)	Unemployed members of the host community Women Out-of-school youth	CSR Department of Asturias Industries, Inc. TESDA	Asturias Industries, Inc.	2019-2020	Asturias Foundation, Inc.
Health and Nutrition	Provision of medicines/medical and dental services Provision of emotional and psychosocial support to individuals and groups	Host community	CSR Department of Asturias Industries, Inc. DOH MHO	Asturias Industries, Inc.	2019-2023	Asturias Foundation, Inc.
Education	Provision of educational assistance for high school students	180 students per year, for five years	DepEd CSR Department of Asturias Industries, Inc.	Asturias Industries, Inc.	2019-2023	Asturias Foundation, Inc.

CONCERN	PROGRAM/PROJECT/ACTIVITY	RESPONSIBLE COMMUNITY MEMBER/ BENEFICIARY	GOVERNMENT AGENCY/NON-GOVERNMENT AGENCY AND SERVICES	PROPONENT	INDICATIVE TIMELINE	SOURCE OF FUND
	Provision of educational assistance for high school students for college students	20 students per year, for five years	CHED CSR Department of Asturias Industries, Inc.	Asturias Industries, Inc.	2019-2023	Asturias Foundation, Inc.
	Provision of school supplies	100 students per year, for five years	CSR Department of Asturias Industries, Inc.	Asturias Industries, Inc.	2019-2023	Asturias Foundation, Inc.
Peace and Order	Financial support on closed circuit television (CCTV) installation in strategic areas	Host community	CSR Department of Asturias Industries, Inc.	Asturias Industries, Inc.	During operations phase	Asturias Foundation, Inc.
Environment	Conduct series of session on home-based waste segregation program Coastal clean-up	Host community	CSR Department of Asturias Industries, Inc.	Asturias Industries, Inc.	2019-2023	Asturias Foundation, Inc.
Safety	Provision of traffic signage and early warning device in strategic areas	Host community and nearby barangays	CSR Department of Asturias Industries, Inc.	Asturias Industries, Inc.	Construction Operation	Asturias Industries, Inc.
Cultural Heritage	Financial support to sports, recreation Burial assistance Celebration of women's month, father's day, children's month Support year-end teambuilding and socialization with partners and volunteers	Host community	CSR Department of Asturias Industries, Inc.	Asturias Industries, Inc.	2019-2023	Asturias Foundation, Inc.
Note: Based on the Revised Procedural Manual for DAO 2003-30						

5.3 Information and Education Campaign (IEC)

548 The Information, Education, and Communication (IEC) campaign for the proposed project will be conducted in all phases of its development, which also allows for a regular feedback/grievance mechanism of issues and concerns. The contents of the IEC are based on the action or operation plans of **Asturias Industries Inc.** and will be monitored by a multipartite group for evaluation.

549 A feedback/grievance mechanism is a very important tool to educate people regarding the project's development and to check whether the project has negative or positive effects or perception. It will strengthen the knowledge of the people with regards to the positive impacts of the project, as well as the effort of the monitoring team together with the Proponent in resolving unfavorable events, if any.

550 Integral to the IEC is the regular reporting of **Asturias Industries Inc.** on the progress of the proposed Project's operations. In general, the Proponent shall update the host LGUs if the agreements are followed or if there are minor or major changes to be made, and if there are problems that might occur and advice the LGU on appropriate preparations that are necessary to avoid or mitigate negative results. The Proponent will conduct IEC activities to establish transparency and to develop a partnership with the host communities.

551 IEC activities envisioned for the Project are numerous interactions between the Proponent, the host communities, and the local government officials. **Table 5-2** presents the indicative IEC plan, which can be further improved after the series of consultations and future developments of the Project. Throughout the different phases of the proposed project, the Proponent will continue to inform the stakeholders about the status of the social development plan (SDP) to prevent any speculations, anxiety, and miscommunication.

552 An IEC activity was conducted in Balayan, Batangas last July 17, 2018 (Tuesday). The participants were composed of representatives from the barangay LGUs of Baha and Talibayog and from the other nearby barangays. The objective of the IEC conducted was to present to the participants the proposed project and the activities that will be conducted. The main issue and concern raised by the participants during the IEC was the job and business opportunities of the local residents. Asturias ensured that during the hiring of workers for the proposed project, qualified local residents will be prioritized. Documentation of the said activity is attached in **Annex 8.**

Table 5-3: Matrix of the Project's IEC Plan

TARGET SECTOR IDENTIFIED AS NEEDING PROJECT IEC	MAJOR TOPIC/S OF CONCERN IN RELATION TO PROJECT	IEC SCHEME / STRATEGY / METHODS	INFORMATION MEDIUM	INDICATIVE TIMELINES AND FREQUENCY	INDICATIVE COST (PHP)
Residents of Brgy. Baha and Brgy. Talibayog, Calatagan	▪ Personnel requirements and announcement of job opening for potential workers/employees/contractors	▪ Group Consultation ▪ Multi-media	▪ Invitation letter ▪ Multi-sectoral cluster meetings ▪ Newspaper publication ▪ Radio broadcast ▪ Posters	At least, two months prior to start of construction	PHP 50,000.00
Residents of Brgy. Baha and Brgy. Talibayog, Calatagan	▪ Presentation of construction works/activities ▪ Potential impacts and proposed mitigation measures during construction works	▪ Group Consultation ▪ Multi-media	▪ Invitation letters ▪ Focus Group Discussion ▪ Multi-sectoral cluster meetings ▪ Handouts ▪ Audio-visual presentations on EIA ▪ Posters and flyers	At least 1 month prior to start of construction and quarterly during the entire construction phase	PHP 50,000.00
Municipality of Calatagan **Brgy. Baha and Brgy. Talibayog** **NGOs**	▪ Report on project's compliance to ECC and EMP during construction period	▪ Group Consultation ▪ Grievance mechanism	▪ Invitation Letters ▪ Handouts ▪ Multi-sector cluster meeting ▪ Grievance box (comments, suggestions) at the municipal and barangay halls	1 month prior to completion of construction works	PHP 25,000.00
Municipality of Calatagan **Brgy. Baha and Brgy. Talibayog**	▪ Presentation of completion of construction works and preparation for operation	▪ Group Consultation	▪ Invitation Letters ▪ Multi-sectoral meeting	1 month prior to completion of construction phase	PHP 25,000.00
Municipality of Calatagan **Brgy. Baha and Brgy. Talibayog** **NGOs**	▪ Project operation phase ▪ Highlight of the project's environmental control measures ▪ Compliance to ECC conditionality's and the EMP ▪ Actual impacts during construction and control measures implemented	▪ Group Consultation ▪ Grievance mechanism	▪ Invitation letter ▪ Handouts ▪ Posters ▪ Grievance box (comments, suggestions) at the municipal and barangay halls	Priority to operation phase and yearly thereafter	PHP 40,000.00

TARGET SECTOR IDENTIFIED AS NEEDING PROJECT IEC	MAJOR TOPIC/S OF CONCERN IN RELATION TO PROJECT	IEC SCHEME / STRATEGY / METHODS	INFORMATION MEDIUM	INDICATIVE TIMELINES AND FREQUENCY	INDICATIVE COST (PHP)
Schools **NGOs** **LGUs**	▪ Plant tour and highlight of project's environmental control measures, SDP, and environmental projects	▪ Group Consultation	▪ Educational tour to project site	Throughout the operation phase	PHP 50,000.00
Asturias Industries Inc. employees	▪ Awareness and Safety ▪ Disaster Risk Reduction and Management ▪ Climate Change awareness and adaptation	▪ Group Consultation ▪ Multi-media	▪ Climate change adaptation and disaster risk reduction and management seminar ▪ Hazard identification and risk assessment training ▪ First aid training	Once a year	PHP 50,000.00
Brgy. Baha and Brgy. Talibayog **Schools**	▪ Climate Change awareness and adaptation ▪ Disaster Risk Reduction and Management	▪ Group Consultation ▪ Multi-media	▪ Climate change adaptation and disaster risk reduction and management seminar	Once a year	PHP 50,000.00

SECTION 6

ENVIRONMENTAL COMPLIANCE MONITORING

6.1 Self-Monitoring Plan

553 The Environmental Monitoring Plan (EMoP) presents a set of critical environmental parameters that will allow **Asturias Industries Inc.** to ensure environmental compliance and sustainability of the cement facility operations. The EMoP allows monitoring, verification, and performance of the necessary corrective measures towards the mitigation of the identified environmental impacts. Information obtained during the EMoP implementation can be used in examining the short and long-term effects of the proposed Project's various environmental aspects, from which future strategies on environmental enhancement measures can be formulated.

554 **Table 6-1** presents the proposed EMoP that will be implemented by the Proponent during the different phases of the proposed Project's development. Shown in the matrix are the concerns, parameters to be monitored, as well as the corresponding sampling and measurement plan (method, frequency, location), lead person, annual estimated cost, and environmental quality performance level (EQPL) range (i.e., Alert, Action, Limit).

555 Air and water quality will be monitored as part of the EMoP. Proper methods for sampling and analysis of each media must be employed.

556 For sampling and analysis of air quality, the proponent must refer to DAO 2000-81: "Implementing Rules and Regulations of the Philippine Clean Air Act". Results of the ambient air quality sampling must be compared with the National Ambient Air Quality Guideline Values (NAAQGV) and National Emission Standards for Source Specific Air Pollutants (NESSAP), respectively. NAAQGV and NESSAP standards are disclosed in DAO 2000-81.

557 There are two references that must be followed regarding the sampling and analysis methods and water quality standards. Proper methods for water sampling and analysis are in EMB MC 2016-012 "EMB Approved Methods of Analysis for Water and Wastewater". Results of the water sampling and analysis must be compared with the standards stated in DAO 2016-08: "Water Quality Guidelines and General Effluent Standards of 2016."

558 The prescribed air and water monitoring stations are on **Figure 6-1**.

559 **Asturias Industries** Inc. will monitor its compliance through regular submission of Self-Monitoring Report (SMR) and Compliance Monitoring Report (CMR) to the DENR-EMB.

Table 6-1: Environmental Monitoring Plan (EMoP)

KEY ENVIRONMENTAL ASPECTS PER PROJECT PHASE	POTENTIAL IMPACTS PER ENVIRONMENTAL SECTOR	PARAMETER TO BE MONITORED	SAMPLING AND MEASUREMENT PLAN			LEAD PERSON	ANNUAL ESTIMATED COST	EQPL MANAGEMENT SCHEME					
			Method	*Frequency*	*Location*			*EQPL Range*			*Management Measures*		
								Alert	*Action*	*Limit*	*Alert*	*Action*	*Limit*
PRE-CONSTRUCTION/CONTRUCTION PHASES													
Local Sourcing of Labor	People: Employment Opportunities	No. of employees from host barangays	Record no. of employees from host barangays	During pre-construction	Administration Office of the Project	Asturias Industries Inc.	Minimal	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Construction and installation of plant and support facilities	Solid Waste Generation	Weight of waste generated	Weighing/ log-book recording	Daily/weekly	Waste storage facility	Asturias Industries Inc.	Part of operation costs	50% of maximum storage capacity	80% of maximum storage capacity	Maximum storage capacity	Prepare waste for disposal by third party	Contact third party for waste for disposal	Disposal of waste by third party.
	People: Occupational health and safety	No. of work-related illnesses/ injuries, No. of safety man-hours	Log-book/ database registration	Daily	Administration office of the project site	Asturias Industries Inc.	Minimal	1 Non-Lost Time Accident	Multiple Non-Lost Time Accident	1 Lost Time Accident	Investigate, Do necessary actions.; Re-training of staff regarding health and safety guidelines	Investigate, Do necessary actions.; Review and reinforce safety guidelines.; Re-training of staff regarding health and safety guidelines.	Investigate, Do necessary actions.; Review and reinforce safety guidelines.; Re-training of staff regarding health and safety guidelines.; Stricter implementation of health and safety guidelines
	Water Quality: Impact on Coastal water quality	pH	Refer to EMB MC 2016-12	Quarterly	Refer to Figure 6-1	Asturias Industries Inc.	PHP 10,000 per parameter	6.5-7.5	8.0-8.5	6.5-8.5	Investigate, identify non-point sources	Investigate, identify non-point sources; Conduct maintenance of septic tanks, drainage and siltation ponds	Investigate, identify non-point sources, repair damages/ defects, repeat analysis
		TSS						60 mg/L	65 mg/L	80 mg/L			
		Fecal Coliform						180 MPN/100mL	190 MPN/100mL	200 MPN/100mL			
		Oil & Grease						2 mg/L	2.5 mg/L	3 mg/L			
	Water Quality: Impact on ground water quality	pH	Refer to EMB MC 2016-12	Quarterly	Refer to Figure 6-1	Asturias Industries Inc.	PHP 10,000 per parameter	6.5-8.0	8.0-8.5	6.5-9.0	Investigate, identify non-point sources	Investigate, identify non-point sources; Conduct maintenance of septic tanks and drainage	Investigate, identify non-point sources, repair damages/ defects, repeat analysis
		Fecal Coliform						8.0 MPN/100mL	9.0 MPN/100mL	10.0 MPN/100mL			
		Oil & Grease						0.5 mg/L	0.75 mg/L	1.0 mg/L			

KEY ENVIRONMENTAL ASPECTS PER PROJECT PHASE	POTENTIAL IMPACTS PER ENVIRONMENTAL SECTOR	PARAMETER TO BE MONITORED	SAMPLING AND MEASUREMENT PLAN			LEAD PERSON	ANNUAL ESTIMATED COST	EQPL MANAGEMENT SCHEME					
			Method	*Frequency*	*Location*			*EQPL Range*			*Management Measures*		
								Alert	*Action*	*Limit*	*Alert*	*Action*	*Limit*
Use of Heavy Equipment	Air Quality: Impact on Ambient Air Quality and Noise	NO_2	DAO 2000-81 Analysis Methods	Quarterly	Refer to Figure 6-1	Asturias Industries Inc.	PHP 20,000 per station per event	105 µg/NCM	135 µg/NCM	150 µg/NCM	Continuous maintenance of heavy equipment	Continuous maintenance of heavy equipment; Investigate, identify non-point sources	Investigate condition of equipment; Repair damages/ defects, repeat analysis
		SO_2						125 µg/NCM	160 µg/NCM	180 µg/NCM			
		TSP						180µg/ NCM	200µg/ NCM	230µg/ NCM			
		PM_{10}						500 mg/NCM	550 µg/NCM	600 µg/NCM			
Use of Heavy Equipment	Hazardous Waste Generation (used oil)	Volume of wastes generated	Number of drums/log-book recording; Weighing/ log-book recording	Weekly	Waste storage facility (Refer to DAO 1992-29)	Asturias Industries Inc.	Part of operation costs	50% of maximum storage capacity	80% of maximum storage capacity	Maximum storage capacity	Ensure proper storage of hazardous waste, as stipulated in HW ID. Prepare hazardous waste for treatment/ disposal by third party (Refer to DAO 1992-29)	Ensure proper storage of hazardous waste, as stipulated in HW ID. Contact third party for hazardous waste for treatment/ disposal (Refer to DAO 1992-29)	Treatment/disposal of hazardous waste by third party. (Refer to DAO 1992-29)
OPERATION PHASE													
Operation of cement plant and quarry	Air Quality: Impact on Ambient Air Quality and noise	NO_2	DAO 2000-81 Analysis Methods	Quarterly	Refer to **Figure 6-1.**	Asturias Industries Inc.	PHP 20,000 per station per event	80 µg/NCM	120 µg/NCM	150 µg/NCM	Continuous maintenance of engines	Continuous maintenance of engines; Investigate, identify non-point sources	Investigate condition of engines; Repair damages/ defects, repeat analysis
		CO						25 mg/NCM	30 mg/NCM	35 mg/NCM			
		SO_2,						120 µg/NCM	150 µg/NCM	180 µg/NCM			
		TSP						180µg/ NCM	200µg/ NCM	230µg/ NCM			
		PM_{10}						120 mg/NCM	150 µg/NCM	200 µg/NCM			
		Noise						65 dB	70 dB	75 dB			
Operation of cement plant	Stack Monitoring	CO	COMS	Continuous	Coal Mill, Raw Mill, and Clinker Cooler	Asturias Industries Inc.		300 mg/NCM	400 mg/NCM	500 mg/NCM	Continuous maintenance of equipment. Continuous monitoring.	Investigate, identify non-point sources	Investigate, identify non-point sources, repair damages/ defects, repeat analysis
		NO						300 mg/NCM	400 mg/NCM	500 mg/NCM			
		SOx						100 mg/NCM	150 mg/NCM	200 mg/NCM			
		PM						80 mg/NCM	100 mg/NCM	150 mg/NCM			
Operation of cement plant and quarry	Water Quality: Impact on Coastal water quality	pH	Refer to EMB MC 2016-12	Quarterly	Refer to Figure 6-1	Asturias Industries Inc.	PHP 10,000 per parameter	6.5-7.5	8.0-8.5	6.5-8.5	Continuous maintenance of treatment system. Continuous monitoring.	Investigate, identify non-point sources Conduct maintenance of septic tanks, drainage and siltation ponds	Investigate, identify non-point sources, repair damages/ defects, repeat analysis
		TSS						60 mg/L	65 mg/L	80 mg/L			
		Fecal Coliform						180 MPN/100mL	190 MPN/100mL	200 MPN/100mL			
		Oil & Grease						2 mg/L	2.5 mg/L	3 mg/L			

KEY ENVIRONMENTAL ASPECTS PER PROJECT PHASE	POTENTIAL IMPACTS PER ENVIRONMENTAL SECTOR	PARAMETER TO BE MONITORED	SAMPLING AND MEASUREMENT PLAN			LEAD PERSON	ANNUAL ESTIMATED COST	EQPL MANAGEMENT SCHEME					
			Method	*Frequency*	*Location*			*EQPL Range*			*Management Measures*		
								Alert	*Action*	*Limit*	*Alert*	*Action*	*Limit*
Operation of cement plant and quarry	Water Quality: Impact on Groundwater quality	pH	Refer to EMB MC 2016-12	Quarterly	Refer to Figure 6-1	Asturias Industries Inc.	PHP 10,000 per parameter	6.5-8.0	8.0-8.5	6.5-9.0	Continuous maintenance of treatment system. Continuous monitoring.	Investigate, identify non-point sources	Investigate, identify non-point sources, repair damages/ defects, repeat analysis
		Fecal Coliform						8.0 MPN/100mL	9.0 MPN/100mL	10.0 MPN/100mL			
		Oil & Grease						0.5 mg/L	0.75 mg/L	1.0 mg/L			
Operation of cement plant and quarry	People: Occupational health and safety	No. of work-related illnesses/ injuries, No. of safety man-hours	Log-book/ database registration	Daily	Administration office of the project site	Asturias Industries Inc.	Minimal	1 Non-Lost Time Accident	Multiple Non-Lost Time Accident	1 Lost Time Accident	Investigate, Do necessary actions. Re-training of staff regarding health and safety guidelines	Investigate, Do necessary actions. Review and reinforce safety guidelines. Re-training of staff regarding health and safety guidelines.	Investigate, Do necessary actions. Review and reinforce safety guidelines. Re-training of staff regarding health and safety guidelines. Stricter implementation of health and safety guidelines
Operation of cement plant and quarry	People: Potential negative Public Perception	No. of valid complaints	Consultation with local officials and residents	Upon official request /summon of the local barangay office	Barangay Baha and Brgy. Talibayog	Asturias Industries Inc.	Minimal	1 minor complaint, such as nuisance complaints (e.g. noise caused by operation)	Multiple minor complaints such as nuisance complaints (e.g. noise caused by operation)	1 major complaint (incidents causing loss of life, damage to private property, adverse effects to health an economics)	Investigate, address issue accordingly	Investigate, address issue accordingly. Review and reinforce safety guidelines. Re-training of staff regarding health and safety guidelines.	Investigate, address issue accordingly. Review and reinforce safety guidelines. Re-training of staff regarding health and safety guidelines. Increase community IEC regarding measures taken to solve major complaints. Get feedback from community regarding acceptability or adequacy of actions taken to mitigate major concerns.
Operation of cement plant and quarry	Solid Waste Generation	Weight of waste generated	Weighing/ log-book recording	Daily/ weekly	Waste storage facility	Asturias Industries Inc.	Part of operation costs	50% of maximum storage capacity	80% of maximum storage capacity	Maximum storage capacity	Prepare waste for disposal by third party	Contact third party for waste for disposal	Disposal of waste by third party.

KEY ENVIRONMENTAL ASPECTS PER PROJECT PHASE	POTENTIAL IMPACTS PER ENVIRONMENTAL SECTOR	PARAMETER TO BE MONITORED	SAMPLING AND MEASUREMENT PLAN			LEAD PERSON	ANNUAL ESTIMATED COST	EQPL MANAGEMENT SCHEME					
			Method	*Frequency*	*Location*			*EQPL Range*			*Management Measures*		
								Alert	*Action*	*Limit*	*Alert*	*Action*	*Limit*
Operation of cement plant and quarry	Hazardous Waste Generation (used oil, oil-contaminated materials, BFLs)	Volume of wastes generated	Number of drums/log-book recording Weighing/ log-book recording	Weekly	Waste storage facility (Refer to DAO 1992-29)	Asturias Industries Inc.	Part of operation costs	50% of maximum storage capacity	80% of maximum storage capacity	Maximum storage capacity	Ensure proper storage of hazardous waste, as stipulated in HW ID. Prepare hazardous waste for treatment/ disposal by third party (Refer to DAO 1992-29)	Ensure proper storage of hazardous waste, as stipulated in HW ID. Contact third party for hazardous waste for treatment/ disposal (Refer to DAO 1992-29)	Treatment/disposal of hazardous waste by third party. (Refer to DAO 1992-29)
Effluent from plant site	Water Quality: Degradation of water quality due to effluent discharge	Temp. change pH TSS	Refer to EMB MC 2016-12	Quarterly	Refer to Figure 6-1	Asturias Industries Inc.	PHP 10,000 per parameter	2°C (change) 6.0-9.5 90 mg/L	2.5°C (change) 6.0-9.5 95 mg/L	3°C (change) 6.0-9.5 100 mg/L	Continuous maintenance of treatment system. Continuous monitoring.	Investigate, identify non-point sources	Investigate, identify non-point sources, repair damages/ defects, repeat analysis
ABANDONMENT PHASE													
Pull-out of equipment, decommissioning of fuel storage, abandonment of offices	Generation of Demolition spoils and solid wastes	Weight (kg); no. of items	Weighing/ log-book recording	Daily/ weekly	Project Site	Asturias Industries Inc.	To be deter-mined	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
	Potential negative public perception	No. of valid complaints	Consultation with local officials and residents	Variable	Municipality of Sta. Cruz	Asturias Industries Inc.	PHP 40,000 per consultation	1 minor complaint, such as nuisance complaints (e.g. noise caused by decommissioning, inconvenience and traffic caused by trucks)	Multiple minor complaints such as nuisance complaints (e.g. noise caused by decommissionin g, inconvenience and traffic caused by trucks)	1 major complaint (incidents causing loss of life, damage to private property, adverse effects to health an economics)	Investigate, address issue accordingly	Investigate, address issue accordingly. Review and reinforce safety guidelines. Re-training of staff regarding health and safety guidelines.	Investigate, address issue accordingly. Review and reinforce safety guidelines. Re-training of staff regarding health and safety guidelines. Increase community IEC regarding measures taken to solve major complaints. Get feedback from community regarding acceptability or adequacy of actions taken to mitigate major concerns.

Notes: EQPL = Environmental Quality Performance Level

- Alert or Red Flag: early warning
- Action Level: point where management measures must be employed so as not to reach the regulated threshold or limit level, or to reduce deterioration of affected environmental component to pre-impact or optimum environmental quality
- Limit Level: regulated threshold of pollutant (standard that must not be exceeded); point where emergency response measures must be employed to reduce pollutants to lower than standard limit.

Figure 6-1: Prescribed Monitoring Locations

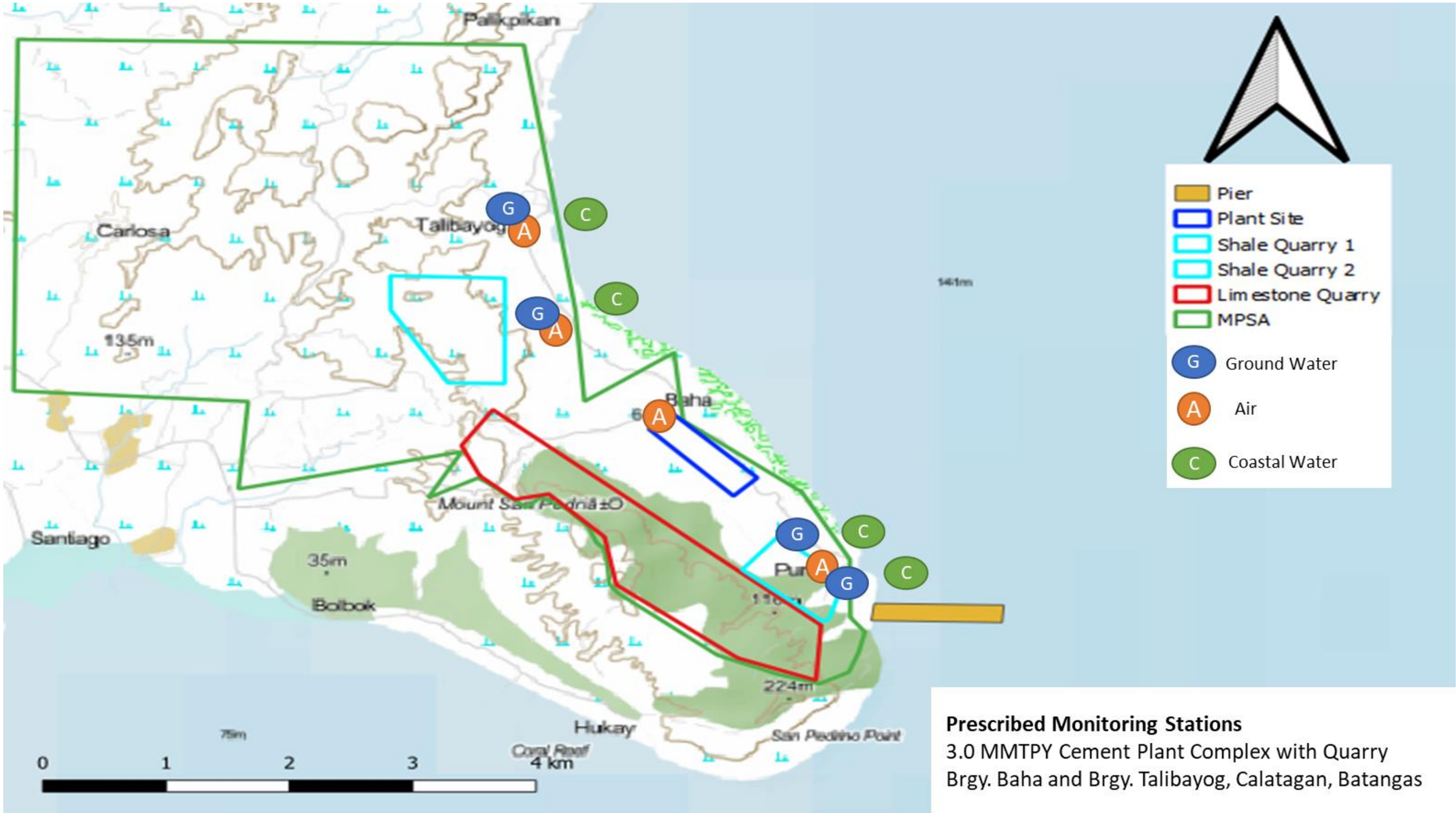


FIGURE NO.:	FIGURE TITLE:	
6-1	**PRESCRIBED MONITORING LOCATIONS**	
PROJECT PROPONENT:	NAME OF PROJECT:	EIA PREPARER:
ASTURIAS INDUSTRIES, INC.	**3.0 MMTPY Cement Plant Complex & Quarry Project** *Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas*	**LCI ENVI CORPORATION**

6.2 Multi-Sectoral Monitoring Framework

560 The Monitoring Framework, as stated in Annexes 3-2 and 3-4 of the RPM for DENR Administrative Order No. 2017-15, presents a proposed program wherein the proposed Project's environmental compliance will be verified and reported to concerned stakeholders.

561 The MMT will be composed of government regulators (LGU representatives) and recognized non-governmental organizations that have valid issues and concerns on the proposed project. The proponent shall provide appropriate funding for the MMT activities based on the Annual Work and Financial Plan approved by EMB. DENR-EMB must provide guidance to the MMT and shall conduct performance audits of the MMT.

562 The MMT's objective is to provide a venue to discuss the important concerns of stakeholders regarding the Project. These concerns may involve the following items:

- Verify the compliance of **Asturias Industries Inc.** in its ECC and EMP;
- Check performance and compliance of **Asturias Industries Inc.** in their approved EPEP/AEPEP;
- Validate the proposed Project's conformance to government standards, **Asturias Industries Inc.'s** submission of necessary post-ECC documentation requirements;
- Identify the legitimate concerns of the host community, in relation to the implementation of the Project;
- Determine the extent and scale of the environmental impacts generated by the Project;
- Provide additional information, education, and communication (IEC); and
- Integration/documentation of complaints, suggestions, and compromise agreements.

563 The MMT members and their corresponding roles and responsibilities are presented in **Table 6-2**.

Table 6-2: Proposed Composition of the MMT for the Project

COMPOSITION	MEMBER	ROLE/RESPONSIBILITY
LGU representatives	(1) representative from the Municipal Environment and Natural Resources Office (MENRO) of Calatagan	▪ Serve as the MMT chair ▪ Oversee Proponent's compliance to environmental regulations ▪ Issue/revoke the ECC of the Project as mandated
	(1) Rural Health Unit (RHU) Chief or Municipal Health Officer (MHO) of Calatagan	▪ Exercise local authority and knowledge on environmental and social conditions in the project impact area
	Concerned Barangay Captain (Baha and Talibayog)	
One representative from an LGU-accredited local NGOs with mission/s specifically related to environmental management	(1) To be determined	▪ Represent the mission/s of the NGO
Maximum of 2 representatives from locally recognized community leaders	(1) Farmers (2) Fishermen (3) Baha and Talibayog Senior Citizens Association	▪ Represent vulnerable sectors in the project impact area

COMPOSITION	MEMBER	ROLE/RESPONSIBILITY
Maximum of 3 representatives from government agencies	(1) Philippine Coast Guard (PCG) (2) Bureau of Fisheries and Aquatic Resources (BFAR) (3) Department of Agriculture (4)	▪ Carry out mandate considering the project type and its expected impacts
Reference: DENR Administrative Order No. 2017-15		

564 The DENR heads the MMT and oversees compliance to environmental regulations. Furthermore, it has the power to revoke the ECC if deemed necessary. As the proponent, **Asturias Industries Inc.** must comply with environmental regulations by providing mitigation and enhancement measures. Lastly, representatives from the host municipal and barangay LGUs provide the consensus of the local community and has jurisdiction over the project site.

565 **Asturias Industries Inc.** will continue to regularly conduct consultations/meetings with the MMT members. These meetings shall be conducted quarterly and annually. Special meetings may also be held if necessary, most especially during emergency situations or other important occasions that require immediate resolution.

6.3 Mine Rehabilitation Fund Committee

566 Pursuant to the requirement of the DENR Administrative Order No. 2010-21 also know as the "Implementing Rules and Regulations of the Philippine Mining Act of 1995 (RA 7942)", a Mine Rehabilitation Fund Committee must be created to evaluate and monitor the performance of the quarry operation of the proponent. The following are the duties and reposnibilities of the members of the MRF committee:

- Evaluate and monitor the compliance of Asturias Industries Inc. with its approved EPEP and AEPEP;
- Manages, operates and monitors the safety of the Mine Rehabilitation Funds and Final Mine Rehabilitation and Decommissioning Fund and ensure that these funds are kept separate and distinct from one another and records all transactions; and
- Monitor and evaluate the performance of the MMT.

567 Composition of the members of the MRF committee are the regional director of the EMB, representatives from the LGU, local NGOs and POs and from the proponent. The MRF committee will be headed by the regional director of the DENR.

6.4 Environmental Guarantee and Monitoring Fund Commitments (Cement Plant Operation)

568 The Environmental Guarantee Fund (EGF) pertains to the fund to be set up by a project proponent which shall be readily accessible and disbursable for the immediate clean-up or rehabilitation of areas affected by damages in the environment and the resulting deterioration of environmental quality as a direct consequence of a project's construction, operation or abandonment. It shall likewise be used to compensate parties and communities affected by the negative impacts of the project, and to fund community-based environment related projects including, but not limited to, information and education and emergency preparedness programs.

569 The indicative allocation for the EGF for the operation of the proposed cement plant complex is PHP 1,000,000.00 (One Million Pesos). The said amount will be subject to review and approval of the MMT. The fund shall be replenished if the amount falls below 50%.

570 The EGF shall be established and used for the following risk-management related purposes:

- the immediate rehabilitation of areas affected by damage to the environment and the resulting deterioration of environmental quality as a direct consequence of project construction, operation, and abandonment;
- the conduct of scientific or research studies that will aid in the prevention or rehabilitation of accidents and/or risk-related environmental damages; or
- for contingency clean-up activities, environmental enhancement measures, damage prevention program including the necessary IEC and capability building activities to significantly minimize or buffer environmental risk- related impacts.

571 The EGF can be used for, but not limited to, the following project-specific purposes:

- Environmental enhancement measures such as greening programs in the area,
- Support development and implementation of coastal resource management in area,
- Support development and implementation of water conservation plan, and
- Oil spill clean-up

572 On the other hand, the Environmental Monitoring Fund (EMF) refers to the fund that a proponent shall set up after an ECC is issued for its project or undertaking, to be used to support the activities of the multi-partite monitoring team. It shall be immediately accessible and easily disbursable. The indicative allocation for the EMF of the proposed project is PHP 500,000.00 (Five-Hundred Thousand Pesos), which will also be subject to review and approval of the MMT.

6.5 Contingent Liability and Rehabilitation Fund (Quarry Operation)

573 As required by the DENR Administrative Order No. 2010-21, a Contingent Liability and Rehabilitation Fund (CLRF) must be established and maintained by the proponent for its quarry operation.

574 The Contingent Liability and Rehabilitation Fund (CLRF) is an environmental guarantee fund to ensure that damages of the mining activity to the environment will be well compensated and to assure there is a source of funding for the sustainable rehabilitation of any adverse effect due to mining.

575 The CLRF for this project will be in the form of Mine Rehabilitation Fund (MRF) and Final Mine Rehabilitation and Decommissioning Fund (FMRDF).

6.5.1 Mine Rehabilitation Fund (MRF)

576 The MRF will be established and maintained by Asturias Industries , Inc. to ensure availability of funds for the compliance with the activities included in the Environmental Protection and Enhancement Program (EPEP) which is the basis for the Annual Environmental Protection and Enhancement Program (AEPEP).

577 The MRF will also be used for physical and social rehabilitation of areas and communities affected by the mining activities and for research on the social, technical and preventive

aspects of rehabilitation. The MRF will be in two forms; (1) Monitoring Trust Fund (MTF) and (2) Rehabilitation Cash Fund (RCF).

6.5.1.1 Monitoring Trust Fund (MTF)

578 The MRF is the fund that will cover the expenses of the monitoring program approved by the MRF committee. The minimum amount for this fund is Php 150,000 to cover the maintenance and other operating budget incurred by the monitoring team. Replenishment of this amount shall be done quarterly to correspond to the expenses incurred by the monitoring team.

6.5.1.2 Rehabilitation Cash Fund (RCF)

579 The RCF is the fund reserved to ensure the compliance of the proponent to the approved rehabilitation activities and schedules. The amount of the RCF will be equivalent to 10% of the total amount needed to implement the EPEP or Php 5,000,000, whichever is lower. The fund will be annually replenished to maintain the minimum amount required.

6.5.2 Final Mine Rehabilitation and Decommissioning Fund (FMRDF)

580 This fund will be established to ensure the availability of the full cost contained in the approved Final Mine Rehabilitation and/or Decommissioning Plan (FMR/DP). This fund will only be utilized for the implementation of all the decommissioning and/or rehabilitation activities presented in the FMR/DP for the succeeding years until the objectives of the mine closure have been achieved.

SECTION 7

DECOMMISSIONING/ABANDONMENT/REHABILITATION POLICY

7.1 Post-Construction Decommissioning

581 After the construction, the project site will be thoroughly cleaned as preparation for the operation. All the temporary facilities installed in the project site will be properly dismantled and removed including the equipment brought in the project site. Heavy equipment will be removed at the site during night time so that it will not affect the traffic in the project site. It will be ensured that there will be no oil spills during the decommissioning of the equipment.

582 All the wastes generated will be properly disposed or recycled. Construction debris and domestic wastes will be segregated, and all residual wastes will be hauled out by the Municipal waste collectors. All hazardous wastes will also be collected by DENR-registered haulers. Human wastes from the portable toilets will be properly siphoned by DENR-register desludgers. No wastes will be left in the project site.

7.2 Project Decommissioming/Abandonment

583 **Asturias Industries Inc** will allocate sufficient time and available resources if the decommissioning, abandonment, and/or rehabilitation of the Project will be necessary.Depending on the nature and reasons for abandonment, some facilities, such as the containers used as offices, may not be necessarily demolished or removed from the site, since some of these can be useful for other applications. Otherwise, proper dismantling, removal, and transportation of the structures, equipment, and machineries from the existing site will be conducted to minimize possible or further threats to the surrounding environment. Other activities that will be done during this Phase are:

- Proper advice and compensation to all affected personnel;
- Securing of necessary government clearances related to the abandonment of the existing Project (including request for the relief of ECC conditions and commitment);
- Removal of solid, liquid, and hazardous wastes within the site through DENR-certified waste transporter/treater; and
- Clean-up and possible remediation of the site, if future evaluations and testing suggest that such activity is applicable.

584 Some plant facilities, such as office and accommodation buildings, can be repurposed by the community. Cement manufacturing facilities such as crushing plant, kilns, etc.) will be removed while storage facilities can be repurposed. Siltation ponds will be backfilled and re-vegetated. The limestone quarry will be stabilized and re-vegetated. The proposed final land use of the cement plant complex and quarry areas after the decommissioning or rehabilitation is presented in

585 **Table** 7-1**.**

586 Asturias commits to prepare and submit its **Final Mine Rehabilitation and Decommissioning Plan (FMRDP)** after the issuance of its Environmental Compliance Certificate (ECC). This will include the rehabilitation activities and fund commitments for the proposed rehabilitation programs.

Table 7-1: Proposed Final Land Use of Project Site After Decommissioning and/or Rehabilitation

Process/Component	Proposed Final Land Use
Cement Plant Complex	
• **Cement Plant and Facilities**	• Stable and re-vegetated area. • Removal of structures and possibly transferred to other projects or sold. • Retained storages for other useful purpose.
• **Office and accommodation buildings**	• Retained facilities for other useful purpose. • Laboratory and motor pool equipments and other items will be removed and transferred to other project or sold.
• **Silt traps/ponds and drainage system**	• Silt traps/ponds backfilled and re-vegetated. • Water reservoir retained as recreation/picnic area. • Drainage system retrofitted to conform to proposed final land use.
Limestone Quarry	
• **Active/Un-rehabilitated Quarry Areas**	• Stable and re-vegetated area.
• **Siltation traps/ponds and drainage system**	• Stable and re-vegetated area. • Drainage system retrofitted to conform to proposed final land use.

SECTION 8

INSTITUTIONAL PLAN FOR EMP IMPLEMENTATION

587 The institutional organization of **Asturias Industries Inc** for the proposed Cement Plant Complex with Quarry Project is shown in **Figure 8-1**. The organization is formed to achieve the following:

- Economical and safety operations and maintenance of the proposed cement plant components;
- Implementation of the company policies;
- Environmental compliance and sustainability; and
- Promotion and enhancement of the social acceptability of the proposed project.

588 The institutional organization will involve **Asturias Industries Inc 's** top-level management, who is responsible for providing the corporate direction and policies of the company. The policies shall then be disseminated to the department heads and managers for implementation of the company personnel, including those who will be working on the operations of the proposed project.

589 **Asturias Industries Inc** will also establish a partnership with relevant government agencies, various stakeholders, and local host communities in relation to the project. This partnership is necessary to maintain a transparent and positive relationship for the proposed project and its stakeholders, as well as to ensure that the environmental protection and enhancement measures are complied with.

590 The key stakeholders of the proposed project will be identified as the following:

- Municipality of Calatagan, Batangas;
- Brgy. Baha and Brgy. Talibayog;
- Residents and community organizations that will be affected by the proposed project;
- Various industry organizations;
- Local peace-and-order councils (i.e., PNP, Barangay Police); and
- Other concerned non-government organizations.

591 **Asturias Industries Inc** commits to:

- Comply with the conditions that will be stipulated in the ECC and other related environmental laws;
- Foster mutually beneficial partnership and cooperation with the host community;
- Promote sustainable use and responsible development of resources by adopting appropriate technologies;
- Develop livelihood programs and upgrade skills of host community to contribute and enhance the quality of life; and
- Develop training programs for its employees to ensure that they will be continually prepared for the tasks assigned to them.

Figure 8-1: Organizational Chart for the Institutional Plan

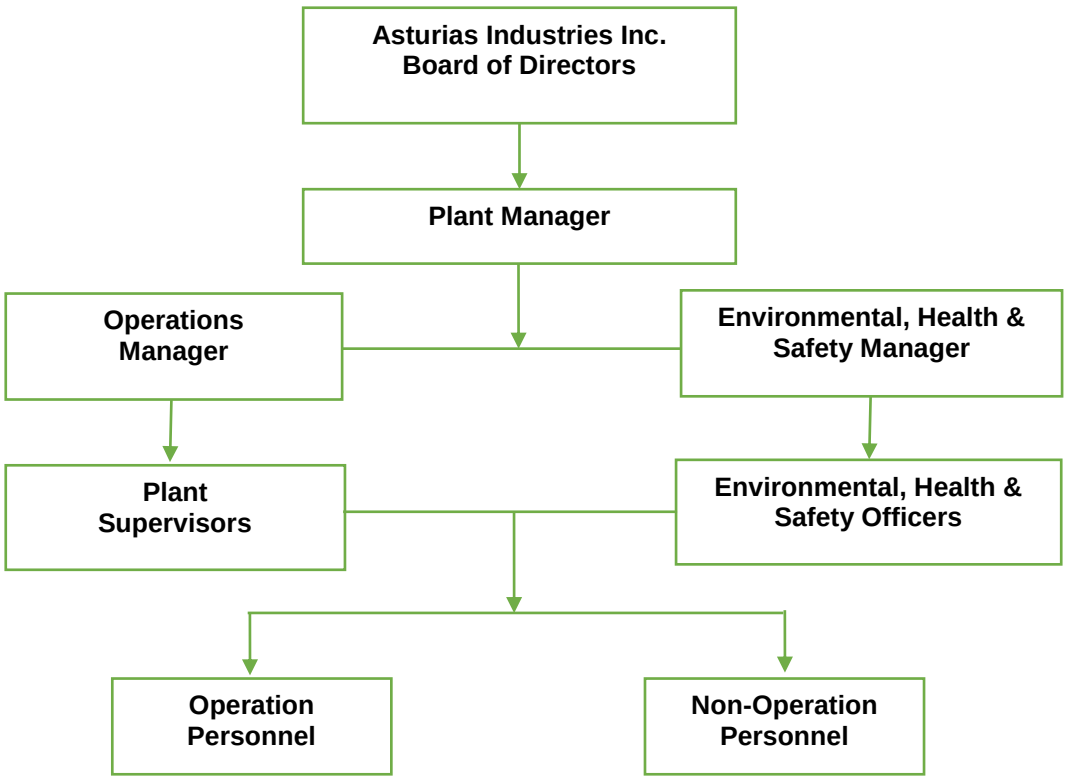


FIGURE NO.:	FIGURE TITLE:	
8-1	**ORGANIZATIONAL CHART FOR THE INSTITUTIONAL PLAN**	
PROJECT PROPONENT: **ASTURIAS INDUSTRIES, INC.**	NAME OF PROJECT: **3.0 MMTPY Cement Plant Complex & Quarry Project** *Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas*	EIA PREPARER: **LCI ENVI CORPORATION**

592 To manage environmental concerns of the project, a separate team will be formed. This will be led by the plant manager. Members of the team will be composed of the Mine Environmental Protection and Enhancement Office (MEPEO), Pollution Control Officer, Safety and Health Officer and the Community Relations Officer.

Figure 8-2: Framework of Organizational Setup for Environmental Concerns

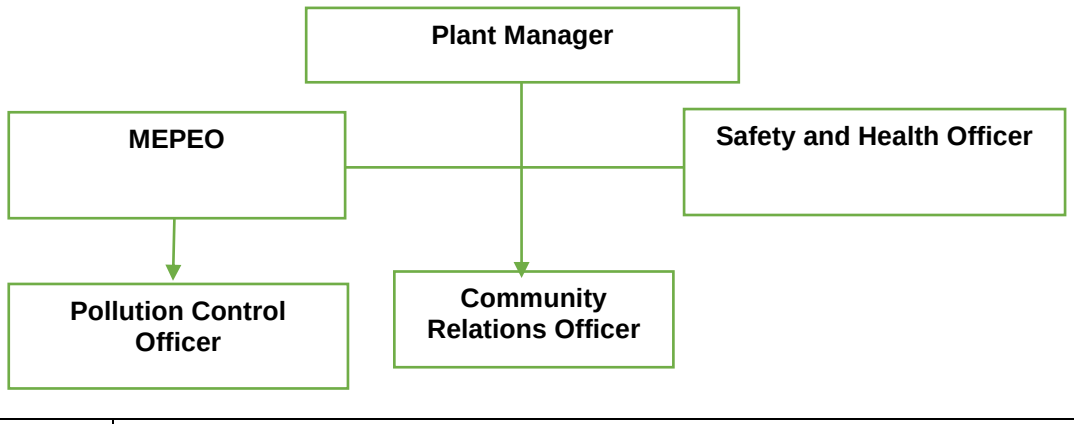


FIGURE NO.:	FIGURE TITLE:
8-2	**FRAMEWORK OF ORGANIZATIONAL SETUP FOR ENVIRONMENT CONCERNS**

PROJECT PROPONENT:	NAME OF PROJECT:	EIA PREPARER:
ASTURIAS INDUSTRIES, INC.	**3.0 MMTPY Cement Plant Complex & Quarry Project** *Brgy. Baha and Brgy. Talibayog, Calatagan, Batangas*	**LCI ENVI CORPORATION**

8.1 Grievance Mechanism

593 A credible grievance mechanism is necessary for the community, especially the stakeholders, to have confidence that if they lodge a complaint, it will be treated in a fair and objective manner. The fairness of the process is to be understood in the context of the imbalances of power that may exist. The grievance registration or communication process should present no or low barriers in terms of access (e.g. geographic location/education levels/language/ access to modern communication technology) by the stakeholders.

594 Registering a complaint can pose risks for the stakeholders, especially if it concerns issues such as corruption, misconduct, or monetary compensation, or if it interferes with local social and gender norms. Hence, the grievance mechanism should be free of retribution and should proactively consider potential dangers and risks to complainants and incorporate ways to prevent harm. Protection of privacy of the complainant will also be prioritized.

595 The stakeholders must be fully informed of the proper venue to lodge their complaints or grievances, and of their rights to use alternative measures if they choose to do so if they are not satisfied with the response of the Proponent to their complaints.

596 The Grievance Redress Mechanism (GRM) that will be employed for the project is detailed in 6 steps. This is applicable both during the construction and once the operation of the project starts. The GRM is presented in **Table 8-1**.

597 A Grievance Officer will be designated by the proponent. The designated grievance officer of shall coordinate with the responsible units/departments about any possible complaints, issues and concerns lodged on the project.

Table 8-1: Grievance Redress Mechanism

GRM Step	Description of the Procedure
Step 1	Affected person lodges the complaint.
Step 2	The Proponent will document and register the received complaints during operation of the project.

GRM Step	Description of the Procedure
Step 3	Two days upon the receipt of the complaint, a meeting will be called between the affected person and the proponent. The affected person will be immediately informed if the grievance is within, or outside, the purview of the mechanism. If the scope is outside, the affected person will be referred to the proper institution and/or proper mechanism for the complaint. If the complaint is within the scope of the project, the resolution of the complaint shall be discussed during the meeting. Investigation will be immediately scheduled for proper resolution of the complaint. After the investigation, the proponent will immediately decide on the most suitable internal measure to reduce the impact the source of the complaint while working on the final measure not later than 5 days from the day when the meeting for the complaint was held.
Step 4	If the affected person is satisfied with the resolution of the complaint, the proponent shall obtain a written confirmation of satisfaction from the affected person.
Step 5	For at least a week after closure of grievance, the Grievance Officer, shall monitor the effectiveness of the resolution.
Step 6	If the issue/impact persists, the affected person can lodge an appeal at the barangay level. The Barangay Chairman shall immediately record the appeal, contact the grievance to discuss the immediate resolution of the issue. If the issue persists despite the second action, the affected person can seek assistance from the City Government. A total of two weeks is given to process, address and monitor a grievance that will arise due to the project implementation.