TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF PHOTOS

LIST OF ANNEXES

EXECUTIVE SUMMARY

A. PROJECT FACT SHEET

I. Project Information

Name of Project	**Proposed Modification of Mabini Break Bulk Terminal and Port Facility**
Location	Barangay Pulong Balibaguhan Municipality of Mabini Province of Batangas
Cement Handling Method	Mixing and grinding of raw materials. Sea terminal for raw materials in-loading and for cement in-loading and out-loading/dispatching.
ECC	ECC-365-BA-120-97 (***Annex A***) Issued to Universal Bulk Corporation last May 19, 1997
Area Covered	255,576 m^2 (Previous ECC area, no area expansion)
Production Capacity	Existing: 850,000 MT/Y Proposed: 1,200,000 MT/Y

An Environmental Compliance Certificate (ECC) for cement Break-Bulk Terminal and Port Facility Project was issued to Universal Bulk Corporation in May 19, 1997. In 2006, the ECC was transferred to Mabini Grinding Corporation. Currently, Mabini Grinding Corporation has an existing Lease Agreement with Holcim Philippines authorizing the latter to apply for necessary permits and to operate the project ***Annex S.***

II. Proponent Profile

Proponent Name	**Holcim Philippines, Inc.** **(Holcim)**
Address	Head Office 7th Floor, Venice Corporate Center No. 8 Turin Street McKinley Hill Town Center Fort Bonifacio, 1634 Taguig City, Philippines
	Mabini Plant Barangay Pulong Balibaguhan, Mabini, Batangas
Contact Person	**Alexander R. Garcia** Operations Manager
Contact Number	Head Office: (+632) 459-3333

III. Project Preparer

AXceltechs Inc.

Address	Unit 10C, Lansbergh Place, 170 Tomas Morato, Quezon City
Authorized Representative/ Contact Person(s)	**ENGR. PAULO NONI T. TIDALGO** Managing Director
Contact Number	(02) 376-0043

IV. Existing and Proposed Project Components

Project Components	*Existing Operations*	*Proposed*	*See Figure 3*
REHABILITATION/UPGRADING OF EXISTING FACILITIES/EQUIPMENT			
1. Port in-loading/Port Facility	Port facilities can receive 440 TPH of raw materials designed for RORO and LCT.	Installation of eco-hoppers and conveyors to receive 900 TPH for bulk materials and 500 TPH for powder materials.	MBFM00 MBFM01
		Installation of sea vessel cement loading facility from the silo to sea vessel	MBCD04
		Installation of a pneumatic system for loading cement from silo to vessel	
2. Cement Dispatch	Bagged cement loading and bulk cement loading.	Installation of big bags (tonner) facility	MBCD01
		Install new palletizer including transfer belt conveyor & palletless, plastic sheet shrink wrap for bad weather and sea transport	MBCD02
MAINTENANCE – REPLACEMENT OF OUTDATED/OLD EQUIPMENT WITH LATEST MODELS			
1. Grinding	Mill Separator @ 120 TPH	Replace with newer model mill separator @ 140 TPH	MBFM02
	Mill Table Motor	Replace with newer model mill motor.	MBFM05
	Process Control System	Replace with latest version.	MBFM06
	Mill Fan using turbo coupling for speed control.	Replace with VFD for improve fan electrical efficiency	MBFM07
	Mill Gear Box with no real time monitoring	Install real time monitoring system of gearbox, for improved reliability	MBFM08
2. Blending	Cement Mixer	Replace with newer model of cement mixer	MBFM03
		Install system for fly-ash or limestone addition to HEX, after mill	MBFM04
3. Others			
	One (1) Weighbridge	Installation of second weighing bridge	MBSC01
	Unpaved existing parking area	Pave the parking area	MBSC02
		Develop 2nd parking area within the project area.	MBSC03

B. Process Documentation of the Conduct of Environmental Impact Assessment

The terms of reference used for this Environmental Impact Assessment (EIA) was consistent with that stipulated in the Revised Procedural Manual (RPM) for Department of Environment and Natural Resources (DENR) Administrative Order (DAO) No. 2003-30, Implementing Rules and Regulations of Presidential Decree No. 1586 "*Establishing the Philippine Environmental Impact Statement System*".

The Environmental Performance Report and Management Plan (EPRMP) Team is comprised of multi-disciplinary specialists/experts who have extensive training and experience on their respective fields and in the conduct of EIA for various industry sectors.

I. EPRMP Team

This study is a conglomeration and integration of the various technical, environmental, institutional/legal, and social inputs and findings of the following specialists/experts:

EPRMP Team Member	*Field of Expertise/Module*	*Registration No.*
Paulo Noni T. Tidalgo, EM, RN	Environment, Mining and Geology	IPCO – 103
Bernardo V. Valmonte, Jr. EM	Mining and Geology	IPCO – 0723
Ronald Pahunang	Air and Noise	IPCO - 173
Catherine L. Addawe, AgE	Water Quality and Hydrology	IPCO - 055
Siela T. Almocera, EnP	Social Experts	IPCO – 109
Benjamin Francisco, PhD	Marine Ecology	IPCO - 038
Jess M. Addawe	GIS	IPCO – 056
Czarina May M. Olores, SE	Consolidator	IPCO – 075

II. EIA Study Schedule and Area

The technical scoping was held last 2 December 2016, which was participated by DENR Environmental Management Bureau (EMB) personnel, EIA Review Committee members, Holcim Philippines, Inc., and Axceltechs.

Activitiy(ies)	Date
Public Scoping	May 26, 2017
Technical scoping	August 23 – 24,

Activitiy(ies)	Date
Marine Ecology Assessment	January 28 – 30, 2017
Water Sampling	January 27, 2017 January 30, 2017
Air Sampling	April 18 to 25, 2017 April 25 to 26, 2017
Social Survey/Assessment	February 24, 2017

The area subjected to the EIA conducted was based on the perceived direct and indirect impact areas of the proposed project. As stipulated in DAO 2003-30, known as the "*Consolidated Implementing Rules and Regulations of the Philippine Mining Act of 1995"*, direct impact areas, in terms of physical environment, are those where all project facilities are to be constructed/situated and the designated plant area. On the other hand, areas not directly subjected to any activities/construction and those outside the project vrea but are within the jurisdiction of the Municipality of Mabini (e.g. stretch of river draining the project area, communities along haul roads) are considered as indirect impact areas. For the social impacts, the study focused on the (1) one direct impact barangay and one (1) indirect impact barangay. Consistent with the provision of DAO 2010-21, the direct impact barangay is Barangay Pulong Balibaguhan.

III. EIA Methodology

Primary and secondary data were utilized for the assessment of the project impacts. Primary data were obtained from conducted on-site investigation and field sampling/surveys while secondary data were acquired from the proponent and government agencies/institutions. Relevant and previously conducted studies were also considered. The following are the sampling/assessment methodologies employed by the EPRMP team for the study:

Module		***Methodology***
Land	Land Use	Gathering and review of secondary data
	Geology and Geomorphology	Gathering and review of secondary data
	Natural Hazards	Gathering and review of secondary data
	Pedology	Gathering and review of secondary data

Module		*Methodology*
Water	Hydrology and Hydrogeology	Gathering and review of secondary data
	Water Quality	In-situ measurements; grab sampling and laboratory analysis
	Marine Ecology	Manta tow, Line intersect and survey
Air and Noise	Meteorology	Gathering and review of secondary data; Tier 1 method of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories
	Air and Noise Quality	High volume sampler (TSP and metals) Colorimetric-Pararosaline Griess-Saltzman *Atomic Absorption Spectrophotometry* Sound level meter for noise
People	Socio-economic Profile	Gathering and review of secondary data Key informant interviews Perception survey Focus group discussions

IV. Public Participation

A perception survey for the direct impact barangay was conducted on March 2017. The survey was focused on Barangay Pulong Balibaguhan, the host barangay of Holcim-Mabini. A total of 41 households were surveyed. The target sample size for the perception survey was based on 90% level of confidence and 10% margin of error.

Separate FGDs were conducted for the impact barangays. The FGDs were conducted on February 24, 2017. It was attended by the members of Sangguniang Barangay (Barangay Chairperson and Councilors), Barangay Functionaries (Barangay Secretary, Barangay Treasurer, and Barangay Healworkers), Purok Leaders, and Sectoral/ People's Organizations.

C. Summary of Baseline Characterization

Module	*Summary of Baseline Conditions*
Pedology	There are three soils types present, the Ibaan loam with a mixture of gravel is generally found in mountains and hills (gravel and tuffaceous concretions are the characteristics features of the surface and subsoil). The hillsides are covered with coconut trees, and physical characteristics.
Hydrology	The project area is situated within the Southern Tagalog Water Resources Region (Water Resources Region 4) which is comprised of 42 Principal Rivers. However, the municipality of Mabini, Batangas, where the project is located, has no inland water bodies. It is generally characterized by valleys between prominent hills or mountains. It is bounded by irregular coastlines with rugged surfaces and harborial beaches (Mabini CDP, 2015)[1]. Surface runoff within the project facility drains directly to Batangas Bay.
Water Quality	All parameters tested in the water samples collected were within Class SC guidelines for ambient marine water quality and Class C guidelines for groundwater quality as per DAO 2016-08.
Marine	It is evident that over the last few decades, the coastal habitats in the coastal impact area of the project site have been subjected to various forms of stresses and pressures that have altogether eroded portions of what seems to be remnants of coral reefs which are now colonized by macro-algae or overrun by

[1] Municipal Government of Mabini, Batangas. (2015). *Comprehensive Development Plan 2016-2025.* Mabini, Batangas.

Module	***Summary of Baseline Conditions***
	sandy substrate. The reef flat in front of Barangay Talaga East has mostly been lost to destructive fishing methods – presumably decades ago, and the remaining patches of coral colonies are few and far between; most of which are degraded by silt intrusion and colonized by macro-algae. Coral rubbles are few and it is construed that these have been collected for construction of boat docks and small jetties, and used for other residential activities. Small rubble has been presumably washed ashore during several typhoons that hit the area in the past two years. Coral re-growth in stable portions of the reef flat in the northeastern sector appears little and slow, dominated by recruits of massive and few branching corals in small patches that are far apart. In two areas where corals were found, these were dominated by non-scleractinian mushroom corals, few massive coral species Porites spp., and a several colonies of the silt-resisting coral Goniopora minor (discerned by its long polyps).
Noise Quality	Measured noise levels at the guest house of the proponent and parking area of the project site showed levels within the ambient noise standards set for heavy industrial area (morning, daytime, evening, and nighttime).
Air Quality	As discussed in Environmental Performance/Existing Condition Methodology, monitoring by CRL involved sampling of TSP, PM_{10}, $PM_{2.5}$, NO_2, SO_2, and metals in ambient air (Sd, As, Cd, Cr, Cu, Pb, Hg, Ni, and Zn). For TSP, PM_{10}, NO_2, and SO_2, sampling was conducted in 24 hours and 1

Module	***Summary of Baseline Conditions***
	hour to obtain samples comparable with the ambient guideline values and standards. Monitoring results show that particulate pollutants (TSP and PM_{10}) were relatively lower as compared to the ambient guideline values and standards. The highest measured 24-hour average concentrations of TSP and PM_{10} were 39.4 and 30.7 µg/Nm^3, which were about 7 and 5 times lower than ambient guideline values of 230 and 150 µg/Nm^3, respectively. For the 1-hour average TSP and PM_{10} concentrations, highest measured concentrations were 36.8 and 103.4 µg/Nm^3, in which the highest was observed at the parking area of the project site Relatively higher measured PM_{10} concentration was likely due to fugitive emissions arising from vehicular traffic. Result of 1-hour sampling for PM_{10}, was higher than TSP, though the mass diameter of the latter is greater than PM_{10}.
Socio-Economic	Based on the 2015 Census of Population of the Philippine Statistics Authority, the population of Mabini is 46,211. The population of Barangay Pulong Balibaguhan in 2015 is 940. Comparing it with the 2010 population, 887, the barangay has a population growth rate of 1.16%. The growth rate of Pulong Balibaguhan is almost the same as the municipality and is also expected to double its population in 60 years.

Module	*Summary of Baseline Conditions*
	Barangay Talaga East has a population of 1,716 in 2015. Within five (5) years, its population grew by 0.38% considering its population in 2010 is 1,684. Its growth rate is lower than of the municipality, if this growth rate will remain constant its population will double after 184 years. Perception Survey the level of support of the respondents to the project was asked. Most of the respondents (36%) were uncertain if they agree or not on the implementation of the proposed project. Many respondents (32%) also refused to answer the question. The uncertainty and refusal of the respondents to directly answer the question may be due to the reason that they still need to get more information and details about the proposed project. There were 9 or 22% of the respondents are supportive of the project, 10% of the respondents answered otherwise. Those who expressed support to the project recognized that the project will greatly help their barangay and the residents because it will bring employment, and additional income to the barangay. Those who are not in favor expressed concerns on the possible pollution of air that will impact on the health of the residents.

D. Summary of Key Environmental Impacts and Management and Monitoring Plan and Contingent Liability and Rehabilitation Fund, Mine Rehabilitation Fund, and Environmental Trust Fund

LAND

Perceived impact on land includes soil contamination due to oil spills and solid waste generation during construction and operation phase of the project.

To address the impact, waste generated by the project shall be monitored and waste segregation shall be strictly implemented. Appropriate storage containers shall be utilized especially for hazardous waste to prevent any leakage or spill. Hazardous waste shall be properly disposed and transported by DENR accredited haulers.

WATER

Water Quality

The impact of the proposed modification to water quality are:

- Generation of silted runoff coming from the dusts washed out from the roads; and
- Water contamination due to accidental spill.

To mitigate the perceived impacts to water quality the following shall be implemented:

- Develop and implement an oil spill contingency plan;
- Install spill booms;
- Impose a policy of no shipboard waste disposal;
- Maintenance and regular desilting of drainage canals;
- Install silt traps or sand boxes along the canals;
- Install and regular replacement of dust arresting bag filters to minimize the dusts along the roads;
- Provide secondary containment with capacities greater than the oil/fuel contained in tanks; and
- Regular training of Oil Spill Response Team.

Marine Resources

Major perceived impacts of the project on Marine Resources are:

- Potential oil pollution;
  - Slicks may reach coral reefs leading to loss of species and associated demersal fish (in secondary impact area only) Inadvertent introduction of exotic species through disposal of ballast water; and
  - Alteration of the marine species trophic level; potential loss of key prey.

- Disruption to benthic and in-faunal population of mollusks; and
- Loss of commercially important macro invertebrate/bivalve stocks.

To mitigate the impact on Marine Resources the following shall be implemented:

- The most modern sediment curtailment measures and engineering designs will be adopted by the project to address all water discharges from the site and inland facilities. Silt curtains will be employed and entrapment mechanisms will be adopted in order to prevent sediments and silt from spilling into coastal water;
- Annual coral reef monitoring and fish visual census will be undertaken to determine changes in distribution and abundance. Divers will be employed to monitor disturbance to corals, if any, so that appropriate recommendations can be given to the engineering teams. In extreme cases, project can initiate coral trans-location where appropriate, employing artificial reef structures as relocation site;
- Investigations on the propagation of seagrass communities in the reef flat will be undertaken and implemented if technically feasible;
- No additional permanent structures shall be set in the sea floor itself or inter-tidal areas near the port complex. Alterations in the wharf area will be kept to the minimum. All temporary structures will be removed immediately; and
- Shellfish populations will be monitored for potential enhancement of stocks.
- No permanent structures will be built in sensitive areas where bivalves are assessed to reproduce.

AIR AND NOISE

Foreseen impacts for air and noise are Noise and dust pollution

- It is likely that the operation may still cause noise and dust emission. Though, it is expected that generation of noise and dust emissions will be decreased due to the installation of new equipment including pollution control devices as part of the proposed project modification.

Impact Mitigation are as follows:

- Conduct of regular maintenance of plant equipment specifically the installed pollution control devices; and
- Conduct of routine monitoring to assess effectiveness of installed pollution control devices.

PEOPLE

Perceived impacts on Socio are:

- During the operation, the minimal workforce will be added to the existing manpower of Holcim-Mabini. With sufficient training during the construction phase, a proportion of this workforce may be sourced from the local communities.
-
- Health and safety issues will impact on local populations. Increases in traffic, potential dust and marine water pollution, and emissions from the plant may negatively impact on the health condition of the populace. Further, increases in levels of traffic close to pedestrian areas may cause physical injury.

Proposed mitigating measures are:

- Priority hiring of locals
  - Coordinate with the Barangay Councils to identify local labor pool
- Implement Safety and Health Programs for the workers and impact communities to reduce or avoid health and safety risks
- Strict compliance on the proper wearing of Personal Protective Equipment (PPE) for workers
  - Provide assistance to the Barangays on the delivery of efficient healthcare and protective services.

Below is the summary of monitoring activities to be implemented for the proposed expansion:

WATER

Parameters to be Monitored

Marine water quality parameters to be monitored are: pH, Temperature, Dissolved Oxygen, Total Suspended Solids, and Oil and Grease. For ground water quality chloride, pH and temperature values will be observed.

Monitoring Location

Marine: MW1 and MW2

Groundwater: GW1

Monitoring Frequency

Monitoring will be done at least every month by the company and quarterly by MMT. This frequency was set in relation to the prescribed submission of Self-Monitoring Report in Section 14.16 of DAO No. 2005-10, otherwise known as the "Implementing Rules and Regulations of the Philippine Clean Water Act of 1994", and MMT reports in Section 174 of DAO No. 2020-21.

AIR AND NOISE

Parameters

PM, SO_X, NO_X, TSP and CO

Monitoring Location

- Baghouse stack
- Ecohopper gensets
- Brgy. Talaga East
- Plant Gate

Monitoring Frequency

Monitoring will be done at least every month by the company and quarterly by MMT. This frequency was set in relation to the prescribed submission of Self-Monitoring Report in Section 14.16 of DAO No. 2005-10, otherwise known as the "Implementing Rules and Regulations of the Philippine Clean Water Act of 1994", and MMT reports in Section 174 of DAO No. 2020-21.

1.0 PROJECT DESCRIPTION

1.1 Project Location and Area

The Project is located in Barangay Pulong Balibaguhan, Mabini, Batangas. It is in a titled land within the following geographic coordinates in ***Table 1.*** The location map is shown in ***Figure 1***.

Table 1 – Geographic Coordinates Encompassing the Project

Corner	Longitude	Latitude
1	13°44'15.64"N	120°56'34.45"E
2	13°44'11.46"N	120°56'27.83"E
3	13°44'14.97"N	120°56'25.59"E
4	13°44'16.49"N	120°56'25.33"E
5	13°44'17.52"N	120°56'23.31"E
6	13°44'21.09"N	120°56'22.74"E
7	13°44'21.04"N	120°56'20.15"E
8	13°44'23.14"N	120°56'19.45"E
9	13°44'23.86"N	120°56'17.44"E
10	13°44'24.26"N	120°56'18.73"E
11	13°44'24.01"N	120°56'22.27"E
12	13°44'25.68"N	120°56'22.26"E
13	13°44'26.43"N	120°56'25.34"E
14	13°44'28.85"N	120°56'25.20"E
15	13°44'29.32"N	120°56'28.68"E
16	13°44'26.36"N	120°56'29.21"E
17	13°44'26.10"N	120°56'30.42"E
18	13°44'18.66"N	120°56'32.85"E

Mabini is a first class municipality in the Province of Batangas, Philippines. It is located in the Calumpang Peninsula between Batangas Bay to the east and Balayan Bay to the west.

1.1.1 Accessibility

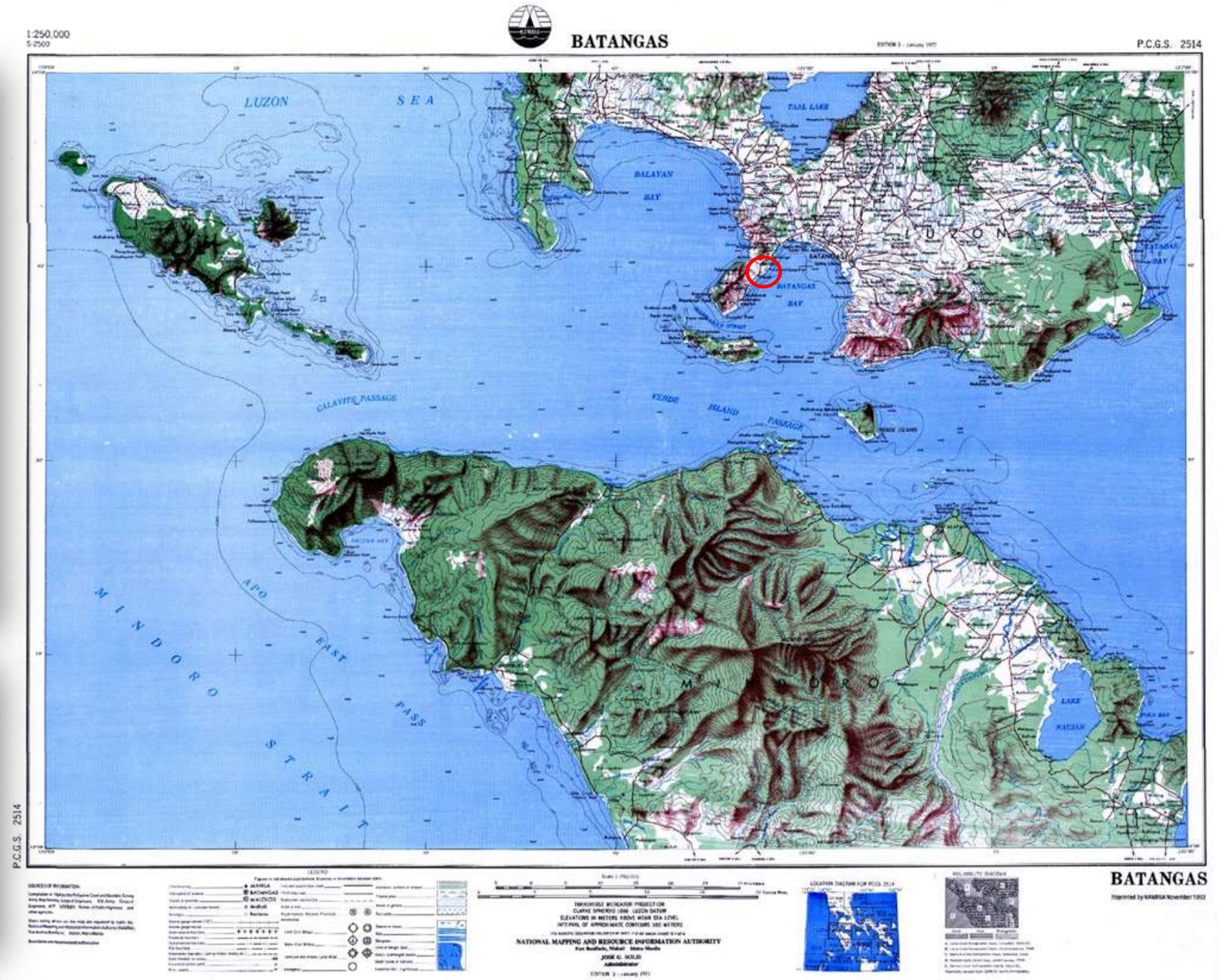
The project is accessible from Manila thru land travel via SLEX and Star Toll exiting in Batangas City, then traversing the Bauan-Batangas Provincial Road and Bauan-Mabini Road. The Project is along the Bauan-Mabini Road. Estimated travel time is 2½ to 3 hours.

The Project is also accessible by sea travel. It has its own port located in the southeast along the coastal area of Batangas Bay.

1.1.2 Impact Area

The area subjected to the EIA was based on the perceived direct and indirect impact areas of the proposed project. As stipulated in DAO 2003-30, direct impact areas, in terms of physical environment, are those where all project facilities are to be constructed/situated and the designated project area. On the other hand, areas not directly subjected to any activities/construction and those outside the project area but are within the jurisdiction of the Municipality of Mabini (e.g. stretch of river draining the project area) are considered as indirect impact areas (***Figure 2***). Consistent with the provision of DAO 2010-21, known as the "*Consolidated Implementing Rules and Regulations of the Philippine Mining Act of 1995"*, the direct impact (***Figure 3***) barangay is Pulong Balibaguhan while the indirect impact area is the Municipality of Mabini.

Figure 1 – Location Map



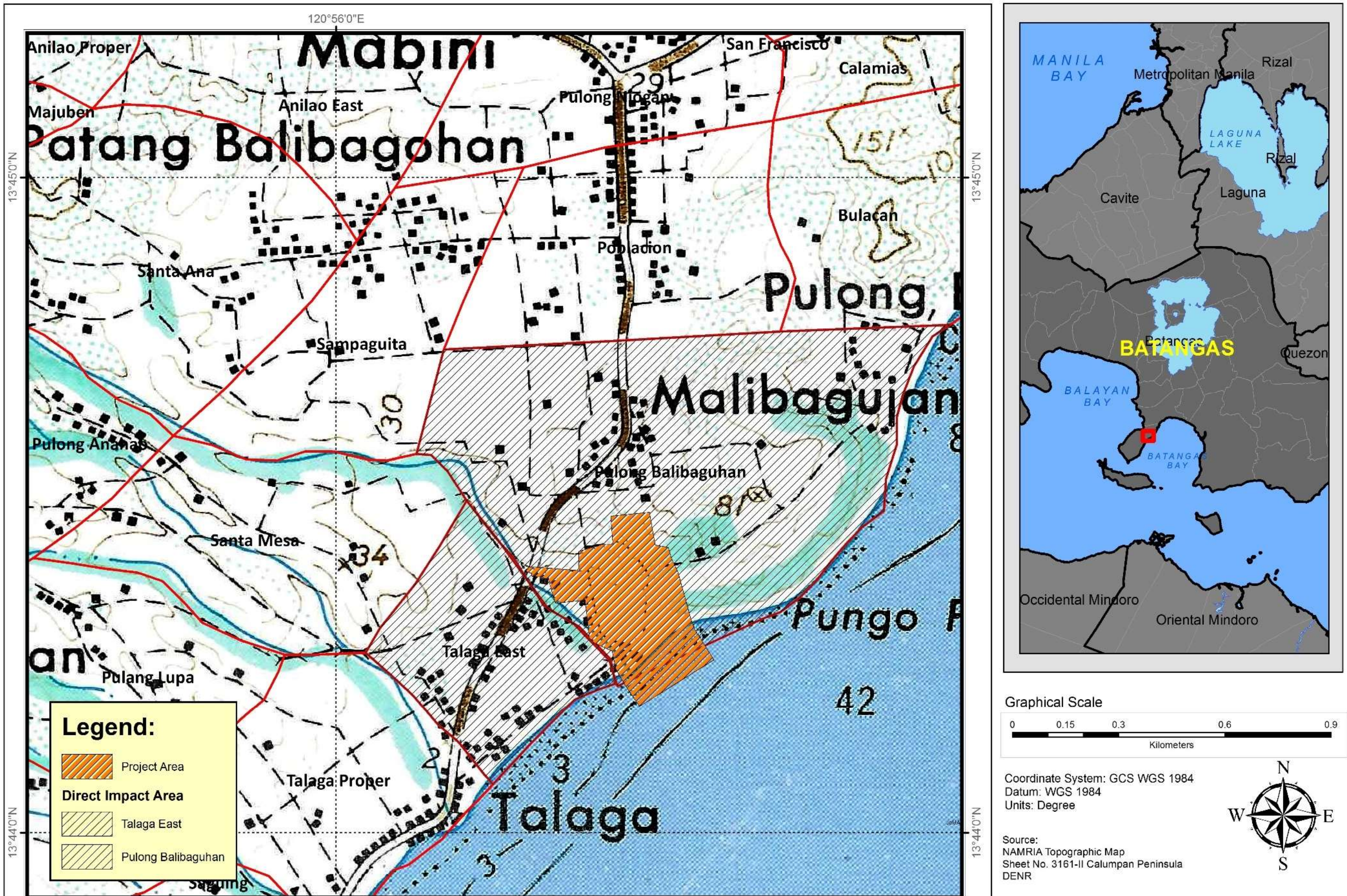


Figure 2 - Direct Impact Area (Environment)

Project Impact Area

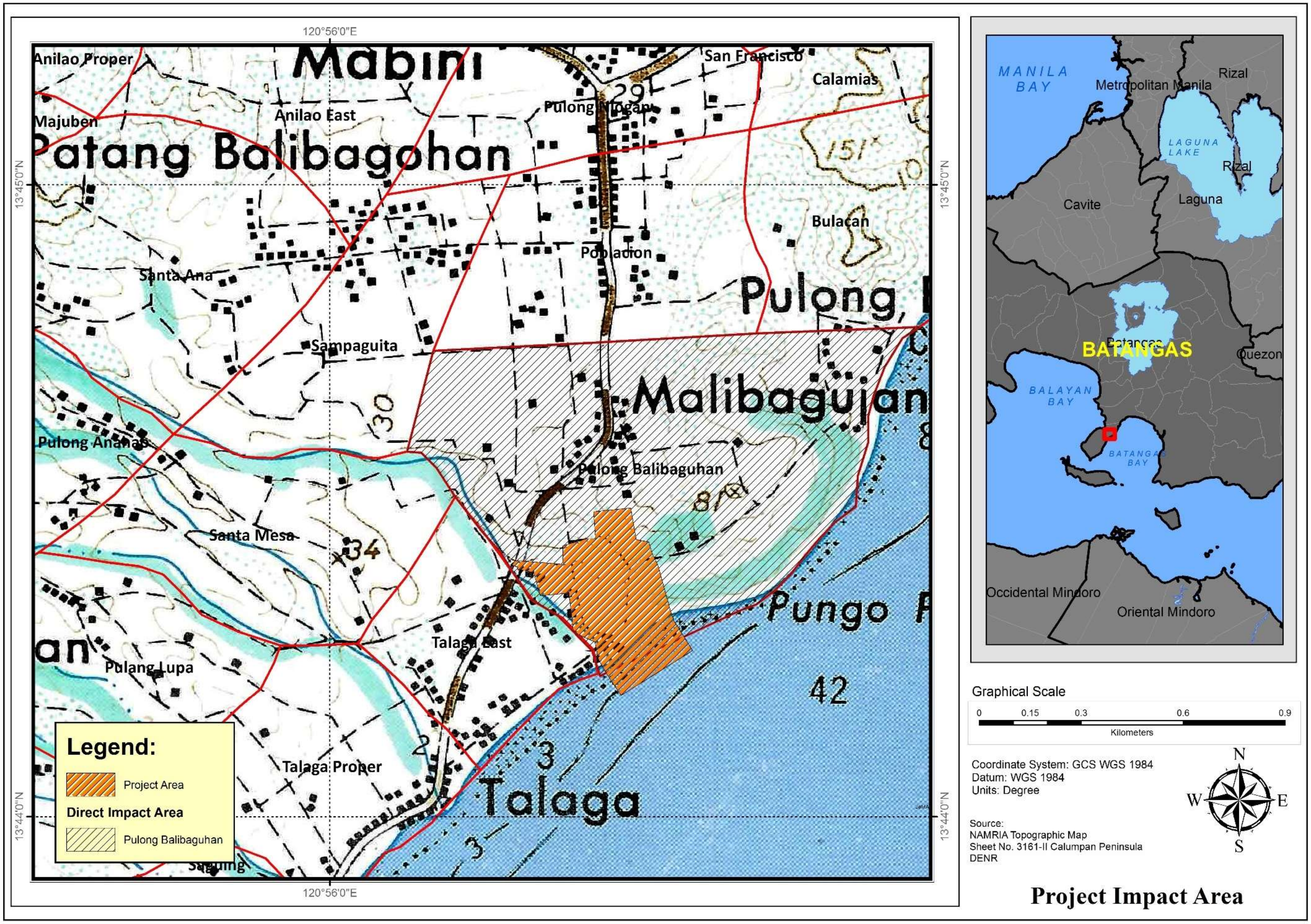


Figure 3 - Direct Impact Area (Socio)

1.2 Project Rationale

The advent of industrialization gave rise to the construction of various infrastructures such as high-rise buildings, roads, commercial centers, housing units, etc. In the establishment of these concrete structures/products, cement serves as the major ingredient for its creation.

In order to supply quality cement for supporting further rapid development of southern Metro Manila / southern Luzon, Holcim Philippines, a member of LafargeHolcim, will execute a series of small and medium size projects to rationalize the plant equipment operation, with focus on equipment upgrading, rehabilitation, debottlenecking and optimization.

The bundle of sub-projects, to carry out in Mabini plant under one project umbrella, aims to maximize the blended cement volumes, to improve dispatch capacity and to facilitate the inloading of raw materials and ground granulated blast furnace slag (GGBFS) & cement powder while keeping product quality at highest standard. This is in line with the company strategy for the medium / long term future development.

1.3 Project Alternative

The nature of the proposed modification will focus on the rehabilitation and upgrading of the existing project components of the Break Bulk Terminal and Port Facility, thus, the proponent has not considered any alternative project site.

Relative to the mill process, the proponent opted to continue utilizing the dry process since this is what the company has been using during the onset of its operations.

The Mabini plant upgrading project is encompassing a range of smaller projects (sub-projects) meant to rationalize the plant equipment operation, being focused on equipment debottlenecking and optimization. The project aim is to maximize the blended cement volumes, to improve dispatch capacity and to facilitate the in-loading of raw materials and GGBFS & cement powder. This is in line with the company strategy for the medium / long term future development.

Although there is no new complete, additional grinding installation to be built in Mabini plant, the project will improve the existing plant

1.3.1 Environmental Impact

The major environmental impact that will be brought about by the project modification considering all the above-mentioned alternatives is dust generation.

1.3.2 Consequences of not Proceeding with Project

In terms of physical environment, the project will continue its current operation. However, it will be more efficient if the plant components will be upgraded. In terms of socio economic, opportunities for employment provided by Holcim La Mabini Plant extends to other places in the Municipality of Mabini and the entire Province of Batangas other than of Barangay Pulong Balibaguhan. Additional employment will be generated once the project is implemented. With no “project option”,the opportunity for additional workforce is not possible.

1.4 Project Components

The **Mabini Break Bulk Terminal and Port Facility** is a sea terminal for raw materials in-loading and for cement in-loading and out-loading; a finishing grinding facility; and a cement dispatching center serving local markets. The Project was issued an ECC in May 19, 1997. The Site Development Map is shown in ***Figure 2***.

The components of the project are:

A. Production Facilities

1. Port in-loading
2. Grinding
3. Blending
4. Cement Dispatching

B. Non-Production Facilities

1. Office
2. Laboratory
3. Rest and Duty Room
4. Electric and Control Room
5. Machine Shop
6. Electrical Shop
7. Guest House
8. Recreation Area
9. Ready Mix Plant
10. Warehouse
11. Guard House
12. Substation
13. Parking

Equipment	Capacity/Specification
Eco-hoppers	2 sets 900 t/h for bulk materials
Pneumatic transport	500 t/h for powder materials

Equipment	Capacity/Specification
Clinker Storage	35,000 t
Slag Storage	25,000 t
Gypsum Storage	5,000 t
Limestone Storage	5,000 t
Vertical roller mill	
Single-cell silo	2 sets x 10,000 t each
Cement Packing	2 sets x Roto-packer x 8 spouts 2 sets x 2,400 bags/h
Cement Palletizing	1 set x Palletless Palletizer 2,400 bags/h

1.4.1 Facilities/Equipment for Upgrade and Maintenance

The Project will be the rehabilitation/upgrading of existing facilities and replacement of outdated/old equipment. ***Table 2*** details the existing facilities/equipment for upgrade and maintenance. ***Figure 3*** details the Process Flowsheet highlighting in the process the upgrade and maintenance.

1.1.1.1. Port in-loading/port facility

- Rehabilitation of port facilities and installation of eco-hopper and belt conveyor.

Figure 4 – Eco-hopper

1.1.1.2. Cement GRINDING FACILITY

- Upgrading of mill separator from 120tph to 140tph.

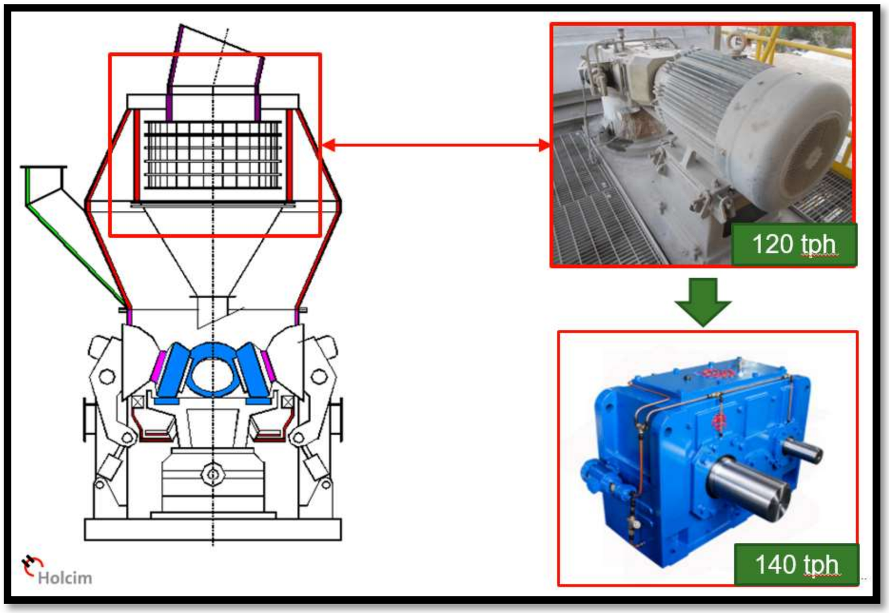


Figure 5 - Mill Separator

- Replacement of new table motor.

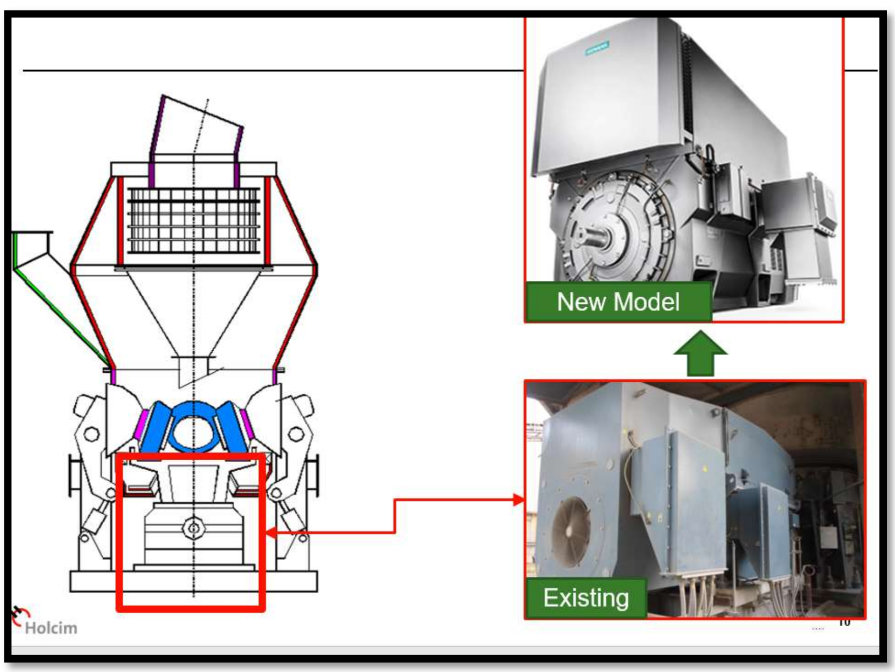


Figure 6 - Table Motor

- Replacement of existing Process Control System with latest version of Siemens S7.

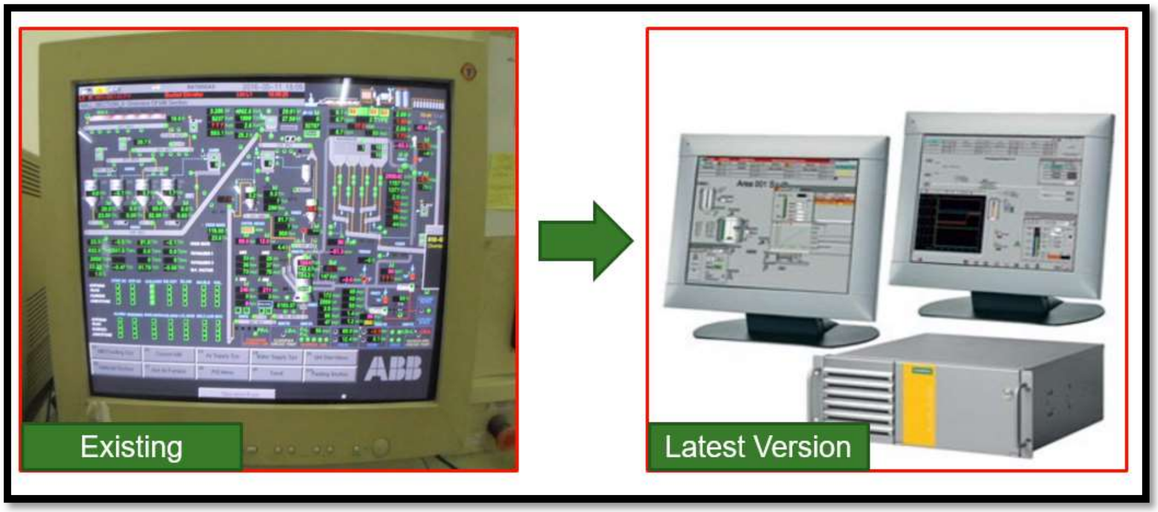


Figure 7 - Process Control System

- Replacement of turbo coupling with Variable Frequency Drive to improve fan electrical efficiency.

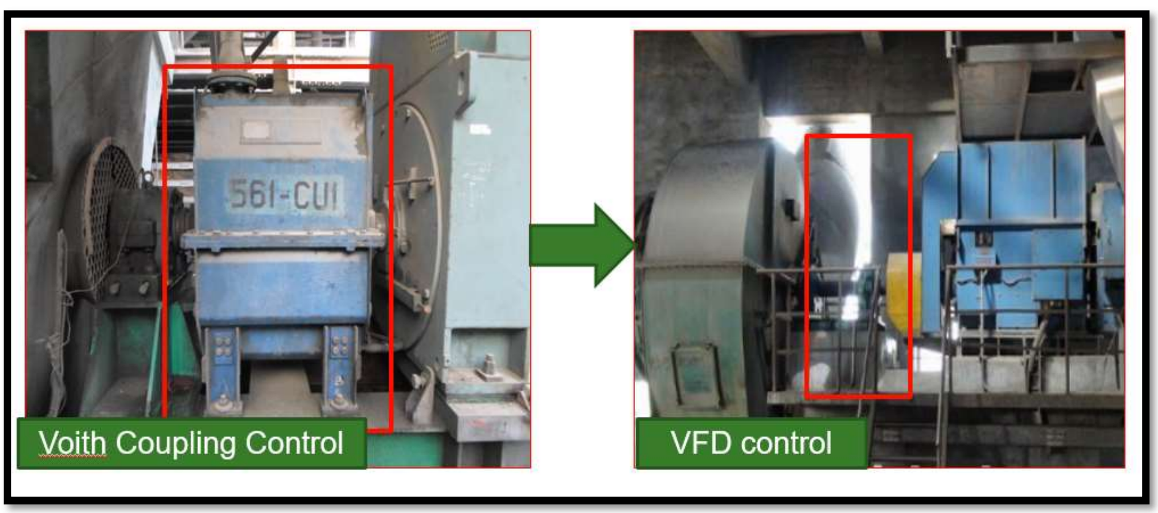


Figure 8 - VFD Control

- Installation of DALOG for real-time monitoring of gearbox.

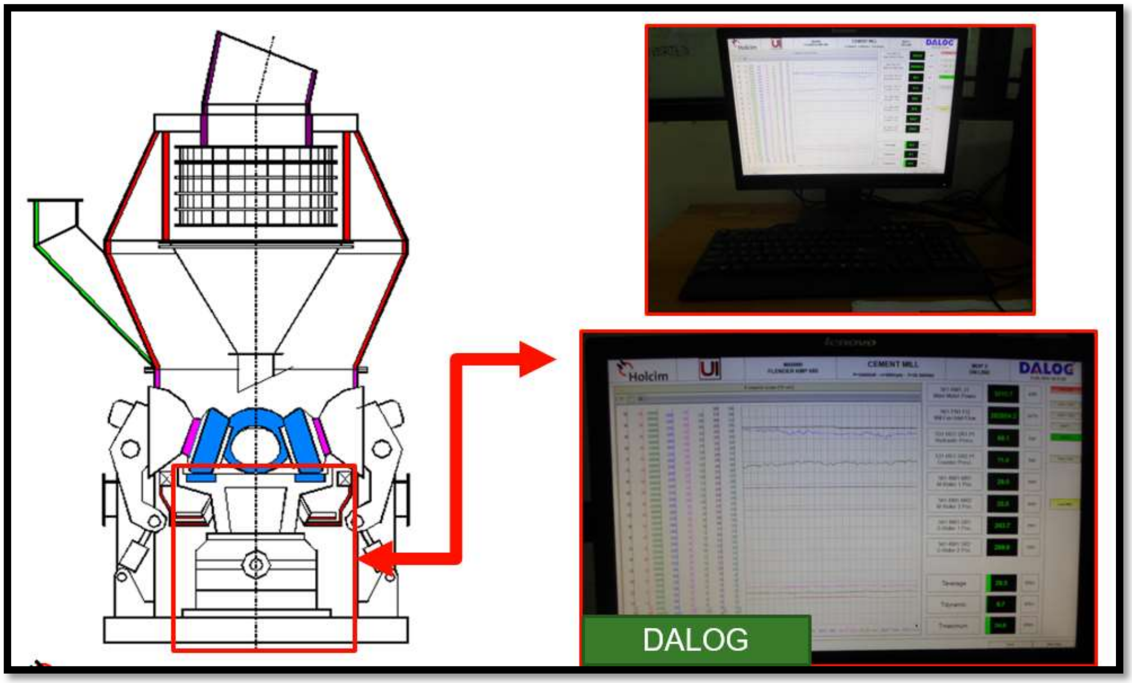


Figure 9 - DALOG

1.1.1.3. Cement Blending Facility

- Upgrading of cement mixer (6U1-MI1) to 250tph capacity

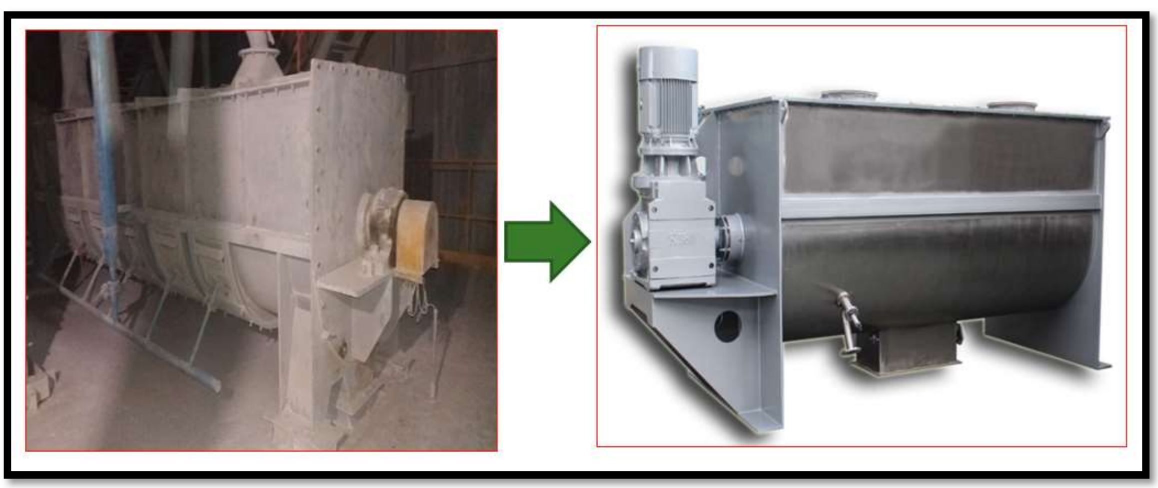


Figure 10 - Cement Mixer

- Installation of system for FA (LST) addition to HEX, after mill

1.1.1.4. Cement Dispatch Facility

- Installation of Big Bags Facility

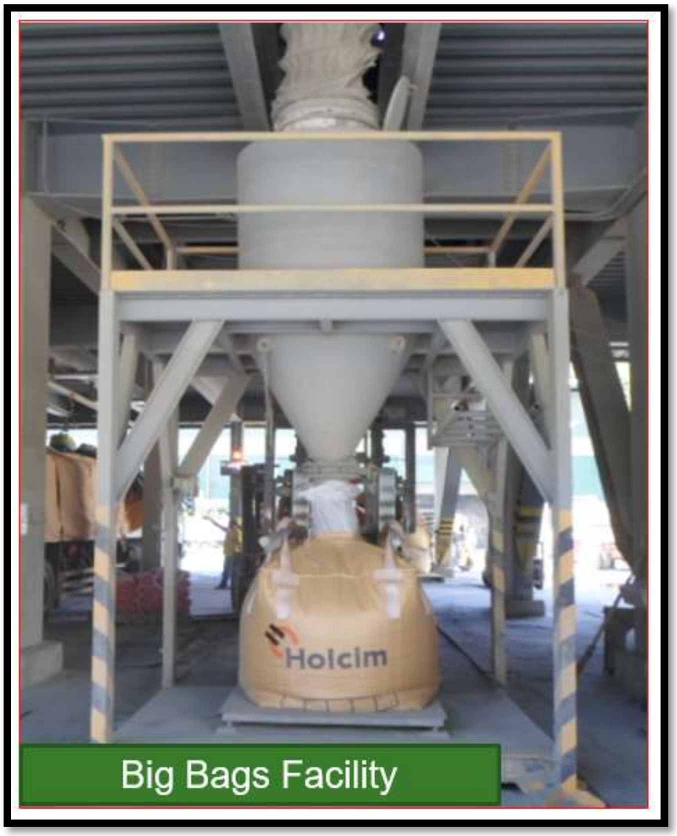


Figure 11 - Big Bags Facility

- Installation of one new palletless palletizer, plastic sheet shrink wrap for bad weather protection and sea transport.

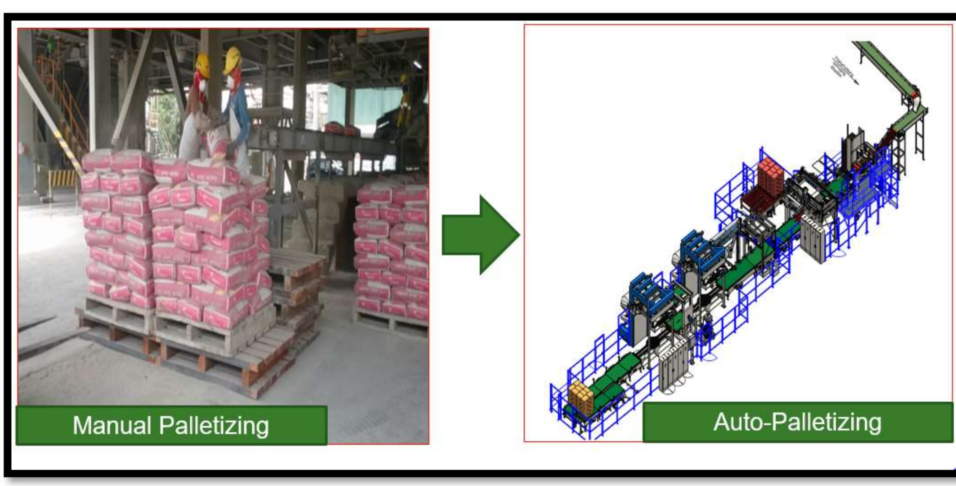


Figure 12 - Auto Palletizer

- Installation of pneumatic system for loading cement from silo to vessel.

Figure 13 - Pneumatic Transport System

- Installation of new weigh bridge to support the increase in production capacity.

Figure 14 - Weigh Bridge

Table 2 – Existing Facilities/Equipment for Upgrade and Maintenance

Project Components	*Existing Operations*	*Proposed*	*See Figure 3*
REHABILITATION/UPGRADING OF EXISTING FACILITIES/EQUIPMENT			
3. Port in-loading/Port Facility	Port facilities can receive 440 TPH of raw materials designed for RORO and LCT.	Installation of eco-hoppers and conveyors to receive 900 TPH for bulk materials and 500 TPH for powder materials.	MBFM00 MBFM01
		Installation of sea vessel cement loading facility from the silo to sea vessel	MBCD04
		Installation of a pneumatic system for loading cement from silo to vessel	
4. Cement Dispatch	Bagged cement loading and bulk cement loading.	Installation of big bags (tonner) facility	MBCD01
		Install new palletizer including transfer belt conveyor & palletless, plastic sheet shrink wrap for bad weather and sea transport	MBCD02
MAINTENANCE - REPLACEMENT OF OUTDATED/OLD EQUIPMENT WITH LATEST MODELS			
4. Grinding	Mill Separator @ 120 TPH	Replace with newer model mill separator @ 140 TPH	MBFM02
	Mill Table Motor	Replace with newer model mill motor.	MBFM05
	Process Control System	Replace with latest version.	MBFM06
	Mill Fan using turbo coupling for speed control.	Replace with VFD for improve fan electrical efficiency	MBFM07
	Mill Gear Box with no real time monitoring	Install real time monitoring system of gearbox, for improved reliability	MBFM08
5. Blending	Cement Mixer	Replace with newer model of cement mixer	MBFM03
		Install system for fly-ash or limestone addition to HEX, after mill	MBFM04
6. Others			
	One (1) Weighbridge	Installation of second weighing bridge	MBSC01
	Unpaved existing parking area	Pave the parking area	MBSC02
		Develop 2nd parking area within the project area.	MBSC03

The air pollution facilities being utilize by the company are:

1. One unit FAM portal scraper reclaimer
2. Two units DCE insertable bag filter serving three units belt conveyor
3. One unit DCE insertable bag filter serving three units belt conveyor
4. Pulse jet bag filter serving one unit clinker bin
5. DCE insertable bag filter serving one unit belt conveyor
6. One unit standard pulse jet bag house serving one unit Loesche vertical roller
7. Two units pulse bag filter serving three units belt conveyor
8. One unit LOMA heater with control dampers for air recirculation
9. One unit DCE insertable bag filter serving Air slide conveyor system
10. One unit DCE insertable bag filter serving one unit bucket elevator
11. Twelve units DCE insertable bag filter serving two units product silo
12. Two units DCE insertable bag filter serving two units bucket elevator
13. Two units bag filter serving four units cement bin with rotary packers
14. Two units bag filter serving four units cement bin with bulk loaders
15. Two units bag filter serving one cement bin
16. Two units Aumond ecohopper

1.5 Process/Technology Option

1.5.1 Inbound Raw Materials and Storage

In-bound raw materials arrive at the plant by sea transport thru the jetty/port or via road transport. The bulk raw materials such as clinker, granulated blast furnace slag (GBFS) or ground granulated blast furnace slag (GGBFS), gypsum, crushed limestone, and other cement additives are normally transported by either ships or LCT barges to the private jetty of the plant. In some situations, the raw materials may be either sourced locally or shipped into a nearby port and trucked to site.

Upon arrival at the jetty/port, the bulk raw material are unloaded into eco-hoppers (provided with dust arresting bag filters) and discharged into the enclosed belt conveyors for storage in the longitudinal composite storage shed.

The barged (LCT) bulk raw materials are transferred to the same storage shed via trucks.

The jetty/port can also receive the ground granulated blast furnace slag (GGBFS) in powder form. The GGBFS will be unloaded and transferred to one of the 10,000 tons storage silos via a fully enclosed pneumatic conveying system.

The plant also has the capacity to receive pre-ground limestone and fly ash via tanker trucks. These powders will be unloaded in a fully contained pneumatic conveying system and stored in bins on site, for straight use in the blending process.

1.5.1.1 Processing

The bulk raw materials are extracted from the storage shed, weighed and fed into a gas swept vertical roller mill (VRM) with a hot gas generator (for drying), separator (for product quality control), gas circuit with a bag filter exhaust fan and stack and an external material re-circulating system.

The hot gas generator (HGG) is fired using light fuel oil (diesel).

The VRM is capable of co-grinding the clinker and slag together with other additive materials to directly produce blended cement or separately for post mill cement blending. The plant has the option of also using trucked in pre-ground limestone and fly ash for producing blended cement.

Once the grinding process is completed, the finished product are transported through enclosed conveyor system and stored in the one of or both silos.

The special blended cement are prepared according to the various requirement of product design by means of blending slag meal (GGBFS), ground limestone, fly-ash and/or other cement additive in ground form, in a mixing installation.

1.5.1.2 Dispatch Outbound Materials

The OPC type cement, special blended cement or GGBFS are dispatched in the cement dispatch plant, either in bulk tanker trucks or packed into bags. The bagged cement are then loaded onto trucks and dispatched to the customers.

The bagged cement may also be packed into palletless pallets, plastic film shrink-wrapped for wet weather protection, and dispatched via ships or LCT barges, as well as by trucks.

The plant can also dispatch via sea transport the following products:

1. Bagged cement (loaded into ships or barges)
2. Finished bulk cement (conveyed from the storage silo to the ships in a fully enclosed system)

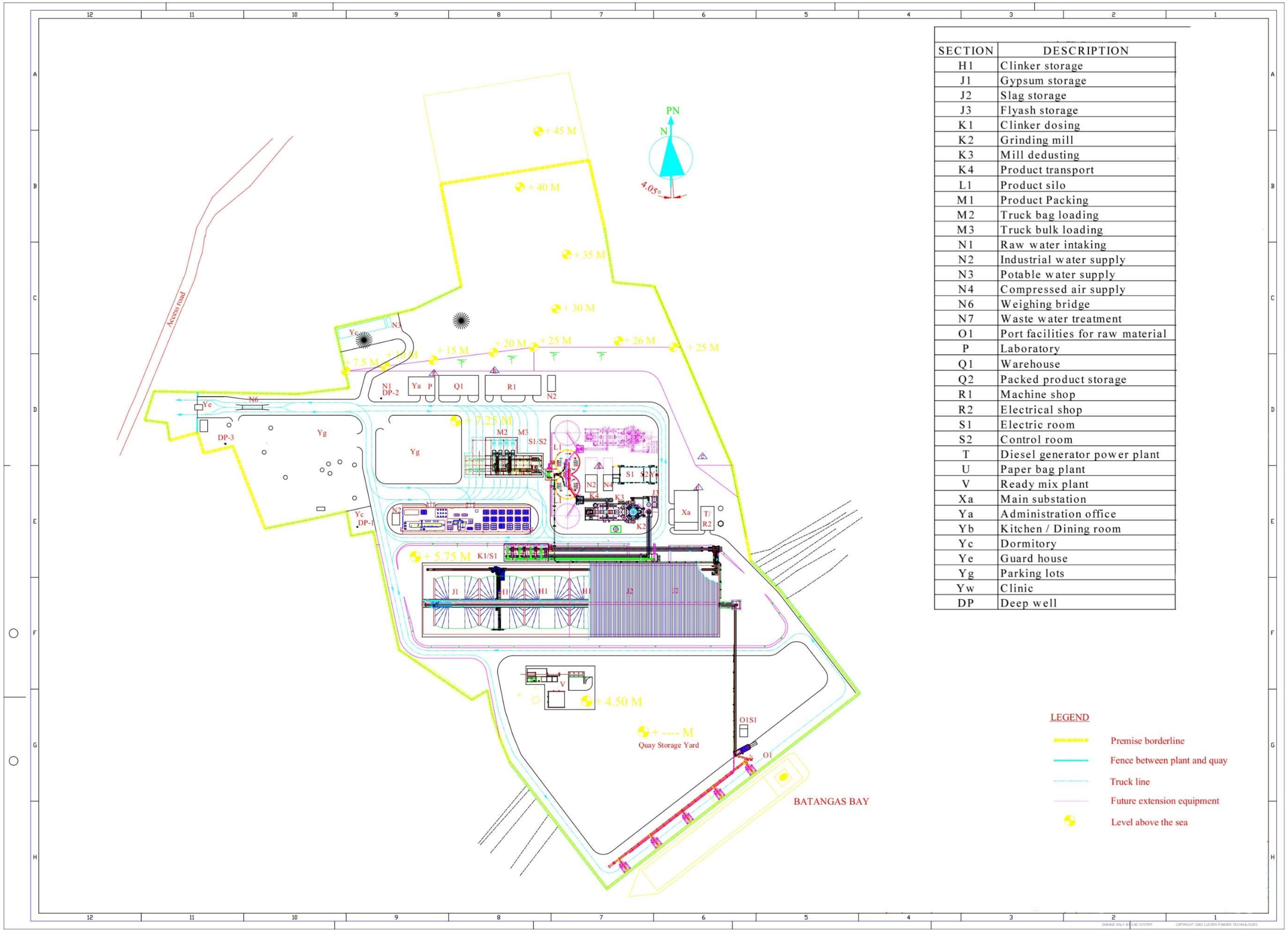


Figure 15 – Site Development

Figure 16 – Mabini Plant Flowsheet Detailing the De-bottlenecking/upgrade

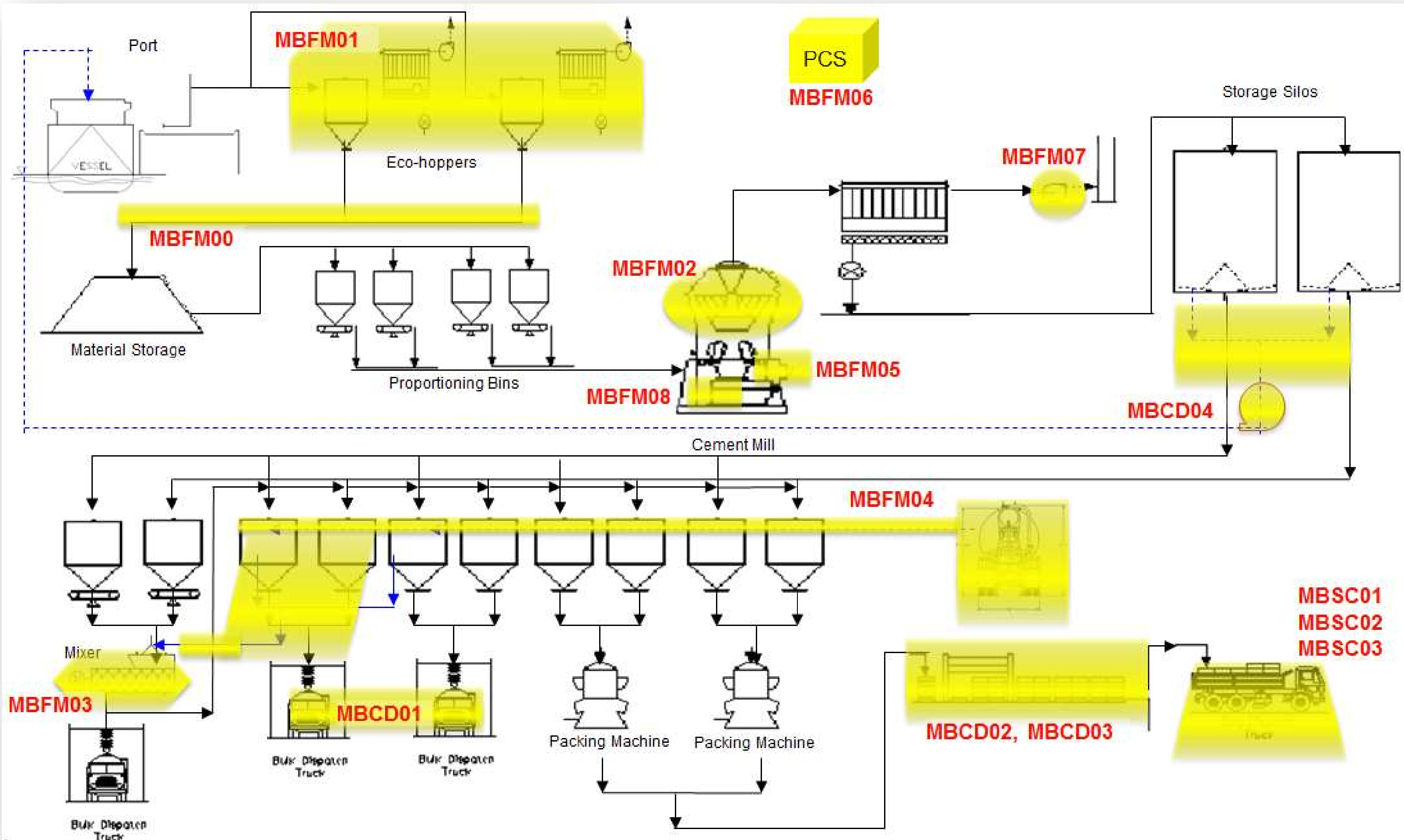


Figure 17 - Existing Plant Process

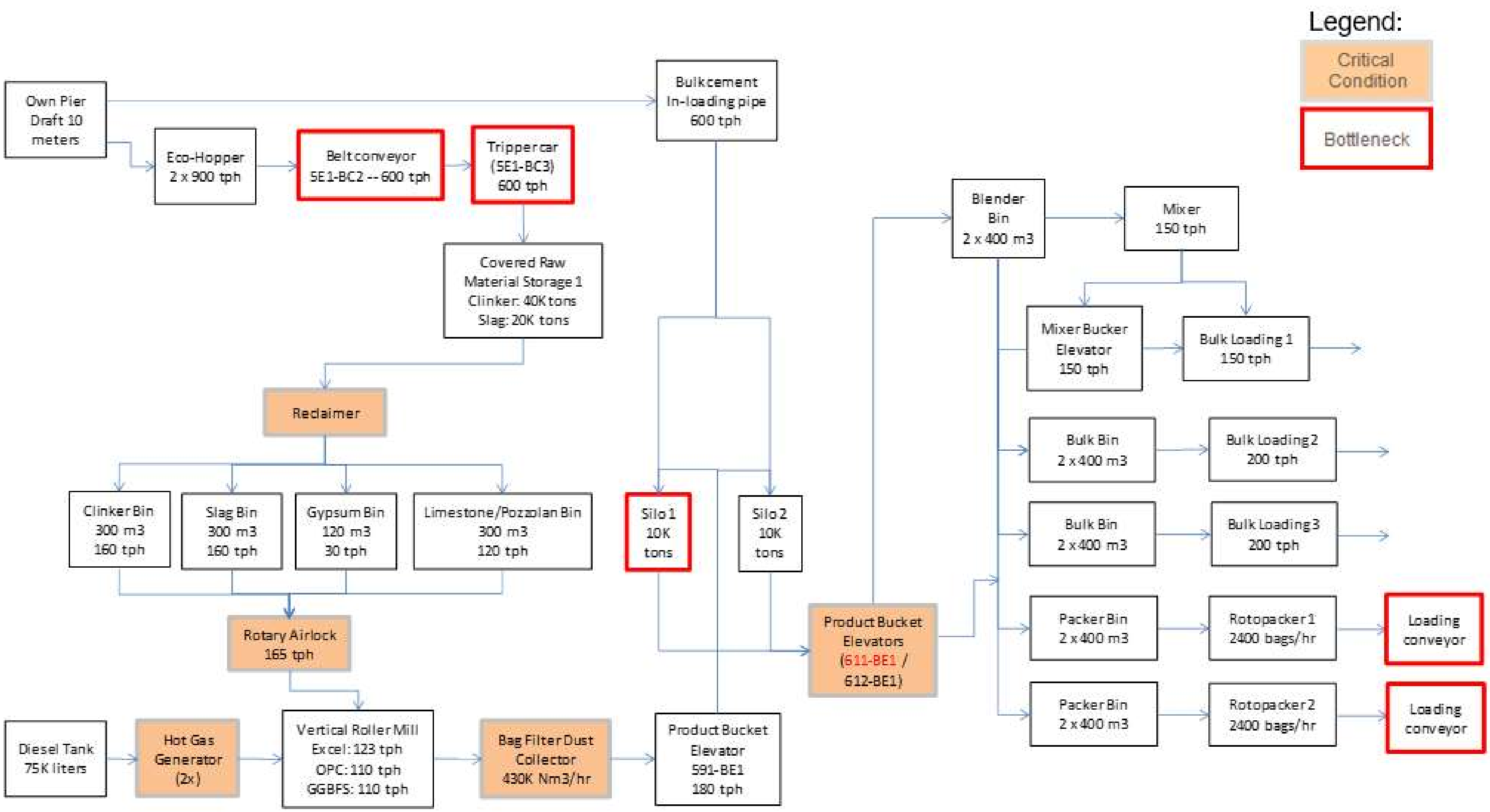


Figure 18 - Proposed Plant Process

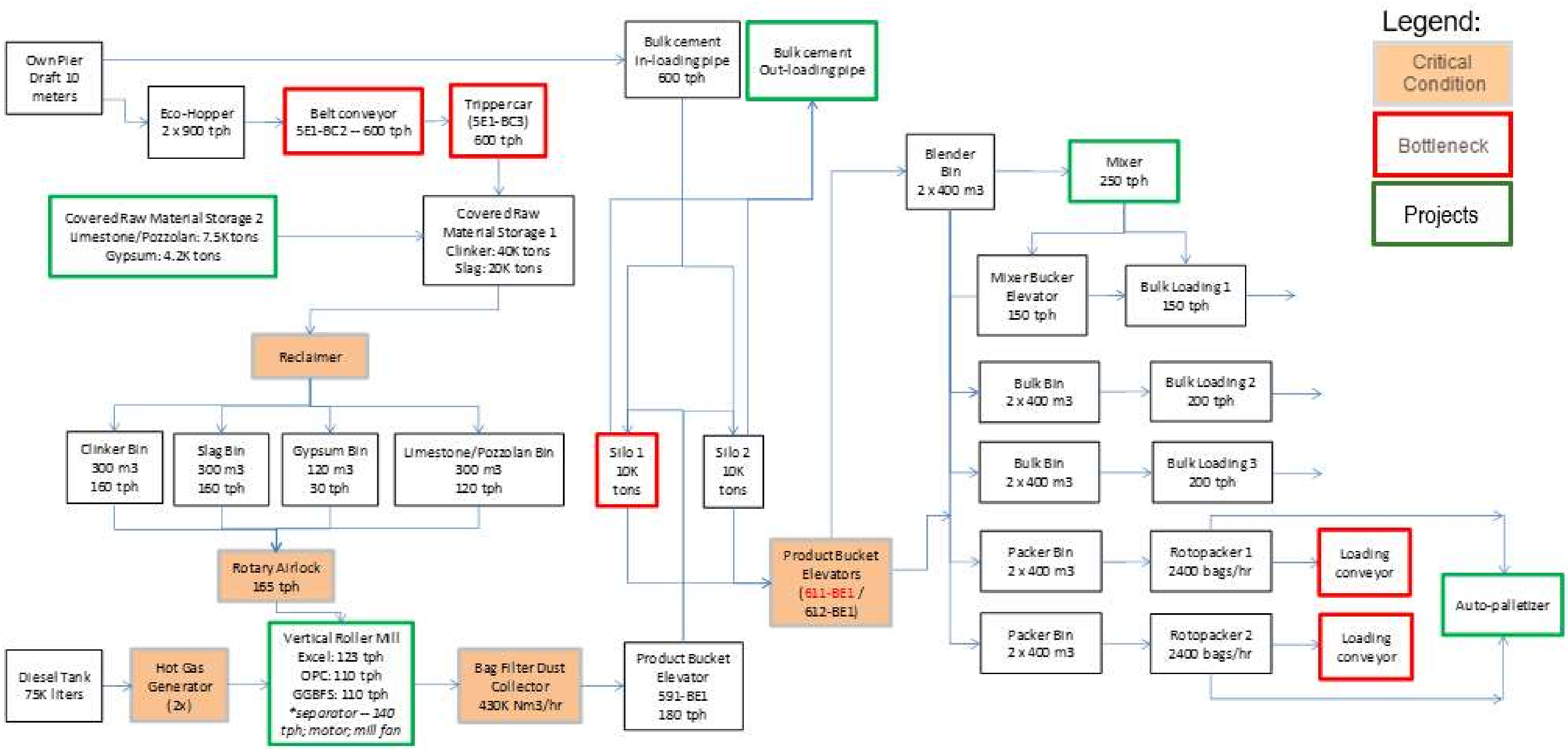


Figure 19 - Material Balance (850,000 MT)

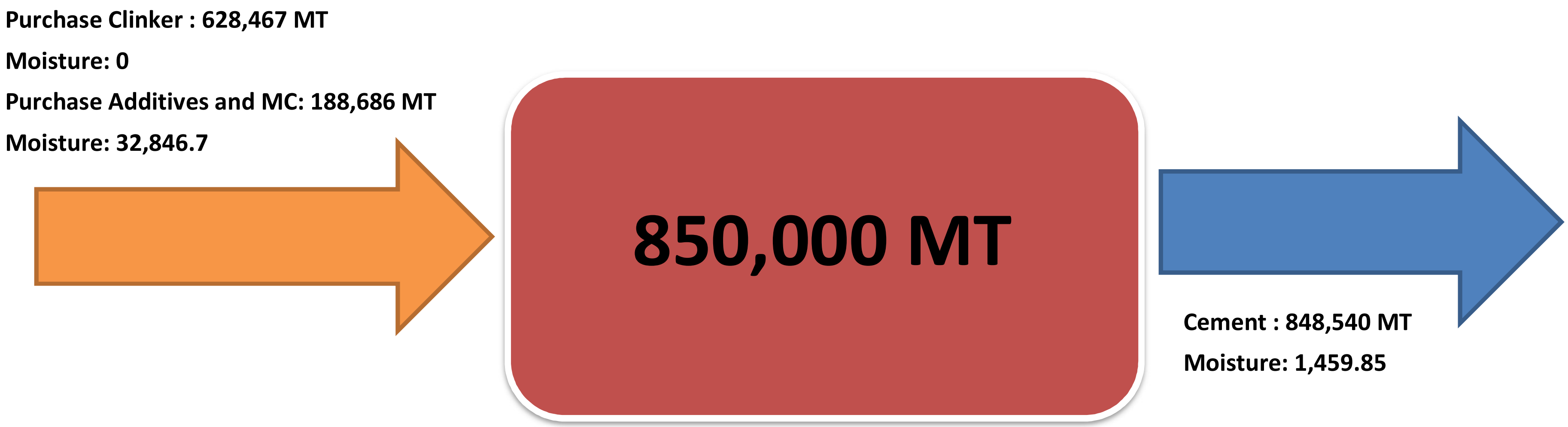


Figure 20 - Material Balance (1,200,000 MT)

1.6 Project Size

1.6.1 Project Area

The project is located in Mabini Batangas covering a total area of 255,576 m^2 (Previous ECC area, no area expansion).

1.6.2 Production Capacity

The project has an existing production capacity of 850,000 MT/year, to support the growing demand of cement in the country, the company will increase the production capacity to 1,200, 000 MT/year of cement products.

1.7 Development Plan, Description of Project Phases, and Corresponding Timeframes

1.7.1 Pre-Construction Phase

- Planning of technical design and finalization of construction method for the installation of the plant facilities;
- Securing of necessary permits.

In compliance to the commitment of environmental protection and community development, the activities stipulated in the existing Environmental Management Plan (EMP), Environmental Monitoring Plan (EMoP), and Social Development Plan (SDP) shall still be implemented.

1.7.2 Construction Phase

Construction phase involves the following:

- Hiring of qualified manpower required to complement the workers in the construction/rehabilitation works; and
- Construction of new plant facilities to support the proposed expansion.

The construction/rehabilitation of equipment/facilities is projected to commence after the acquisition of all regulatory permits from government offices.

1.7.3 Operation Phase

The operation phase covers the grinding, mixing, bagging and dispatching of cement. During this phase, the company will also be implementing the activities stipulated in the EMP, EMoP, and and SDP; simultaneous with its operations to ensure environmental protection and community development.

1.7.4 Abandonment/Decommissioning Phase

The proponent will continuously operate and maintain the project as long as it is profitable and economically viable. Nonetheless, during the operation of the project, in case some of the components are no longer operational, such component will replaced by new operational facilities.

If the proponent decided to stop the project operation, a decommissioning plan will be prepared and implemented.

1.8 Manpower

The total manpower required, including the personnel for a three shifts operation in the plant, will 31 employees. The breakdown of the position and required number of personnel are provided in ***Table 3.*** Hiring of employees will be based in accordance with the labour laws, qualifications and skills.

Table 3 – Manpower Requirement

Position	No of Personnel
Operations Manager	1
Production Manager	1
Mechanical Maintenance Manager	1
Electrical Maintenance Manager	1
Maintenance Planner	1
Production Supervisor	5
Production Engineer (Operators)	4
Process maintenance technician	14
Quality Assurance Engineer	1
PPE/Production Planner	1
CSR officer/AA	1
Total	31

The Project will be managed by an Operations Manager that directly report to the Holcim Management. The daily operations of the plants will be managed by an experienced personnel who shall oversee the operations, finance, production and sales function of the Project. The Table of Organization of the Project is presented in ***Figure 4*.**

1.9 PROJECT COSTS

The amount of PHP664.60 Million is allotted for the Project. The breakdown is provided in ***Table 4***.

Table 4 – Project Costs

Project Component	Amount (PHP Million)
1. Port in-loading	182.10
2. Grinding	121.00
3. Blending	76.00
4. Cement Dispatch	264.50
5. Others	21.0
Total	664.60

2.0 ASSESSMENT OF ENVIRONMENTAL IMPACTS

2.1 Land

2.1.1 Land Use and Classification

2.1.1.1 General Land Use

The geographic location of the Municipality of Mabini makes the municipality the melting pot of contrasting development trends that can co-exist and prosper together. Industrial and tourism developments are both present in the municipality. Industrial land uses are along the Batangas Bay areas on the eastern side of the municipality. Tourism developments are very prominent on the western side along the Balayan Bay areas. These contrasting but co-existing developments are made possible by nature, specifically, that point at Verde Island Passage where the currents of the two water bodies meet. At this point the currents meet and then go their separate ways again not inflicting pollution but preserving each other's state. Industrial and tourism land uses are very prominent land use categories in the municipality. In the central portion, are plateaus of hilly and mountainous portions that serve as settlements and agro-forest areas. Being generally steeply hilly and mountainous. Areas above 18% slope dominate the landscape of the municipality. Agricultural activities are not of the prime nature. There are no inland waterbodies that can be sourced for irrigation purposes. Open grasslands are also present in patches in all barangays. Bult-up areas, however, are present, thriving and growing in each of the barangays and the Poblacion areas of the municipality. The following table shows breakdown of existing general land uses in the municipality.

Based on the Landuse Map of Mabini, the project is situated within the built- up industrial zone ***Figure 21.***

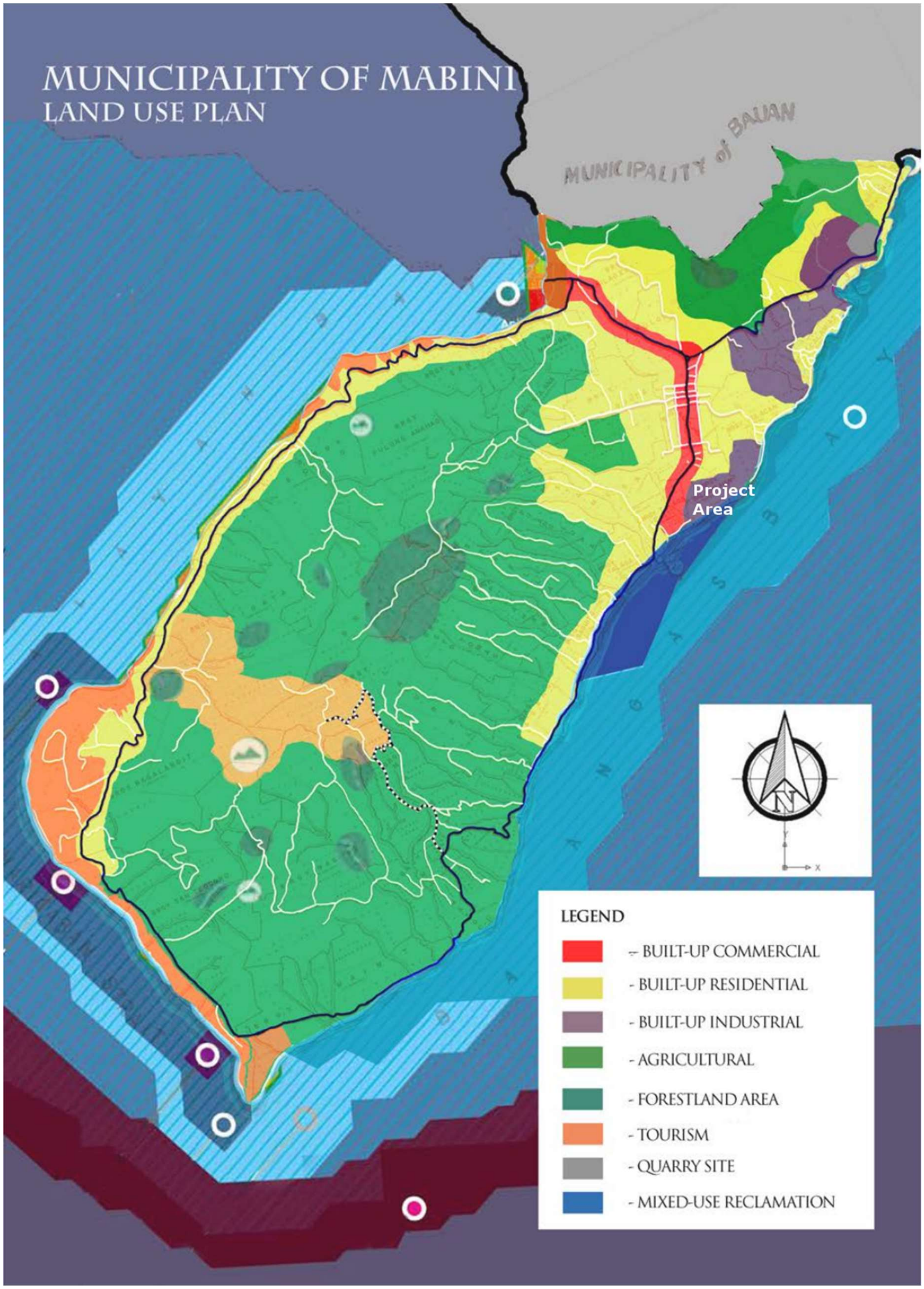


Figure 21 - Landuse Map of Mabini

2.1.2 Geology/Geomorphology

2.1.2.1 Topography

The general topography is characterized by valleys between prominent hills or mountains. Mabini is a town in the southern tip of Batangas Province. It has peninsular characteristics rich in attraction for its scenic and natural beauty. It has irregular coastlines with rugged surfaces and harborial beaches. Prominent hills and green mountains are also present in the area. The notable elevated portions are Mt. Panay, Mahabang Gulod and Gulugod Baboy. There are no inland water bodies. The blue sea water of Balayan and Batangas Bay nearly surrounded the municipality on the eastern, western and southern sides of the municipality.

2.1.2.2 Slope

Slope ranges from 0-3% to 50% and above. Majority of the land area had 50% and above slope. This constitutes about 54% of the total land area. These are the barangays situated on the central, eastern and western portions of the municipality extending down the coastal area of Balayan Bay, Maricaban Strait and Batangas Bay. Highest elevated areas only have slope of 54% and above. These are include Mailayen Mountain, Mount Panay and Mt. Gulugod Baboy.

Based on the slope map in ***Figure 22*** the project is within the 0% to 8% slope class.

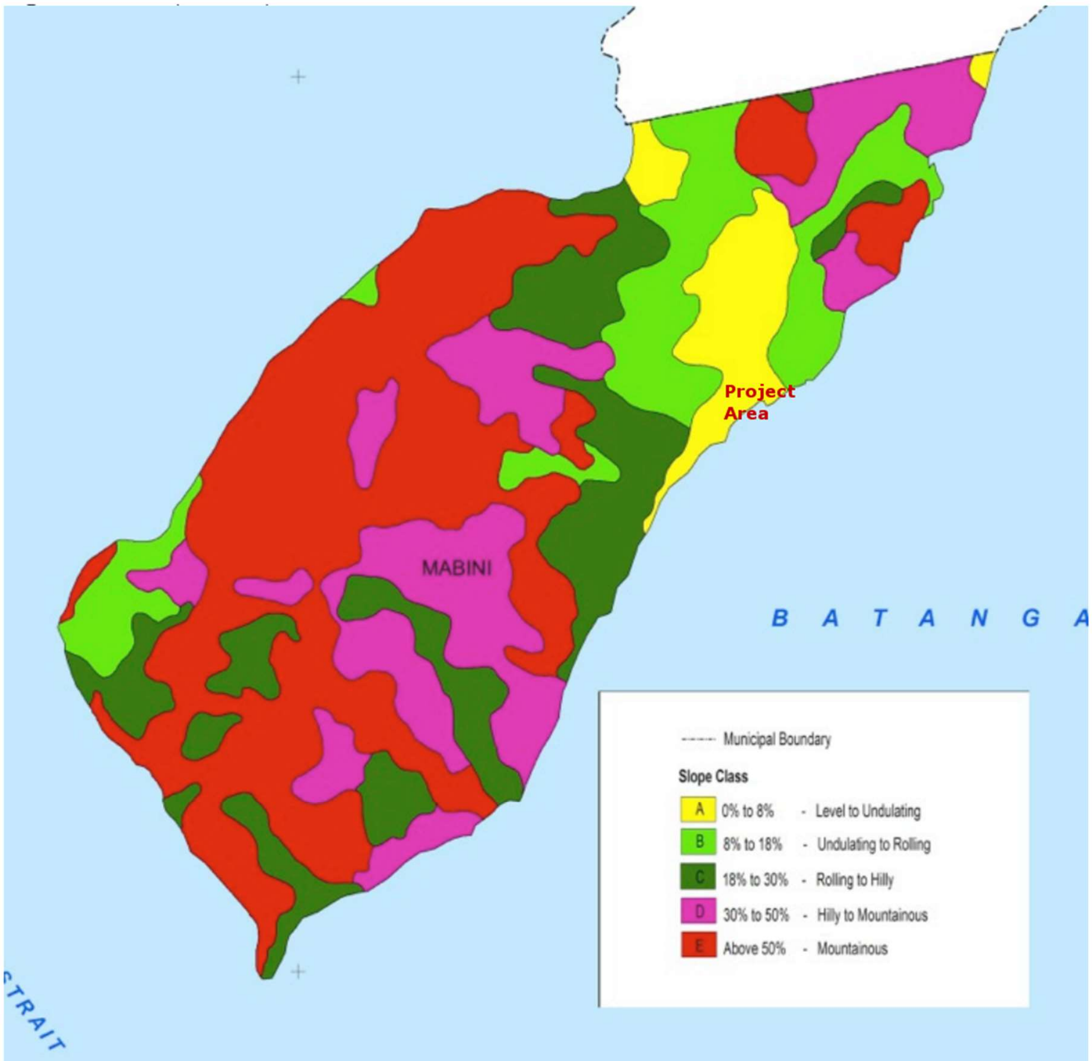


Figure 22 - Slope Map

2.1.2.3 Geology

The municipality has two types of geological bedrock formation. Those on the northern portion towards Bauan are of merely limestone and poorly consolidated sediments while those on the southern tip are of metamorphosed rocks, volcanic and highly crystallized rocks. These are the most stable bedrock foundation vis-àvis compressive strength.

2.1.2.4 Natural Hazards/Constrains

The result of geohazard assessment conducted by Mines and Geosciences Bureau on June 2013 are as follows:

Barangay	***Landslide Susceptibility***	***Remarks***	***Flood Susceptibility***	***Remarks***
Pulong Balibaguhan	-	-	Low	Drainage overflow during rainy season
Talaga East	Low	-	Moderate to high	Affected by storm surges

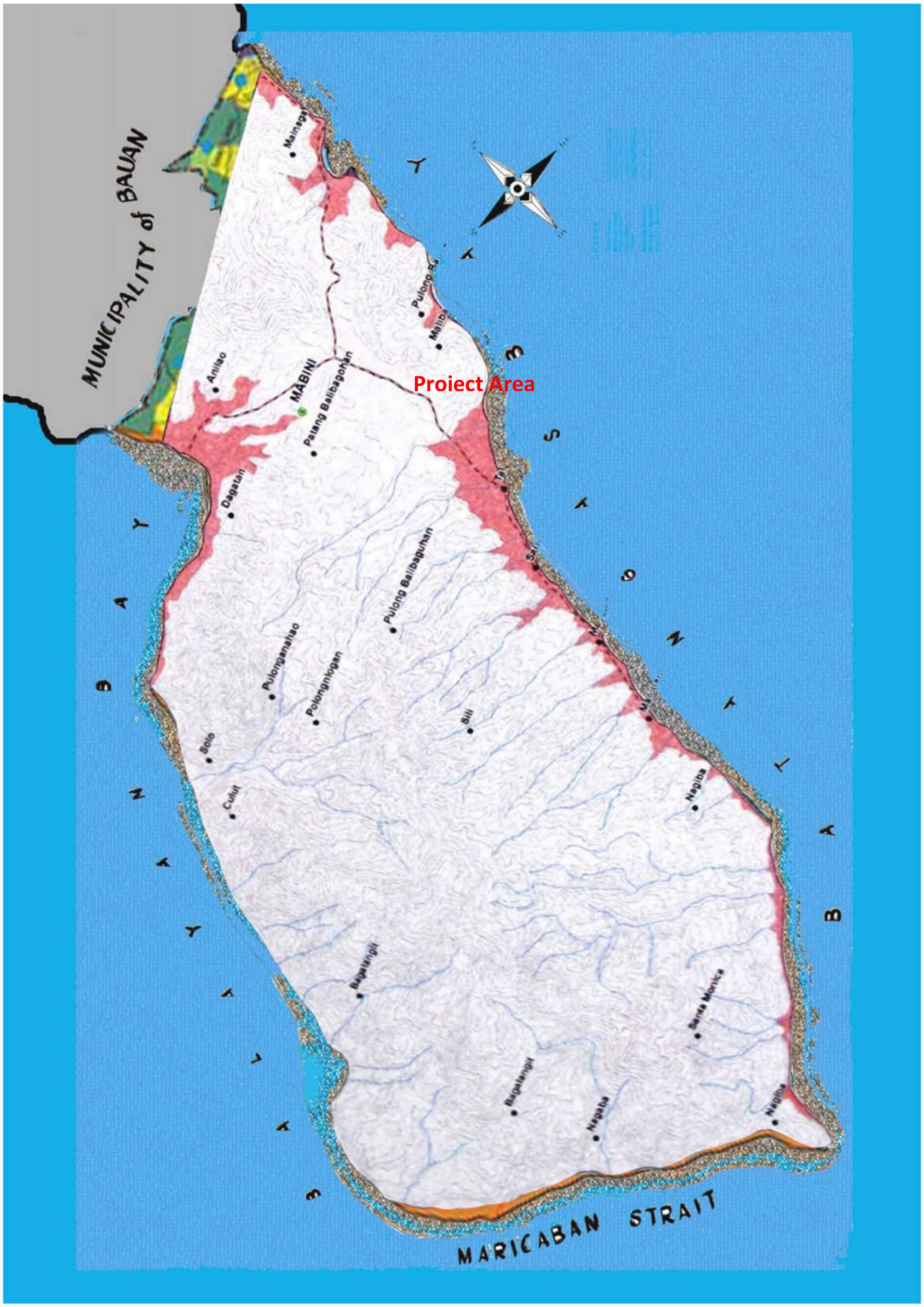


Figure 23- Flood Susceptibility Map

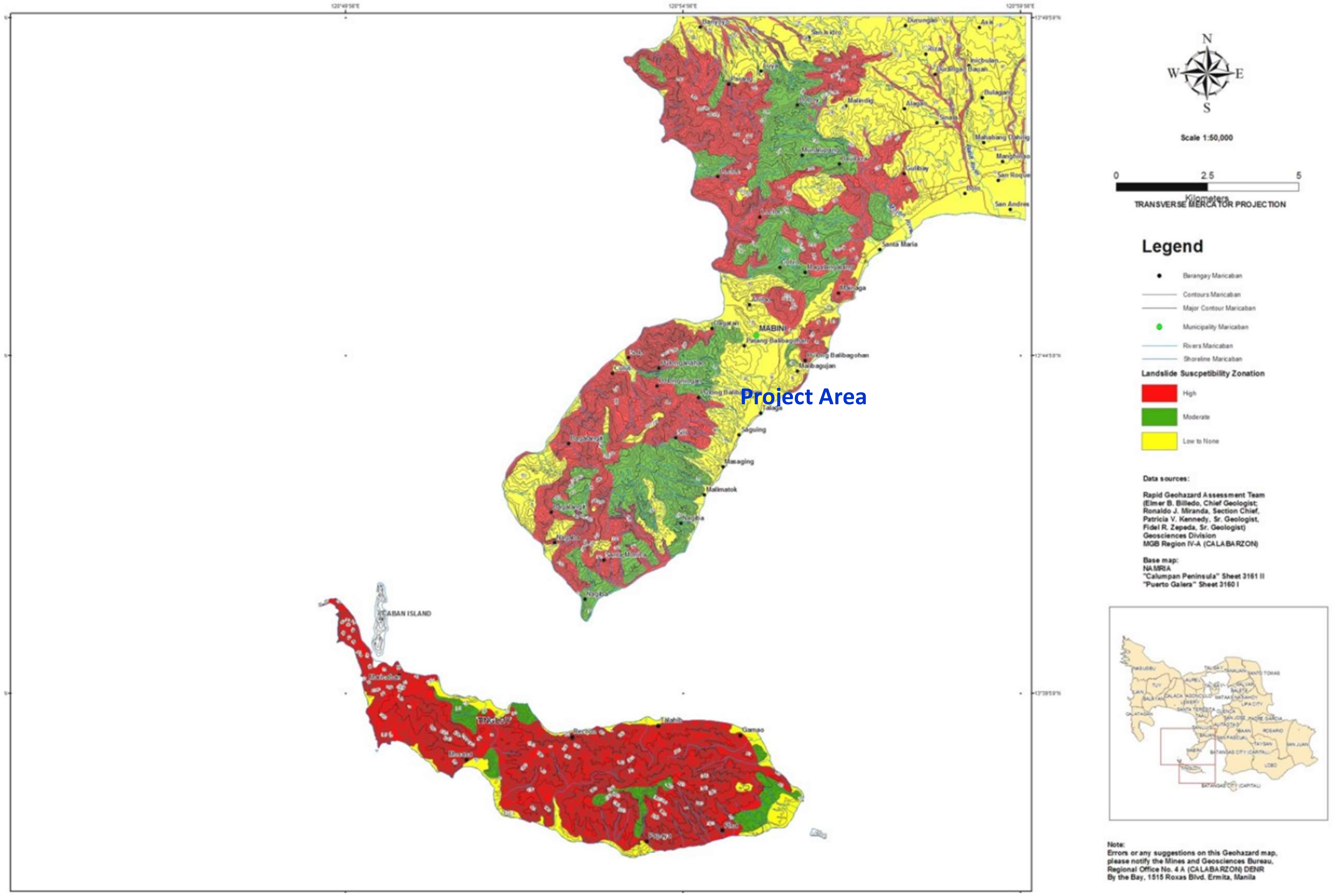


Figure 24 - Landslide Susceptibility Map

2.1.3 Pedology

As per soil report by the Bureau of Soils for the province of Batangas, the soil types of Mabini are Ibaan and Sibal series.

There are three soils types present, the Ibaan loam with a mixture of gravel is generally found in mountains and hills (gravel and tuffaceous concretions are the characteristics features of the surface and subsoil). The hillsides are covered with coconut trees, and physical characteristics.

The surface soil of Ibaan loam is brown to light reddish-brown slightly friable and granular loam. The subsoil is brown to dark brown tenacious clay loam with tuffaceous in lower subsoil. The surface soil is sandy in texture. Upland rice is the principal crop, while corn, sugar cane, citrus, coffee, cacao, bananas and various kinds of vegetables are also growth on this soil. Sibal clay is finely granular, somewhat pervious when dry but sticky when wet. The upper part of the subsoil is dull brown grayish brown almost compact in some places. It consists of calceous materials and is appreciably heavier in texture than the surface soil. The lower subsoil is coarse granular to cloddy friable clay with varying quantities of calceous materials. The vegetation's luxuriant bananas and vegetables are suited to this type of soil.

2.1.4 Terrestrial Ecology

Majority of the project area is cemented/paved, hence, there will be no flora and fauna species to be affected. As part of the commitment of the company to the environment, various planting program within and outside the plant were implemented.

2.2 The Water

2.2.1 Hydrology/Hydrogeology

2.2.1.1 Drainage Morphology

The project area is situated within the Southern Tagalog Water Resources Region (Water Resources Region 4) which is comprised of 42 Principal Rivers (***Figure 25***). However, the municipality of Mabini, Batangas, where the project is located, has no inland water bodies. It is generally characterized by valleys between prominent hills or mountains. It is bounded by irregular coastlines with rugged surfaces and harborial beaches (Mabini CDP, 2015)[2]. Surface runoff within the project facility drains directly to Batangas Bay.

The proposed rehabilitation and upgrading of the existing project components will not involve any area expansion that may cause any changes in the drainage patterns of the area. Given the same project area, the volume of surface runoff coming from the project facility is expected to be the same.

2.2.1.2 Groundwater Resource

The project area is underlain by local and less productive aquifers based on the Groundwater Availability Map shown in ***Figure 26***. This type of aquifer has very low to moderately high permeability with well yields mostly < 6 L/s.

2.2.1.3 Water Use

The Project's domestic water supply is sourced from the local water utility provider. Two (2) deep wells are installed within the facility but only one (1) deep well is being used mainly for watering of roads for dust suppression and also for watering of plants. Average monthly water consumption, based on the submitted Self-Monitoring Reports (SMRs) is 164 m^3 (January 2015 – October 2016 data) (***Figure 27***).

The process involved in the cement production is dry process. Water consumption in this kind of process is very minimal since water is mainly used for cooling of equipment. Cooling water is also being recirculated, with minimal make up water, to minimize water use.

The proposed modifications are not expected to have an impact on water use or cause water use competition.

2.2.1.3.1 Water Use – Impacts and Mitigation Measures

Project water demand is considered to be minimal since the project implements a dry process method in the cement production. Process water, mainly for cooling, is being recirculated (closed circuit) with minimal make-up water. The company has its own deep well as its water source and the proposed modification is not expected to have an impact on water use or cause water use

[2] Municipal Government of Mabini, Batangas. (2015). *Comprehensive Development Plan 2016-2025.* Mabini, Batangas.

competition. Holcim will continue to implement water conservation measures through continuous implementation of a closed-circuit process and regular maintenance of its water system to minimize system losses.

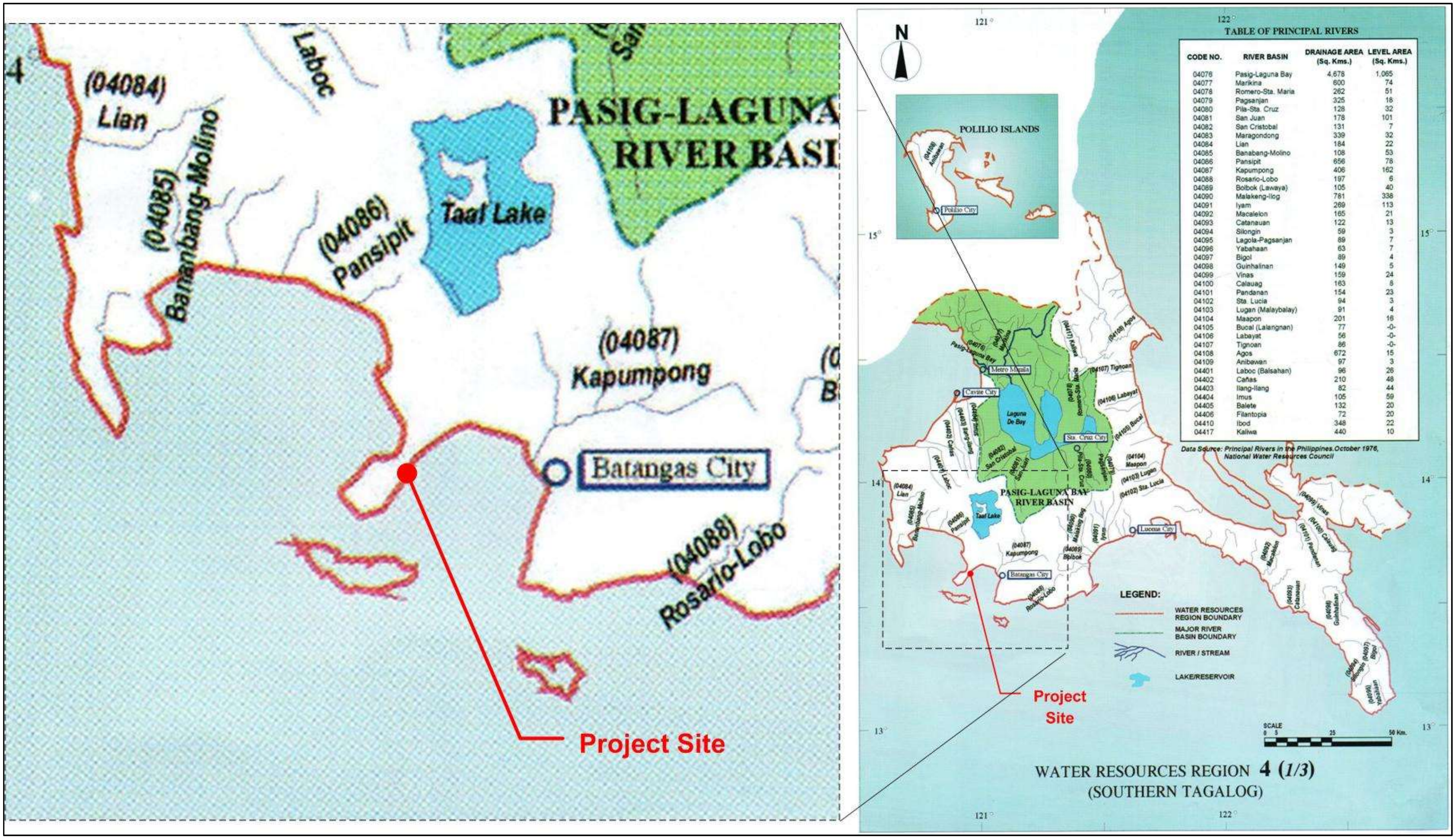


Figure 25 - Map of Water Resources Region 4 Showing the Location of the Project

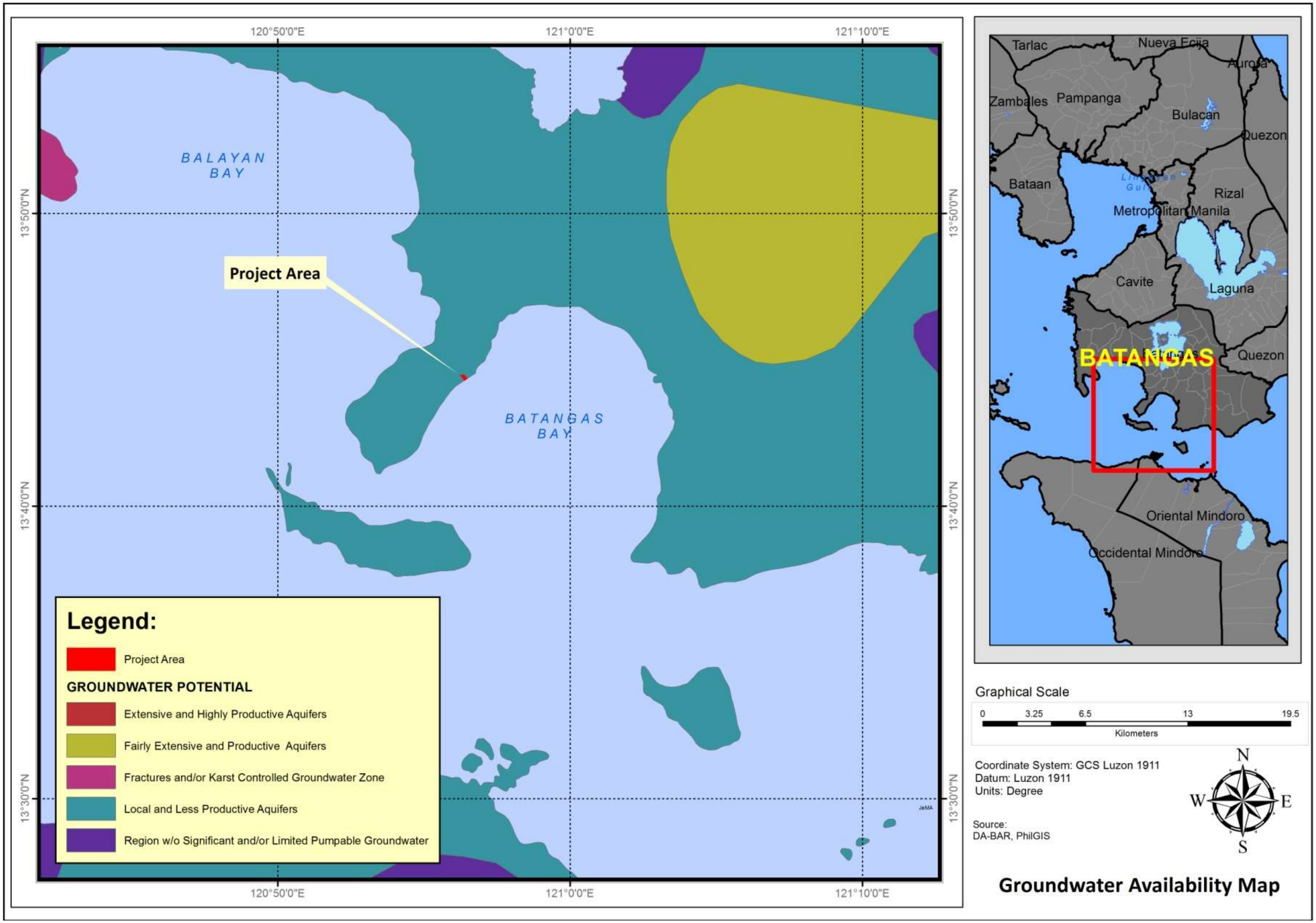


Figure 26 - Groundwater Availability Map

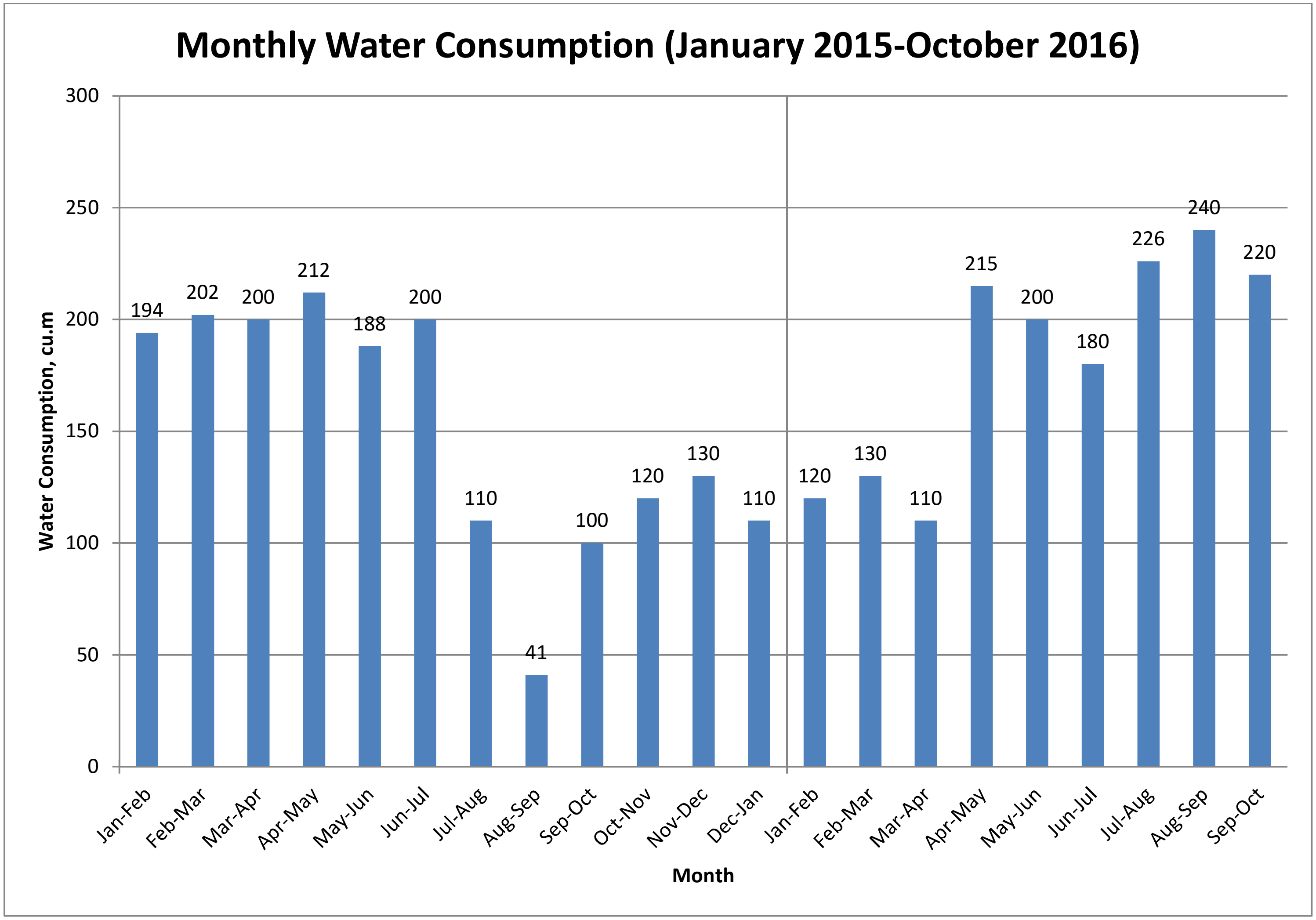


Figure 27 - Monthly Water Consumption (January 2015 - October 2016)

2.2.2 <u>Water Quality</u>

As mentioned in the previous discussions, there are no inland water bodies in Mabini. In addition, the project is not discharging any effluent to Batangas Bay. Because of this, the project has no effluent monitoring data. The previous EIA document for the project was an Initial Environmental Examination (IEE) Report wherein the Environmental Monitoring Plan did not include marine ambient water quality monitoring thus there is no ambient water quality monitoring data for the project. Process water, mainly for cooling process, is being recirculated (zero discharge) which explains the absence of effluent monitoring data. The project has one outlet for its storm drainage system which is located in Talaga, Mabini Coastal Area with Batangas Bay as the receiving water body. It also utilizes groundwater through a deep well and also has a port facility located at Balayan Bay. With this, water quality assessment was conducted last January 27 and 31, 2017 to determine the current state of groundwater and ambient marine water quality in the area. Monthly monitoring of groundwater quality and ambient marine water quality is therefore recommended as indicated in the Environmental Monitoring Plan.

The coastline of Batangas Bay supports the industrial, residential, commercial and transportation needs of various sectors. It is part of the Verde Island Passage Marine Corridor (VIPMC) as shown in ***Figure 28***. Batangas Bay is considered as an important fishing ground of the province.
This section presents the results of water quality study conducted for the proposed modification of Mabini Break Bulk Terminal and Port Facility.

2.2.2.1 Methodology

In-situ water analysis and water sampling procedures were done following the guidelines presented in Water Quality Monitoring Manual Volume I: Manual on Ambient Water Quality Monitoring (EMB-DENR 2008). Two (2) marine water samples and one (1) groundwater sample were collected at the port and from the Holcim deep well, respectively. All the primary parameters listed in Table 3 of DENR Administrative Order No. 2016-08 "Water Quality Guidelines and General Effluent Standards of 2016" were tested. The secondary parameters tested were based on the waste acceptance criteria for AFR of Holcim as required in the Technical Scoping Checklist (see ***Table 5***). Results were compared to Class SC guidelines and to Class C based on the current beneficial use of marine and groundwater resources, respectively. Water quality sampling site map is shown in ***Figure 29***. Refer to ***Table 6*** for the details of the water quality sampling stations.

Table 5 - Water Quality Parameters Tested

Primary Parameters	Secondary Parameters
- 5-day Biochemical Oxygen Demand (BOD_5) - Chloride (Cl) - Color - Dissolved Oxygen (DO)* - Fecal Coliform - Nitrate as NO_3-N - pH* - Phosphate - Temperature – in situ - Total Suspended Solids (TSS)	Metals - Arsenic (As)** - Antimony (Sb)** - Cadmium (Cd)** - Hexavalent Chromium (Cr^{6+})** - Copper (Cu)** - Lead (Pb)** - Mercury (Hg)** - Nickel (Ni)** - Zinc (Zn)** Organics - Oil and Grease (O&G)

* In-situ
** Parameter in the AFR acceptance criteria

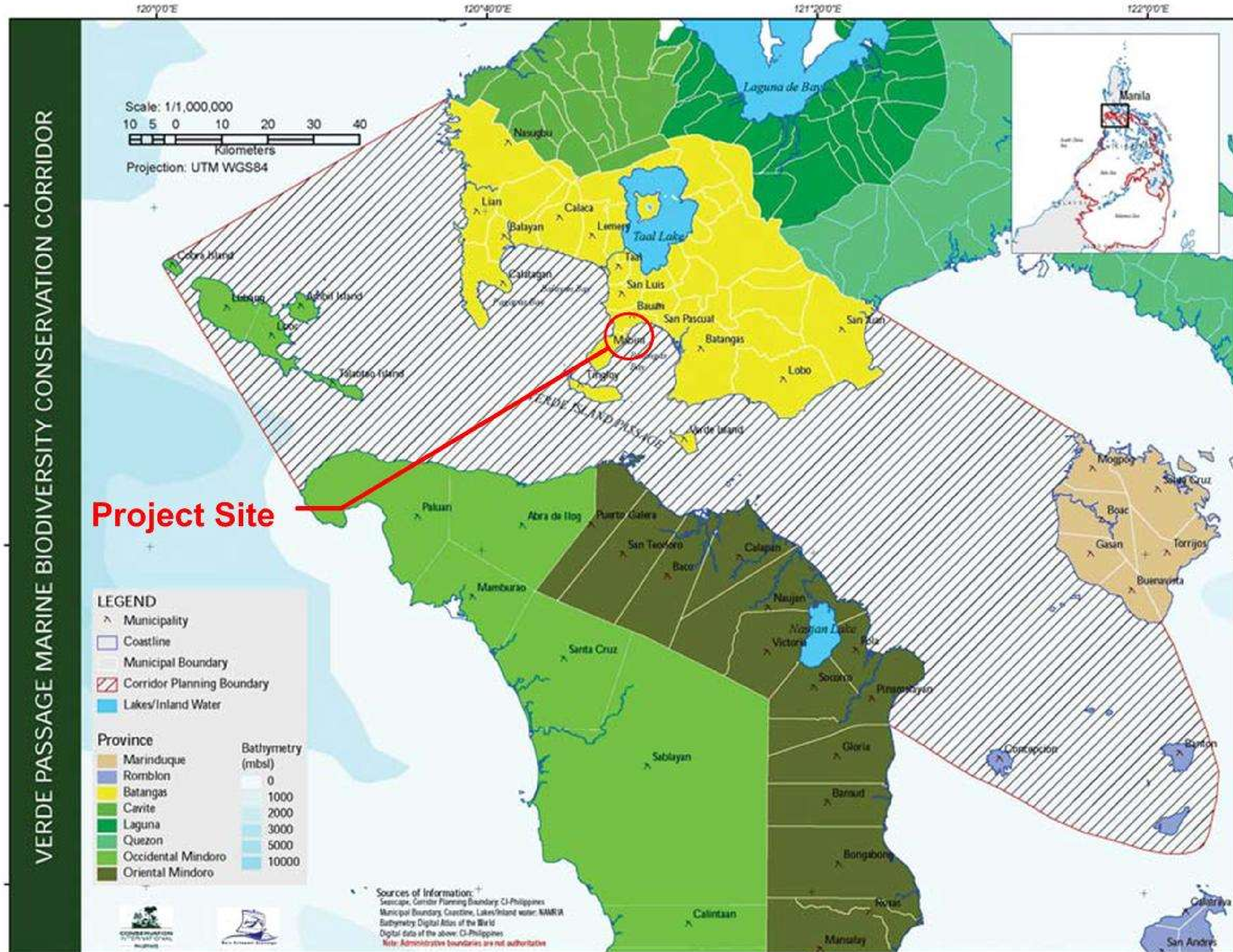


Figure 28 - Map showing the project site within the Verde Passage Marine Biodiversity Conservation Corridor (Source: DENR PAWB, 2009)

Figure 29 - Water Quality Sampling Map (Base map: Google Earth image 3/26/2016)

Table 6 - Description of the Water Quality Sampling Stations

Station	Description	Date and Time of Sampling	Geographic Coordinates
MW1	Marine water west of the port facility, near residential areas	27 January 2017/3:00pm 31 January 2017/11:55am	13°44'12.20"N Lat. 120°56'27.30"E Long.
MW2	Marine water east of the port facility, near San Miguel Mills, Inc. (SMMI)	27 January 2017/4:05pm 31 January 2017/11:45am	13°44'15.70"N Lat. 120°56'34.30"E Long.
GW1	Water valve at the port facility	27 January 2017/3:25pm 31 January 2017/12:05pm	13°44'14.50"N Lat. 120°56'26.50"E Long.

Photo 1 - Photo during sampling at station MW1 (marine water)

Photo 2 - Photo during sampling at MW2 (marine water)

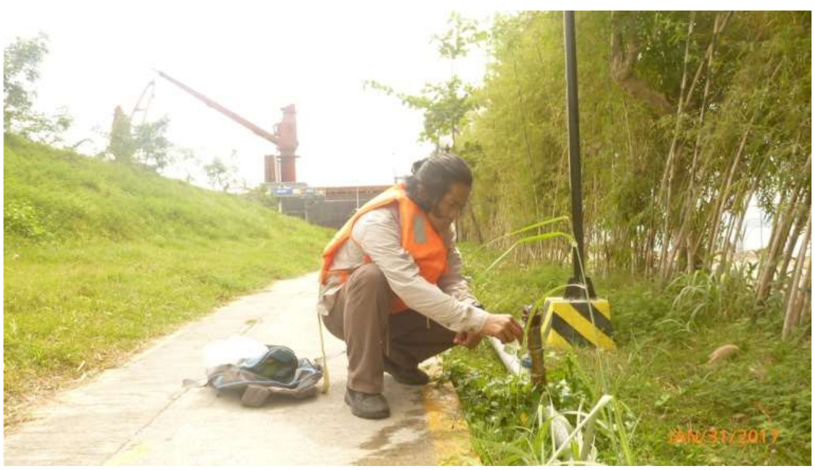


Photo 3 Photo during sampling at GW1 (groundwater)

2.2.2.2 Result and Discussion

Results shown in ***Table 7*** reveal that all parameters tested in the water samples collected were within Class SC guidelines for ambient marine water quality and Class C guidelines for groundwater quality as per DAO 2016-08.

This is an indication that the current project operations have minimal impact in terms of water quality and that, mitigation measures being implemented at the site are effective. As previously discussed, the current and proposed project operations will not involve discharge of effluent coming from the cement production since the project will utilize dry method. Also, the water used for cooling equipment is being recirculated (closed circuit). The only water coming from the facility is stormwater runoff. An adequate drainage system is already installed in the project site and is being maintained properly.

The water quality parameters used in the assessment serves as a baseline for the future project operations since there were no previous water quality monitoring conducted for the project. However, for monitoring purposes, with reference to DAO 2016-08 ***Table 7*** (Significant Effluent Quality Parameters per Sector), Temperature, pH, TSS, DO and O&G for marine water quality and Temperature, pH, and Chloride (to monitor possible saltwater intrusion due to pumping) for groundwater quality, are the parameters recommended to be monitored on a monthly basis.

2.2.2.3 Water Quality - Impacts and Mitigation Measures

Possible project impacts on water quality during the construction phase include generation of contaminated runoff coming from the construction area and accidental oil spill during the rehabilitation and upgrading of the port in-loading/port facility and cement dispatch. To prevent the contaminated runoff from reaching the receiving water body, particulary the Mabini coastal area in Batangas Bay, enclosure of the construction area will be implemented. Sandboxes and oil water separators shall be installed along the drainage canals. In addition, drainage canals shall be maintained on a regular basis especially during the wet season. The proponent shall also develop an oil spill contingency plan in case of accidental oil spills. Spill booms shall be provided and should always be available in case of accidental oil spill at the port. To prevent accidental oil spills from happening, Holcim shall continuously train personnel involved during the construction phase. Holcim shall ensure that the workers provided by the contractor are trained and competent and are fully aware of the environmental management program and the ECC conditions that the company must comply with. This shall also be implemented during the operation phase. Holcim will also strictly implement a “no shipboard waste disposal” policy.

Activities within the plant premises during the operations phase result to generation of silted runoff coming from the dusts washed out from the roads, stockpiled materials and other open surfaces especially during the rainy season. To prevent the silt from reaching the coastal waters, maintenance of drainage canals through regular desilting shall be implemented. Silt traps and sand boxes shall be installed along the canals. Dust-arresting bag filters shall be installed and replaced regularly to minimize deposition of dusts on the roads and other open surfaces. Storage for fuel/oil shall be provided with secondary containment with capacities greater than the oil/fuel being stored to prevent possible contamination of soil and water in case of accidental spills. An Oil Spill Response Team shall be formed and trained accordingly to act in case of accidental oil spills at the site. During operation phase, the project will be generating wastes that may cause water pollution and land contamination if not handled properly. The proponent shall monitor the volume and type of wastes generated from the project operations and shall use appropriate storage containers especially for hazardous wastes to prevent any leakage or spill. The disposal and treatment of hazardous wastes from the plant operations shall be conducted by a DENR-accredited transporter/treater. Waste segregation shall be implemented and properly labeled trash bins shall be provided within the site.

Possible impacts during the abandonment phase include accidental spill of toxic and hazardous wastes due to dismantling and clearing of facilities. To prevent this from happening, the approved rehabilitation and abandonment plan shall be carefully implemented. Hazardous wastes during the abandonment phase shall be hauled by DENR-accredited transport, storage and disposal facilities.

Table 7- Results of Water Quality Assessment

Parameter	**Unit**	**Marine Water**			**Groundwater**	
		MW1	**MW2**	**DAO 2016-08 Guideline Value** Class SC	**GW1**	**DAO 2016-08 Guideline Value** Class C
PRIMARY PARAMETERS						
BOD_5	mg/l	<1	<1	*n/a*	Not tested	*n/a*
Chloride (Cl^-)	mg/l	26,506.7	28,216.8	*n/a*	50.8	*350*
Color	PCU	2 ACU	2 ACU	*75*	2 ACU	*350*
Dissolved Oxygen (minimum)	mg/l	6.12	5.54	*5*	Not tested	*n/a*
Fecal Coliform	MPN/100ml	2.0	70	*200*	<1.1	*200*
Nitrate (NO_3-N)	mg/l	0.22	0.13	*10*	2.73	*7*
pH	range	7.94	7.58	*6.5-8.5*	7.62	*6.5-9.0*
Phosphate (PO_4^{3-}-P)	mg/l	0.03	0.04	*0.5*	0.47	*0.5*
Temperature	°C	27.0	26.3	*25-31*	29.3	*25-31*
Total Suspended Solids (TSS)	mg/l	1	4	*80*	Not tested	*n/a*
SECONDARY PARAMETERS – Metals						
Arsenic (As)	mg/l	<0.001	<0.001	*0.02*	<0.001	*0.02*
Antimony (Sb)	mg/l	<0.005	<0.005	*No guideline value*	<0.005	*No guideline value*
Cadmium (Cd)	mg/l	<0.003	<0.003	*0.005*	<0.003	*0.005*
Hexavalent Chromium (Cr^{6+})	mg/l	<0.01	<0.01	*0.05*	<0.01	*0.01*
Dissolved Copper (Cu)	mg/l	<0.005	<0.005	*0.02*	<0.005	*0.02*
Lead (Pb)	mg/l	<0.02	<0.02	*0.05*	<0.02	*0.05*
Mercury (Hg)	mg/l	<0.0001	<0.0001	*0.002*	<0.0001	*0.002*
Nickel (Ni)	mg/l	<0.02	<0.02	*0.06*	<0.02	*0.2*
Zinc (Zn)	mg/l	<0.003	<0.003	*0.8*	0.348	*2*
SECONDARY PARAMETERS – Organics						
Oil & Grease	mg/l	<1.0	<1.0	*3*	<1.0	*2*

2.2.3 Marine Ecology

2.2.3.1 Purpose of Assessment

Coastal resources and the ecological functions that they sustain nurture various goods and services that are biologically and economically important for marine biodiversity, sustained fisheries production and aesthetic values. Assessment of primary coastal habitats and benthic fishery resources was conducted by a team of fisheries and marine biologists headed by Dr. Benjamin Francisco, in coastal waters around the jetty complex of HOLCIM PHILIPPINES, INC. in Barangay Pulong Balibaguhan, Mabini, Batangas (***Figure 30***) from 28-30 January 2017. The assessment focused on determining the current condition of benthic habitats and associated fisheries resources in the land-sea interface near the Holcim complex where increased plant activities are proposed to be undertaken. The survey also attempted to identify and locate other coastal habitat niches such as seagrass meadows and mangrove tress that are all within range of potential anthropogenic stressors that can emanate from increased port operations and ship berthing activities. The objective of the assessment is to catalogue and describe the condition of primary benthic habitats and its associated fisheries resources that can be susceptible to potential disturbances emanating from project activities, or are prone to be subjected to stresses associated with human activities from point sources in the Holcim complex. Overall, the survey was designed to generate meaningful information that can be the basis for making informed decisions on how to address changes in the condition of resources observed over time, in order to recommend appropriate mitigating measures and safety nets that will help in making EIA strategies that will mitigate potential impacts on such resources; and over the long term, render critical habitats more resilient. By obtaining data and variables of the same types and employing consistent survey protocols, susceptible end points and critical benthic habitats can be characterized in their current state and identification of potential causes and pathways of stressors can be defined for future monitoring purposes.

Figure 30 - Location of the project site and study area in Mabini, Batangas

2.2.3.1.1 Primary Impact Area

The Holcim port complex is located in Barangay Pulong Balibaguhan and partly in Barangay Talaga East, Mabini Batangas. The entire coastline in this area, which is located on the eastern flank of Mabini Municipality, has been declared by the local government as an industrial zone, owing to the fact that many heavy industries in Batangas Bay are located in the vicinity. West of the headland is Balayan Bay, the primary tourism and recreational zone of the municipality which receives an average of 300,000 tourists per year (ref: Municipal Tourism Office, Mabini). Northeast of the Holcim complex is the Port of Batangas City.

The primary impact area is coastal waters fronting the port complex, while secondary impact areas included coastal waters in Barangay Talaga East and Barangay Calamias where other port complexes such as San Miguel Mills, Inc., which is contiguous to the Holcim Complex **(*Figure 31*).** Further northeast of the coastline is the port complex of PNOC. Under this situation, point sources of pollution and other waste streams emanating from the land would be difficult to ascertain.

Figure 31 - Primary Impact Area in the Holcim Port Complex, Mabini, Batangas

The coastline in the impact area is characterized by a squat shelf, with rocky promontories and sandy substrate occurring intermittently. The widest shelf, consisting of sandy seabed mixed with rocks extending about 50 meters from the shoreline is found in front of the Barangay proper of Barangay Talaga East. This area is also the main fishing ground for artisanal fishers from the Barangay employing simple hook and line and spear fishing gear. The larger boats fish a great distance from the shore, in the mouth of Batangas Bay where large pelagic species often pass through during seasonal migration. Elsewhere, the inter-tidal region is dominated by shallow tidal flats that slope to approximately 4 to 5 fathoms in less than 50 meters offshore coastal waters. The Holcim port is located in area of about 7 to 8 fathoms of water; the bottom consists of a very narrow shelf that drops to an abyss in the central portion. The deep indention is therefore ideal for the docking of ships. Key respondents claim that coral reefs, seagrass patches, algal colonies in sandy-muddy deposits are the primary coastal habitats that use to occur in the area. On the other hand, the Municipal Tourism Office claims that these resources do not occur in the zone. The prominent reef formations in the general area are the colonies in Balayan Bay. There are more than 50 reef patches that are dive sites in Balayan Bay, three (3) of which have been declared as marine protected areas. However, the corals in Balayan Bay are a great distance from the primary impact area of the Holcim project; with the relatively proximal reef – the Twin Rocks coral formation – situated about 5 kilometers away.

At the time of the survey, no mangroves and seagrass beds were observed along the stretch of the coastline where resource assessments have been undertaken.

2.2.3.2 Scope of Assessment and Methodology

Specific objectives of the assessment include:

1. Estimate distribution and species composition of reef associated fish assemblages within specific survey stations;

2. If present in significant quantities, characterize reef habitat conditions by estimating the cover of various coral life forms utilizing standard categories in representative sampling sites;

3. Conduct mangrove and associated beach vegetation survey if such resources are present in the study area, in order to determine species density and distribution as well as the overall spatial profile;

4. Determine distribution and map out existing seagrass communities in the study area and describe their current condition;

5. Assess and characterize plankton communities, including presence of marine biotoxin and HAB-causing organisms (harmful algal bloom);

6. Catalogue presence of important macro-invertebrates and soft bottom communities in specific study stations; and,

7. Gather secondary information to describe dominant fisheries resources and practices.

The survey results portray a general view of the types and current condition of the coastal environment and the marine resources present in the area *at the time of sampling and cannot represent an irreversible situation*. It should be noted moreover, that numerous natural and man-made factors have contributed, or are currently contributing to coastal resource degradation in the area and these have not been quantified so far. Moreover, the survey does not identify, in this regard, both point and non-point sources of current stressors but only take into account their current impact - if any, on the resources along the survey pathways.

Assessment Tools

The survey methods employed follow standard marine resource survey techniques as prescribed by English, et al. (1994) and modified in accordance with *in-situ* conditions following rapid appraisal techniques for coastal resources. Where coral reefs are encountered, more focused assessment were undertaken with the survey team members undertaking underwater line intercept surveys and systematic snorkelling to more closely determine reef and fish distribution patterns in the slope area where higher live coral cover was discerned. At the Holcim port, the survey conducted spot dives beneath the port itself and in contiguous benthic environs, to determine substrate composition and validate whether corals and seagrass communities are present. Key informants were interviewed to determine marine capture fisheries condition, and sampling stations were set in areas pointed by key respondents as shellfish collection areas up determine presence of macro-invertebrates that are utilized for food and trade.

The baseline survey is focused on assessing the presence, distribution and diversity of principal coastal resources - (i) corals, (ii) reef-associated fish communities, (iii) seagrass communities, (iv) plankton, (v) benthic macro-invertebrates, and (vi) fishing practices and productivity. Mangroves do not occur in the coastline of the plant's project site.

The survey protocol includes:

2.2.3.2.1 Corals

Two survey methods were employed to determine spatial distribution and abundance of live coral cover.

2.2.3.2.1.1 Manta survey method for observation of coral cover in the reef flat and general coastal habitat configuration

Manta Tow surveys (***Photo 4***) were conducted in sequential stations in order to determine the benthic condition over a long stretch of seabed across the coastal waters in the primary and secondary areas of the project. The Manta Tow method is useful in generating a general profile of benthic resources as it permits observation of the condition, distribution and abundance of benthic habitats in a continuous stretch of the coastal environment. Estimates of percentage distribution of coral reefs and associated benthos observed within the tow stations are recorded in accordance with standard categories to document distribution of coral life forms and the collective picture generated can show a fairly accurate description of the overall state of the coastal area under study. The manta tow surveys also enable the identification of the location of seagrass meadows, if present in the area. In areas where significant coral reefs occur, results from a manta tow survey are used to pinpoint the locations of ideal stations where more detailed underwater coral reef characterization employing line transects are undertaken.

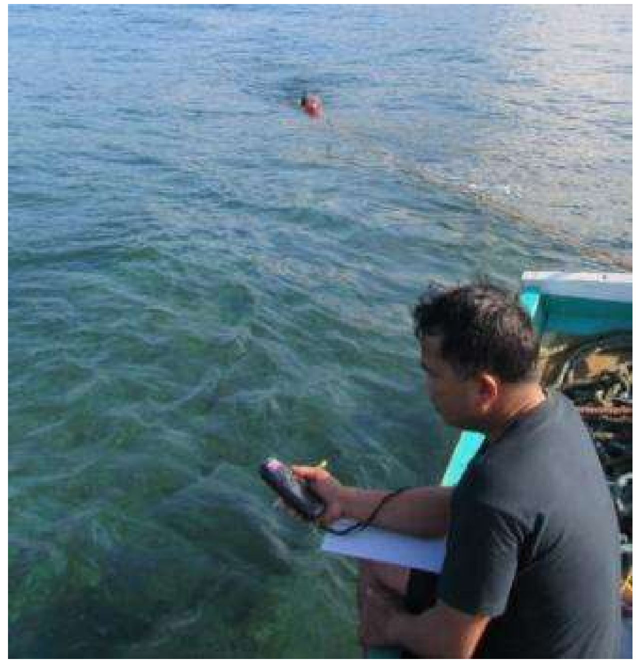


Photo 4 - Manta tow survey to determine general benthic configuration and identify location of corals and seagrass beds.

A total of seventeen (17) manta tow survey stations were investigated covering a stretch of nearshore waters approximately 3,124 meters long along the crest of the coastal shelf from Barangay Talaga East to Barangay Calamias (***Figure 32***). The survey pathway included stations outside of the project site boundary southwest and northeast of the port complex in order to locate corals in secondary impact areas.

Figure 32 - Manta tow stations surveyed in coastal waters fronting Holcim port complex in Mabini, Batangas; 29 January 2017 (map by Jose Rene Villegas).

2.2.3.2.1.2 *Line Intercept Transect (LIT) method for detailed coral reef assessment*

Manta tow observations revealed that patches of coral colonies occur sparsely along the 3-kilometer coastal shelf surveyed; most of which occur in the extreme northeastern region covered by the survey. To document in greater detail the distribution and diversity of the remaining corals in the area, transect lines were laid out in two sampling stations in order to more precisely estimate the relative abundance of corals, other benthic life forms and abiotic components. The survey protocol involved the laying out of a 50-m transect parallel to the shoreline and following the reef contour (Figure 4, Plate 2). Data generated from line-intercept surveys for coral reef assessment provides more rigid data sets on percentage of live coral cover as well as species distribution that can be ultimately used for comparative evaluation if the same survey stations are monitored in the future. The categories utilized for classifying coral cover follow standard ratings used for live coral distribution, i.e., *76-100% live coral cover = Excellent; 51-75% coverage live coral cover = Good, 26-50% coverage live coral cover = Fair, and 0-25% coverage live coral cover = Poor coral cover* (Gomez, et. al.,1981). The coordinates of the two LIT stations are shown in ***Table 8***. The surveys in these stations were supplemented by spot dives to reinforce information on the extent of coral cover and record other relevant information.

Table 8 - Coordinates of LIT stations surveyed for coral communities in the Holcim marine ecology baseline assessment; Mabini, Batangas, 28-30 January 2016

WP Code	Latitude	Longitude	Remarks
LIT1	N 13.737520°	E 120.943630°	Located offshore across bounds of HPI and SMMI. Ave LHC = 2.4% (Poor); with a few Massive Corals at 1.8% as distributed in the transect, also noteworthy is the widespread Sand/Silt at 79.8%
LIT2	N 13.748910°	E 120.953450°	Located offshore across rocky beach area of Bgy Calamias. Ave LHC = 27.8% (Fair); with some Mushroom Corals dominant at 13.8% as distributed in the transect, also noteworthy is the almost the same distribution of Dead Corals with Algae at 28.2% and Sand/Silt at 22.4%

Photo 5 - Underwater assessment for detailed coral diversity and distribution employing the line intercept method in one of several isolated coral patches encountered in the secondary impact area of the Holcim complex in Mabini, Batangas; 29 January 2017. Left photo shows the relative location of the surveyed area with the SMMI port complex a significant distance away.

Figure 33 - Map showing location of two line intercept stations investigated for coral and benthic life form distribution in the vicinity of the Holcim port complex in Mabini, Batangas; 29 January 2017 (map prepared by Jose Rene Villegas).

Fish species diversity and abundance was determined in the two line intercept stations using the standard fish visual census (FVC) met hod. The conduct of FVC is aimed to document a fairly accurate picture of demersal fish species richness, abundance and biomass of fish assemblages associated with benthic habitats. High values for these indicators can indicate the overall ecological condition of a reef area and high species richness is normally associated with robust ecosystem functions. Fish visual census is used to estimate the variety, numbers and sizes of fishes along a 10-meter belt following a 50-meter transect laid over representative coral reef stations. FVC surveys document mostly demersal, reef-associated species of fish that normally indicates the robustness of a coral reef ecosystem. In healthy reefs, the fish species diversity may include both commercially important fish (e.g., Groupers, Snappers) and reef-dependent species of fish such as Angelfishes and Butterfly fishes. The estimation of fish biomass in the stations surveyed can subsequently be used to extrapolate the average fisheries productivity of the broader coastal area under normal circumstances, especially in view of the fact that demersal fish can supply about 30 percent of total food fish production in a locality. This productivity value is in fact one of the most important merits in protecting coral reefs in the area. Collectively, the results of coral reef assessments and fish visual census are used as reference points for comparative monitoring of changes in spatial distribution and diversity of benthic life forms in periodic environmental impact monitoring.

Fish species encountered in the FVC transects are categorized as target, major or indicator species based on categories recommended in FishBase (2004). Target species are economically important food fish that are normally sought by fishers for trade or for food. In reef areas, such demersal species may include high value groupers (*Ephinephalidae*), snappers (*Lutjanidae*), jacks (*Carangidae*) and some species of surgeons (*Acanthuridae*). Fish that belong to the major fish category are considered to be ecologically important because they occupy unique niches and sometimes symbiotic relationships in the coral reef ecosystem. Many of these species are represented by members of the damselfishes (*Pomacentridae*) and wrasses (*Labridae*). Indicator species are coral-feeders whose presence, variety and abundance in a reef area may give an indication of the robustness and diversity of corals present in the reef. These are mostly comprised of the magnificently-colored butterfly fishes (*Chaetodontidae*), species of Angelfishes and the lone highlighted species popularly known as *Moorish Idol*. The FVC station coordinates are shown in ***Table 9*** and ***Figure 34*** below.

Table 9 - Fish visual census (FVC) stations surveyed in the vicinity of the Holcim port complex in Mabini, Batangas, 29 January2017.

WP Code	Latitude	Longitude	Remarks
FVC1	N 13.737520°	E 120.943630°	Same location as LIT1 with a depth of 15ft. Recorded 457 individuals within a 500m^2 transect area with 19 species distributed in 13 family taxa. Most abundant were *Dascyllus trimaculatus* (150 individuals) followed by *Zanclus cornutus* (1 00 individuals).
FVC2	N 13.748910°	E 120.953450°	Same location as LIT2 with a depth of 45ft. Recorded 348 individuals within a 500m^2 transect area with 11 species distributed in 7 family taxa. Most abundant were *Dascyllus trimaculatus* (200 individuals) followed by *Pterocaesio pisang* (40 individuals) and *Chromis analis* (40 individuals).

Figure 34 - Location of fish visual census (FVC) stations surveyed in the vicinity of the Holcim port complex in Mabini, Batangas, 29 January 2017 (map prepared by Jose Rene Villegas).

2.2.3.2.3 Assessment of Seagrass and Associated Macro-algae

No seagrass communities were observed in the seventeen manta tow observation pathways along the coast from Barangay Talaga East up to Barangay Calamias. Remnants of decaying seagrass blades were seen mixed with plastic flotsam but seagrass beds were completely absent in the seabed, even as a large portion of the benthic environment consisted of sandy substrate.

2.2.3.2.4 Survey of commercially-important macro-invertebrates

Figure 35 - Bivalves, principally of the species *Paphia sp (Venus shell) and Codakia punctata (lucine shell),* are being sold along the main road in Mabini town proper.

Bivalves and univalves are collected during gleaning activities for food and trade (***Figure 35***). Macro-invertebrates, like mollusks and bivalves, are usually used for assessment of site – specific effects since they are sessile organisms and their sedentary nature allows effective analyses of pollutants and effects of benthic disturbance, including the presence of biotoxins normally triggered during plankton blooms. The presence of macro-benthos in the sediment is therefore one of the best biological indicators on fertility of the bottom sediment and, on the other hand, the unsuitability of benthic substrates for the viable existence of macro-invertebrate populations. Core sampling and opportunistic surveys of macro-invertebrates in the inter-tidal flat fronting Barangay Talaga East were conducted in two sampling stations (***Figure 36***). Species of bivalves and other shellfish serve as supplemental food for the community in the study area but the survey revealed that macro-invertebrate communities were thinly occurring. Indications of over-gathering and natural disturbance to the sandy substrate in the sampling area, presumably due to recent typhoons, have significantly reduced the shellfish population.

Opportunistic surveys were done through actual specimen collection in shellfish gleaning areas pointed by local fishers. The coordinates of the two macro-invertebrate stations are shown in ***Table 10***.

Table 10 - Coordinates of macro-invertebrate sampling stations in the inter-tidal area fronting Barangay Talaga East, Mabini Batangas.

WP Code	Latitude	Longitude	Remarks
MAC1	N 13.736028°	E 120.938556°	Located SW across a beach area with a bearing of 236.61° and 257m from the Holcim Wharf;

WP Code	Latitude	Longitude	Remarks
			estimated 23 species recorded through opportunistic surveys
MAC2	N 13.735278°	E 120.937611°	Located SW across a beach area with a bearing of 234.66° and 389m from the Holcim Wharf; 9 species recorded through opportunistic surveys

Figure 36 - Sampling stations for collection of commercially-important macro-invertebrates in coastal areas within the vicinity of the Holcim port complex, Mabini, Batangas 28-29 January 2017; (map prepared by Jose Rene Villegas).

2.2.3.2.5 Mangrove Assessment

No mangrove trees were encountered in the survey along the coast of three Barangays in the primary and secondary impact areas of the Holcim complex. It appears that mangroves have long been cleared in the sandy cove of Barangay Talaga East to give way to boat docking and households. On the other hand, portions of the seashore along several port complexes have been reinforced with concrete seawalls and structures. In the northeastern section in Barangay Calamias, the shoreline was dominated by rocks and boulders.

2.2.3.2.6 Plankton Communities

Species composition, abundance and density of phytoplankton and zooplankton communities were determined using plankton net vertically lowered and towed from sub-surface depths. Shannon-Weaver Diversity/Evenness Indices and bio-assessment metrics are then derived from the results of the sampling. Identification of phytoplankton species that can enrich to become harmful algal blooms which may potentially cause paralytic shellfish poisoning (PSP) was also undertaken as algal blooms normally indicate hyper-nutrient levels in the sea sometimes triggered by problems of anthropogenic origin. Sampling stations were strategically chosen so that the stations are focused in the vicinity of the Holcim port complex. Six (6) plankton sampling stations were employed during the survey (***Figure 37*** and ***Table 11).***

Table 11 - Coordinates of plankton sampling stations investigated during marine ecology baseline assessment in the coastal impact area of Holcim port complex; 29 January 2017.

WP Code	Latitude	Longitude	Remarks
PLK1	N 13.737500°	E 120.943670°	Located at the waters across the bounds of HPI and SMMI. Dominant phytoplankton *Chaetoceros* sp. at 1,152 cells/L, while dominant zooplankton *Calanoid* (adult form) at 12,914 indiv/m^3
PLK2	N 13.736590°	E 120.944030°	Located at the waters across the bounds of HPI and SMMI. Dominant phytoplankton *Chaetoceros* sp. at 1,340 cells/L, while dominant zooplankton *Nauplius* (larval form) at 49,535 indiv/m^3
PLK3	N 13.734960°	E 120.942870°	Located at the waters across the HPI Wharf. Dominant phytoplankton *Thalassionema* sp. at 880 cells/L, while unidentified eggs at 31,366 indiv/m^3
PLK4	N 13.735710°	E 120.941600°	Located at the waters across the HPI Wharf. Dominant phytoplankton *Chaetoceros* sp. at 1,560 cells/L, while dominant zooplankton *Nauplius* (larval form) at 125,303 indiv/m^3
PLK5	N 13.732530°	E 120.937060°	Located at the waters across the pier of Bgy Talaga. Dominant phytoplankton *Rhizosolenia* sp. at 1,740

WP Code	Latitude	Longitude	Remarks
			cells/L, while dominant zooplankton *Nauplius* (larval form) at 169,159 indiv/m^3
PLK6	N 13.731360°	E 120.937520°	Located at the waters across the pier of Bgy Talaga. Dominant phytoplankton *Chaetoceros* sp. at 520 cells/L, while dominant zooplankton *Nauplius* (larval form) at 101,051 indiv/m^3

Figure 37 - Sampling stations for plankton communities investigated during marine ecology baseline assessment in coastal areas within the vicinity of the Holcim port complex, Mabini, Batangas 28-29 January 2017; (map prepared by Jose Rene Villegas).

Spot dives employing scuba and systematic snorkeling over a 100 square meter benthic survey were undertaken in three strategic points – two adjacent to the Holcim wharf and one near the area where corals were encountered. The purpose of the spot dives is to validate the absence of coral-associated life forms and fish habitats in the wharf area and to further confirm the presence of corals over a wider area in the light of turbid waters. The spot dive stations are presented in ***Table 12*** below and depicted in ***Figure 37***.

Table 12 - Location of spot dives undertaken during the marine ecology baseline assessment conducted in the coastal impact area of Holcim port complex; 29 January 2017.

WP Code	Latitude	Longitude	Remarks
SPD1	N 13.748722°	E 120.952917°	Located offshore NE of HPI across Bgy Calamias; survey conducted at a 10m radius from obtained coordinates. LHC=5%, SC=0%, DC=25%, DCA=35%, CR=15%, SA=20%
SPD2	N 13.736160°	E 120.940440°	Located offshore SW of HPI Wharf; survey conducted at a 10m radius from obtained coordinates. LHC=0%, SC=0%, DC=0%, DCA=0%, CR=0%, SA=100%
SPD3	N 13.735330°	E 120.939080°	Located offshore SW of HPI Wharf across Bgy Talaga East; survey conducted at a 10m radius from obtained coordinates. LHC=0%, SC=0%, DC=0%, DCA=0%, CR=0%, SA=100%

Figure 38 - Location of spot dive stations surveyed during marine ecology baseline assessment in the vicinity of the Holcim port complex, Mabini, Batangas; 28-29 January 2017.

2.2.3.2.7 Rapid fisheries appraisals

The rapid fisheries appraisal was undertaken through key informant interviews to determine (i) presence of fishing activities in the study area and dominant fishing gears used, (ii) usual catch composition, (iii) estimated catch rates, and (iv) issues affecting fisheries. A focus group discussion was also conducted with Barangay officials and the Barangay Fisheries and Aquatic Resource Management Council (BFARMC) of Bgy. Talaga East. In the coastal waters fronting the Barangay, fishers conducting actual fishing operations were interviewed. The intense demand for seafood brought about by the huge tourism industry in the western part of Anilao signifies that fisheries of the area is comprised of both pelagic and demersal fishing operations; with the latter dominated by hook and line operations in reef areas in Balayan Bay and in deep waters of Batangas Bay where tuna and tuna-like species are traditionally caught. However, it was noted that few coral reef-based fishing operations are actually occurring in coastal waters fronting the several port complexes in Barangay Pulong Balibaguhan and Talaga East. In three days of surveys, only six (6) fishers were actually seen conducting gill net and spear fishing in nearshore waters.

2.2.3.3 Results and Surveys

2.2.3.3.1 Overall Impressions

It is evident that over the last few decades, the coastal habitats in the coastal impact area of the project site have been subjected to various forms of stresses and pressures that have altogether eroded portions of what seems to be remnants of coral reefs which are now colonized by macro-algae or overrun by sandy substrate. The reef flat in front of Barangay Talaga East has mostly been lost to destructive fishing methods - presumably decades ago, and the remaining patches of coral colonies are few and far between; most of which are degraded by silt intrusion and colonized by macro-algae. Coral rubbles are few and it is construed that these have been collected for construction of boat docks and small jetties, and used for other residential activities. Small rubble has been presumably washed ashore during several typhoons that hit the area in the past two years. Coral re-growth in stable portions of the reef flat in the northeastern sector appears little and slow, dominated by recruits of massive and few branching corals in small patches that are far apart. In two areas where corals were found, these were dominated by non-scleractinian mushroom corals, few massive coral species Porites spp., and a several colonies of the silt-resisting coral Goniopora minor (discerned by its long polyps).

Overall, there are no indications of a robust fringing reef along the coastline surveyed. Similarly, results from fish visual census in two stations where sparse coral patches occur, reveal low species richness and abundance. Turbid waters have also suppressed seagrass growth, which are surprisingly absent in the entire area surveyed through manta tows. Mangrove stands were likewise absent along the 3- kilometer coastline investigated.

Macro-invertebrate communities – those that are collected for food and supplemental income by local residents are insignificant and no aggregations of bivalves or gastropods of locally-significant commercial importance were encountered in two sampling sites and along the line intercept transects in patchy coral reef areas. Colonies of sea urchins aggregate in many portions of the seabed along the survey pathways, together with dense communities of crinoid echinoderms (feather stars). These feather stars are filter feeders and draw their nutrition from the turbid waters in the area. The sea urchins are numerous due to the absence of predators – mainly triggerfishes, parrotfish and eels; and they thrive in the area presumably because crinoids, as well as detritus, constitute part of their diet.

2.2.3.3.2 Results: Broad Area Coral Profiling Through Manta Tow

Out of the seventeen (17) manta tow observations pathways in the shelf fringing three Barangays, twelve (12) stations had no coral cover while five (5) stations – in the extreme northeastern section of the secondary impact area near the boundary of Barangay Calamias and Barangay Bulacan hosted live coral cover (LHC) ranging from 5 to 15% (*Category: Poor*). These patches of corals in the reef crest appeared to be isolated and interrupted by carpets of rocks and boulders (***Table 13*** and ***Figure 39***). Overall, 12 of the stations consisted of sandy substrate in a shelf that appeared to be flat and turbid. Dead corals with algae were encountered in only two manta tow tracks (i.e., S1 to T01 and station T04 to T05). These two stations are located in the broader sandy flat fronting Barangay Talaga East and appeared to be remnants of a reef that once existed in the area but can no longer be discerned clearly during the survey. Patches of live corals occurred between Tracks T12 to T17 fronting a rocky shoreline in Barangay Calamias, interrupted by rocks, dead corals with algae, and dense colonies of feather stars (*Comanthina nobilis, Comatula rotalaria* and *Himerometra* sp.; ***Photo 6*** left). The corals in this squat stretch of shelf appear to be stressed due to sediments and intrusion of garbage, with massive varieties of *Porites* sp. and mushroom corals *Fungia* spp. dominating the colonies (***Photo 6*** right). Along these last five tracks, the overall live coral cover was estimated at only 8%. The relatively highest live hard coral cover, ranging from 10 to 15 % LHC, was seen in only two tracks (T12-T13 and T13-T14) where small recruits of *Acropora* tabulate corals were also encountered. In these coral patches, 50% of the substrate consisted of dead corals overgrown with algae, indicating that there used to be a fringing reef in the area. The corals in these stations appear to be prone to periodic sediment streams and massive corals have been vividly blanketed. On the whole, the live hard coral cover across 17 manta tow tracks was registered at an average of 2.85 %, soft corals at 0.2%, dead corals at 0.7%, dead corals with algae 17.9%, coral rubble 0.3% and sand at 78% (Figure 10). Overall, the coral profile along the 3.12 kilometer stretch of coastal waters surveyed in three Barangays is categorized as "*Poor*".

Two stations near the Holcim wharf revealed some dead corals (***Figure 41***) but no live colonies were seen even as systematic snorkeling was undertaken around the vicinity. In contrast, the northeastern section towards Barangay Calamias contained six (6) stations with dead coral encrusted with algae (***Figure 42***) which are apparently part of some live coral colonies farther north. The corals are located past manta tow station 17 and appeared to be more robust, with colonies of massive *Porites* sp. and a scattering of mushroom corals *Fungia* spp. Recruits of some branching species were observed. This area was subjected to detailed coral profiling through line intercept transect survey; the results of which are discussed in the next section. It should be noted, however, that this coral reef is almost two kilometers away from the Holcim port complex.

Overall, all of the surveyed tracks along the manta tow pathway was dominated by sand (***Figure 43***). The loss of corals appear to be caused by a confluence of factors - destructive fishing methods in the past, sedimentation and most recently, strong wave and current action damages as caused by Typhoon Nina in 2016. It is presumed that such strong underwater currents have dislodged remaining branching coral colonies and even swept away coral rubble from the seafloor.

In track T13 to T14 which had the highest live coral cover amongst the 17 tow pathways, a juvenile (approx. 60cm) Green Sea Turtle, *Chelonia mydas* was seen.

Pie graphs of substrate and coral life form composition for each manta tow track is shown in ***Annex C.***

Photo 6 - Feather stars Comanthina nobilis, Comatula rotalaria and Himerometra sp. are commonly found in the degraded reef flat seen in Barangay Calamias during marine ecology baseline assessment along the Holcim port complex secondary impact area; 29-30 January 2016.

Photo 7 - Coral colonies along a small stretch of reef patch in Barangay Calamias in the extreme northeastern region past the Holcim port complex consisted mostly of massive corals, dead corals with algae and rocks.

Table 13 - Results of seventeen manta tows for coral and benthic substrate profiling over a 3-kilometer stretch of coastal waters in the vicinity of the Holcim port complex; 29-30 January 2017 (Observers: Benj Francisco, Michael Chester Francisco and Jose Rene Villegas)

MANTA TOW RESULTS FOR REEF AND SUBSTRATE COMPOSITION			
Site name:	Eastern coastal waters running SW-NE across the HPI Wharf and its immediate vicinities; Municipality of Mabini, Batangas	**Survey Team:**	
Time / Date:	0923H-1017H / 29 Jan 2017	1. Benjamin Francisco 2. Michael Francisco 3. Rene Villegas	
Tow Speed:	4.5 kmh (ave)		
Visibility:	Varying from approx. ± 3m to ± 4m		
Weather:	Fair-Cloudy with some intermittent drizzles		

MANTA TOW RESULTS FOR REEF AND SUBSTRATE COMPOSITION								
Wave:		Rolling to strong wave action from approx. ± 30cm to ± 100cm wave crests						
Current:		Mild						
Tide:		Rising @ 0.01m to 0.14m; as ref from Anilao Balayan Bay Tidal Station (WXTIDE32)						
Water Temp:		Varying from approx. 26°C-27°C						
Wind:		Beaufort Scale #s 2 to 3						
Cloud Cover:		Altostratus to Nimbostratus						
Tow Coverage	**Location [DecDeg]**	**LHC**	**SC**	**DC**	**DCA**	**CR**	**S**	**Remarks**
S1	N 13.730556° E 120.933639°	-	-	-	-	-	-	Start of Tow
S1-T01	N 13.731667° E 120.934889°	0	0	5	0	0	95	Mostly sand and silt with a few patches of dead standing corals
T01-T02	N 13.732667° E 120.935806°	0	0	0	0	0	100	Predominantly sand and silt
T02-T03	N 13.733639° E 120.936889°	0	0	0	0	0	100	Predominantly sand and silt
T03-T04	N 13.734500° E 120.938083°	0	0	0	0	0	100	Predominantly sand and silt
T04-T05	N 13.735500° E 120.939389°	0	0	5	0	0	95	Mostly sand and silt with a few patches of dead standing corals
T05-T06	N 13.736111° E 120.940667°	0	0	0	0	0	100	Predominantly sand and silt
T06-T07	N 13.736444° E 120.941556°	0	0	0	0	0	100	Predominantly sand and silt
T07-T08	N 13.737222° E 120.942861°	0	0	0	0	0	100	Predominantly sand and silt
T08-T09	N 13.738167° E 120.944556°	0	0	0	20	0	80	Mostly sand and silt with a few patches of dead corals overgrown with algae
T09-T10	N 13.738944° E 120.946056°	0	0	0	0	0	0	Deep Water (substrate not visible); subjected to spot dive
T10-T11	N 13.739694° E 120.947139°	0	0	0	0	0	0	Deep Water (substrate not visible); subjected to spot dive
T11-T12	N 13.741056° E 120.947972°	0	0	0	0	0	0	Deep Water (substrate not visible)
T12-T13	N 13.742778° E 120.948139°	10	0	0	50	0	40	Patches of table corals adjacent to dead corals overgrown with algae

MANTA TOW RESULTS FOR REEF AND SUBSTRATE COMPOSITION								
T13-T14	N 13.744806° E 120.948778°	15	0	0	50	5	30	Observed live juvenile green turtle (*Chelonia mydas*) ~ 60cm length
T14-T15	N 13.746528° E 120.950250°	5	0	0	20	0	75	Mostly sand and silt with a few patches of live hard corals
T15-T16	N 13.747333° E 120.951583°	5	3	0	60	0	32	Mostly dead corals overgrown with algae with few patches of live corals isolated colonies of soft corals
T16-T17	N 13.748722° E 120.952917°	5	0	0	50	0	45	Mostly dead corals overgrown with algae & sand/silt with a few patches of live corals; plenty flotsam and garbage are strewn; **End of Tow**
Average Reef and Substrate Composition		**2.85**	**0.2**	**0.7**	**17.9**	**0.3**	**78**	

- Tow area coverage are expressed in Decimal Degrees notation in reference to WGS84 Map Datum
- Reef and Substrate composition are expressed in (%) and described as follows:

Live hard coral (LHC) - coverage of stony or hard corals on the bottom or part of the bottom
Live soft coral - (SC) - coverage of soft corals attached to the bottom
Dead coral (DC) - recently dead coral still attached and recognizable at the bottom in original upright position, color usually white with no living tissue
Dead coral with algae (DCA) - corallites still visible, skeletal structure can still be seen but algae dominate the structure (often appears greenish to brownish)
Coral rubble/rock (CR) - loose broken fragments of stony corals, consolidated hard bottom or large

Status Category: Poor = 0 - 24.9; Fair = 25 - 49.9%; Good = 50 - 74.9%; Excellent = 75 - 100% (Gomez et al. 1981)

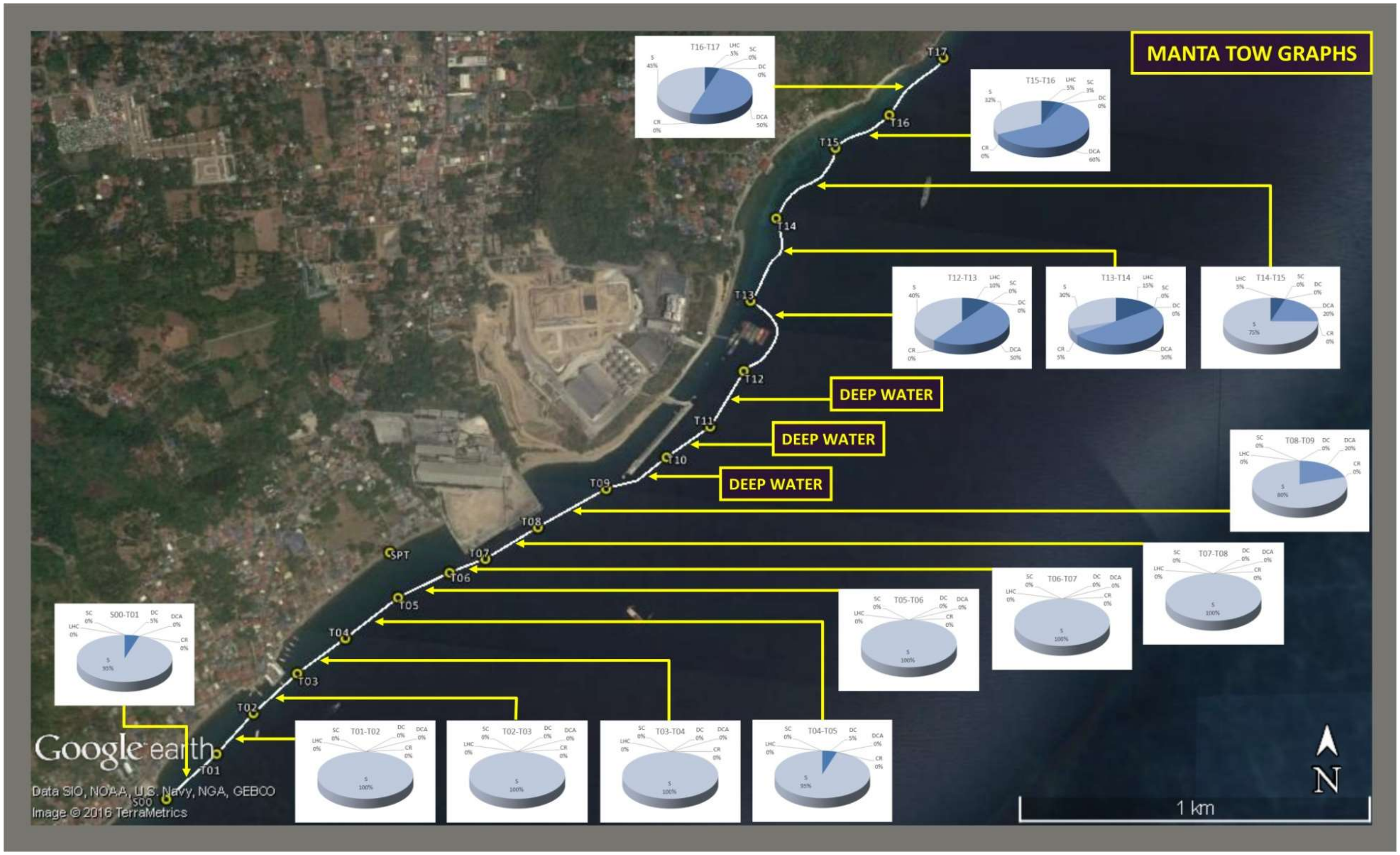


Figure 39 - Results of broad area benthic substrate and coral profiling employing manta tows in coastal waters around the Holcim port complex in Mabini, Batangas; 28-29 January 2017 (observers- Benj Francisco, Jose Rene Villegas and Mico Francisco; map by Jose Rene Villegas).

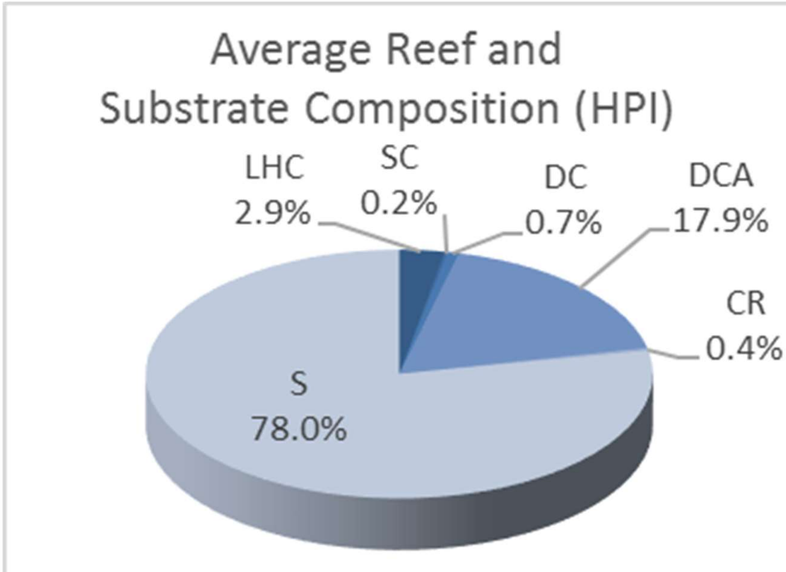


Figure 40 - Average distribution of coral life forms across seventeen manta tow benthic observation pathways surveyed during marine ecology baseline assessment in the vicinity of the Holcim port complex, Mabini, Batangas; 29 January 2017.

Figure 41 - Stations with dead corals near the Holcim wharf appear to be remnants of a reef patch that have altogether disappeared; (marine ecology baseline assessment in the vicinity of the Holcim port complex, Mabini, Batangas; 29 January 2017)

Figure 42 - Six stations surveyed during the marine ecology baseline assessment in the vicinity of the Holcim port complex, Mabini, Batangas (29 January 2017) contained dead corals with algae.

Figure 43 - Majority of stations surveyed during the marine ecology baseline assessment in the vicinity of the Holcim port complex, Mabini, Batangas (29 January 2017) were dominated by sandy substrate.

2.2.3.3.3 Results of Line Intercept Transect (LIT) Surveys for Detailed Coral Assessment

Two LIT stations for recording of detailed coral cover and benthic life forms associated with coral reefs were laid out in areas where patches of corals were observed. In fact, these two stations are the only areas where thinly distributed corals were seen along the benthic manta tow assessments pathways.

The first station is located a short distance northeast of the Holcim wharf where some minor coral patches were seen during the manta tows and required detailed investigation. This is the only area where remnants of corals were seen proximal to the said structure. The second station – near the boundary of Barangay Calamias and Barangay Bulacan is the only area where relatively more coral colonies were observed, but this station is already at a considerable distance from the Holcim wharf.

Across the two stations, the average live coral cover was documented at 15.10%, with massive corals *Porites* sp. and non-scleractinian mushroom corals belonging to the species *Fungia granulosa* dominating coral cover, accounting for only 5.8% and 7.2% of coral cover, respectively. The average percent live hard coral cover is categorized as "Poor". The benthic substrate was dominated by sandy substrate (51%), dead corals with algae (16.30%) and rubble (7.70%). Clumps of crinoids (feather stars) were frequent and was recorded to comprise 6.40% of the benthic environment across the two transects. Branching, digitate, encrusting and foliose corals were few each comprising less than 1% of the benthic substrate across the transect lines. Soft corals were thriving, albeit in very small numbers at 2.8% ***Table 14*** and ***Figure 44***).

Survey impressions indicate that the live corals in the area are highly stressed, with vivid sediment intrusion, as well as various non-degradable garbage.

Table 14 - Average percentage cover of the different coral lifeform categories across two (2) LIT transects located within the proposed Modification of Mabini Break Bulk Terminal project in Barangay Pulong Balibaguhan, Mabini, Batangas, January 29, 2017. (Observers: Victor L. Pantaleon and Ronald T. Pocon).

LIFEFORM CATEGOTES		CODE	AVERAGE PERCENTAGE COVER *(in %)*
Acropora	*Branching*	*ACB*	**0.40**
	Digitate	*ACD*	**0.70**
Non-Acropora	*Encrusting*	*CE*	**0.60**
	Foliose	*CF*	**0.40**

	Massive	*CM*	**5.80**
	Mushroom Coral	*CMR*	**7.20**
AVERAGE PERCENT LIVE HARD CORAL (LHC) COVER			***15.10 - Poor Condition***
Dead Coral		*DC*	**0.20**
Dead Coral with Algae		*DCA*	**16.30**
Other Fauna	*Soft Coral*	*SC*	**2.80**
	Sponge	*SP*	**0.40**
	Crinozoan	*OT*	**6.40**
Abiotic	*Sand*	*S*	**51.10**
	Rubble	*R*	**7.70**

Status Category: Poor = 0 - 24.9; Fair = 25 - 49.9%; Good = 50 - 74.9%; Excellent = 75 - 100% (Gomez et al. 1981)

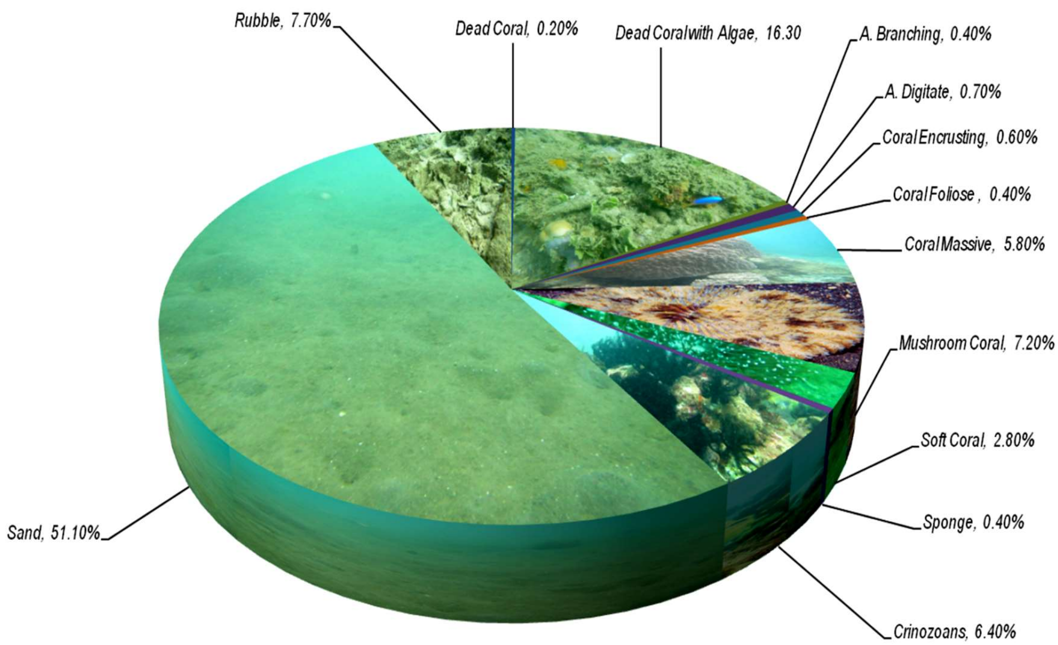


Figure 44 - Distribution of coral life forms, other fauna and abiotics across two LIT stations surveyed around the vicinity of the Holcim wharf complex, January 29, 2017.

On a per station basis, the corals in Station 1, proximal to the Holcim wharf hosts an extremely low coral cover, consisting of 1.80 % massive corals and 0.60 % mushroom corals. Sandy substrate comprised almost 80% of the benthic environment with about 8.6% of coral rubble (***Table 15*** including ***Figure 45*** and ***Figure 46***; also see ***Photo 8***). This small coral patch appears to be remnants of an old reef patch that have been seriously overcome by sediments and low recruitment capacity. There were no branching, encrusting or tabulate corals encountered in the station. Dead corals with algae were likewise were only a handful, comprising 4.40% of the substrate along the survey line. Station 2 hosted a fair coral cover averaging 27.80% throughout the transect line, with mushroom corals dominating the community at 13.80%, followed by massive corals at 9.80%. Soft corals were thriving in this area, consisting of 5.6% of the benthic community in the transect line; crinoids were profuse, accounting for 8% of other fauna encountered. Dead corals with algae comprised a sizeable portion of the transect area, most of which were of the massive forms; in which their mortality are presumed to have been caused by destructive fishing methods of long ago. Branching *Acropora* corals are almost vividly absent and it is presumed that these more fragile species have been seriously broken down by strong currents brought about by the Typhoon Nina that passed Batangas in December 2016.

In both stations recruits of live hard corals were few but recruits of soft corals were significant.

Name of Site: **Barangays Pulong Balibaguhan & Calamias**
Municipality & Province: **Mabini, Batangas**
Observers: **Victor L. Pantaleon & Ronald T. Pocon**
Depth(m): **10 - 15**
Locations & Date: **January 29, 2017**
Station No.:01 : 13.73752^0 N, 120.94363^0 E

LIFEFORM CATEGORIES		CODE	DISTRIBUTION PER TRANSECTS *(in %)*	
			1	2
Acropora	*Branching*	*ACB*		**0.80**
	Digitate	*ACD*		**1.40**
Non-Acropora	*Encrusting*	*CE*		**1.20**
	Foliose	*CF*		**0.80**
	Massive	*CM*	**1.80**	**9.80**
	Mushroom Coral	*CMR*	**0.60**	**13.80**
AVERAGE PERCENT LHC COVER			**2.40(Poor)**	**27.80(Fair)**
Dead Coral		*DC*		**0.40**
Dead Coral with Algae		*DCA*	**4.40**	**28.20**
Other Fauna	*Soft Coral*	*SC*		**5.60**
	Sponge	*SP*		**0.80**
	Crinozoan	*OT*	**4.80**	**8.00**
Abiotic	*Sand*	*S*	**79.80**	**22.40**
	Rubble	*R*	**8.60**	**6.80**

Status Category: Poor = 0 - 24.9; Fair = 25 - 49.9%; Good = 50 - 74.9%; Excellent = 75 - 100% (Gomez et al. 1981)

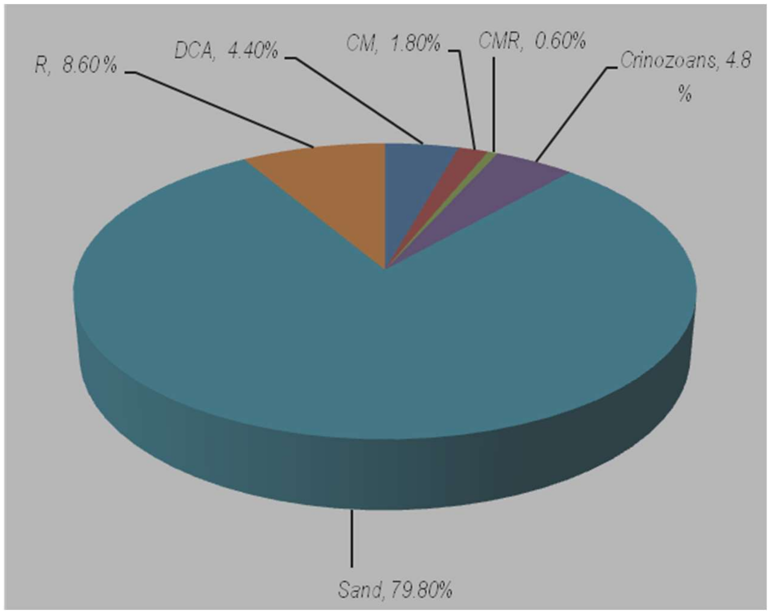


Figure 45 - Distribution of coral communities, other fauna and abiotic components catalogued in two LIT stations surveyed during the marine ecology baseline assessment in the vicinities of the Holcim port complex, Mabini, Batangas: Upper graph is for station 1 and lower graph is for station 2. (29 January 2017).

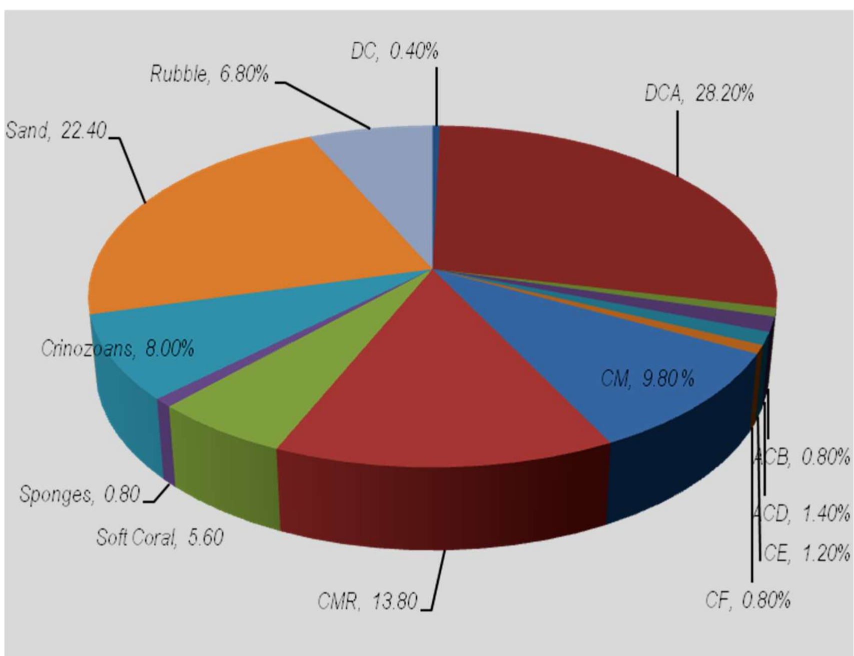


Photo 8 - Photographs showing the dominant live hard and soft corals in the survey site. (images taken on January 29, 2017; Victor L. Pantaleon and Ronald T. Pocon). Upper photos left to right: Fungia granulosa, Porites species, Herpolitha limax, and Oxycomant bennetti (Feathers stars); Porites lobata (LIT station 2); Bottom left to right: three-striped Damselfishes Dascyllus aruanus have taken refuge in scleractinian coral recruits of Pocillopora elegans; and Clavularia viridis, (LIT station 1)

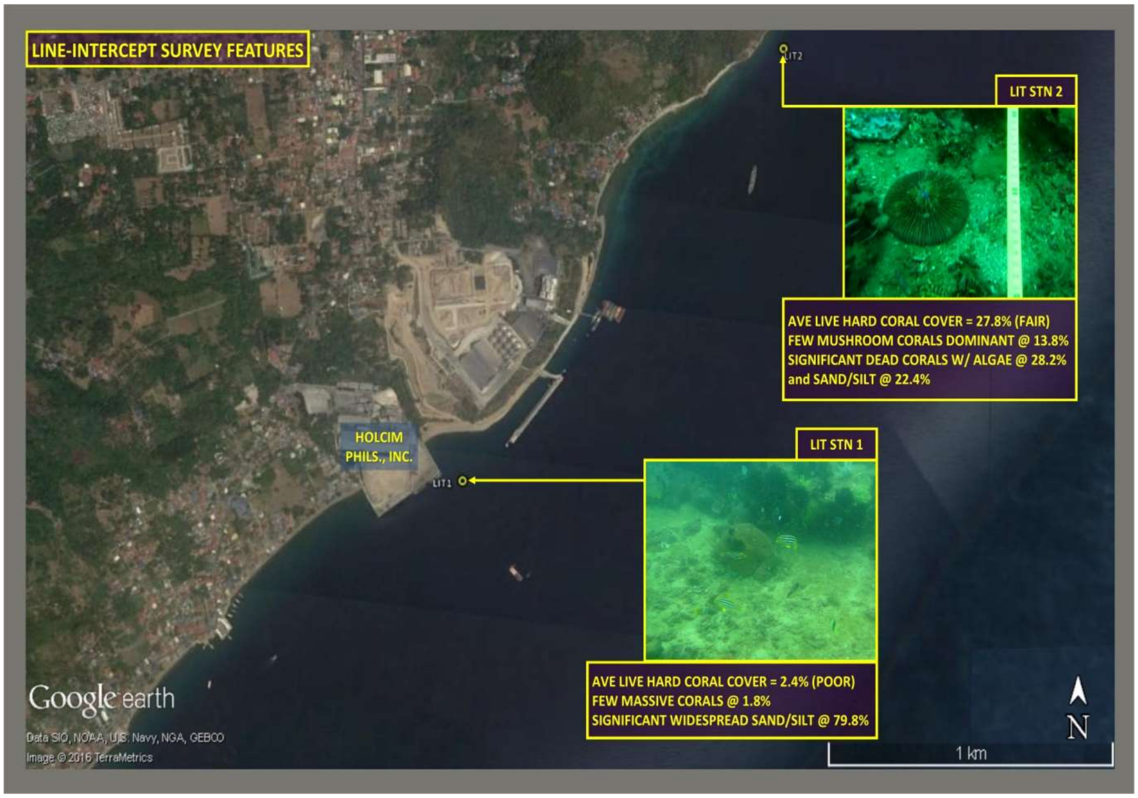


Figure 46 - Location and basic features of the benthic environment surveyed in two LIT stations during marine ecology baseline assessment in the vicinity of the Holcim port complex, Mabini, Batangas (29 January 2017)

Across the two LIT stations and in a spot dive area near LIT station 2, a total of 20 species of corals and three species of feather stars were catalogued (***Table 15***).

Table 15 - Coral colonies in two (2) LIT stations observed in Barangays Pulong Balibaguhan and Calamias, Mabini, Batangas.

Some coral species encountered in two (2) LIT stations surveyed within the proposed Modification of Mabini Break Bulk Terminal.

Massive	Branching	Digitate, Encrusting, Mushroom, Foliose & Other (Feathers star)
Leptoria species	*Acropora robusta*	*Acropora humulus*
Lobophyllia corymbisa	*Montipora digita*	*Acropora digitifera*
Lobophyllia dentatus	*Pocillopora elegans*	*Turbinaria stellulata*
Lobophyllia hemprichii	*Porites nigrescens*	*Clavularia viridis*
Porites lobata		*Cycloseris species*
Porites species		*Fungia granulosa*
		Herpolitha limax
		Sandalolihta dentate

Massive	Branching	Digitate, Encrusting, Mushroom, Foliose & Other (Feathers star)
		Lithophyllon lobata *Montipora foliosa* *Oxycomanthus bennetti* *Comantheria species* *Himerometra robustipinna* *Goniopora minor*

2.2.3.3.4 Survey Results for Associated Reef Fish Communities

Fish visual census in the two stations counted a total of 805 individuals belonging to 27 species in 17 families. By comparison to contemporary species richness in areas where coral reef profiles are better, the species richness in the surveyed areas in Mabini, Batangas are relatively in moderately abundant category. Fish abundance is however, dominated by small individuals. The damselfishes, principally *Dascyllus trimaculatus* comprised almost half of the entire fish population in stations 1 and 2 combined. "*Dalagang Bukid*" (Fusilier) was also abundant, numbering 120 individuals or 15% of the fish population across two transects. The mean distribution per category of fish is relatively good with 12 target species dominated by fusiliers (*Dalagang Bukid*) in both stations, surgeonfishes (*labahita*) and a few snappers and breams. The surgeonfishes were of mature sizes. Indicator fishes consisted of 6 species – mostly the Moorish Idol and butterflyfish as encountered in FVC Station 1. Nine species comprised the 'other' fish category, mostly consisting of parrotfishes, damsels and triggerfish (Figure 18). Combined, the target species accounted for more than 44% of species richness and was recorded at a density of 1.04 fish/500m^2 (Figure 19). The highest density was attributed to the Pomacentridae family group, at 4 individuals per m^2. Because of this, fish biomass of the Pomacentrids was quite high at 9.8 kg /500m^2. Since target species were of small size, the biomass for this group was low at 0.63kg/500m^2 (Figure 20).

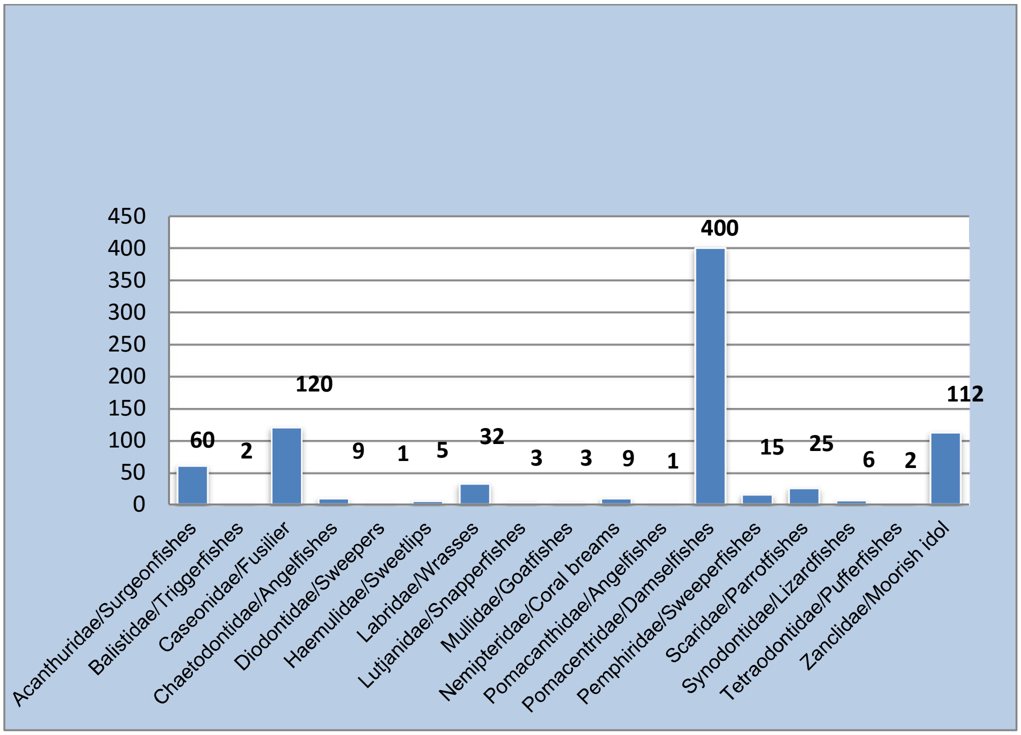


Figure 47 - Fish abundance by family and number of individuals catalogued in two FVC stations during marine ecology baseline assessment in the primary and secondary impact areas in the proposed Holcim Phils., Inc. Modification of Break Bulk Terminal Project in Barangays Pulong Balibaguhan & Calamias, Mabini, Batangas, January 29, 2017; (Observers: Victor Pantaleon, Ronald Pocon and Weng Quimpo)

Surprisingly, there were more fish individuals and species in FVC station 1 which had a far lesser coral cover than in Station 2. Fish abundance in the former station was recorded at 457 individuals in 20 species, accounting for 56.7% of the total fish community catalogued. In the latter station, the fish population consisted of 348 individuals in 11 species, accounting for 43% of the total fish population across two stations. The greater number of fishes in Station 1 is attributed to the presence of a large aggregate of the indicator fish – *Zanclus cornutus* (Moorish Idol) that seemed to have gathered for what appears to be a spawning activity. This coral-indicator species numbered 100 individuals inside the transect belt and many more were outside of the survey corridor.

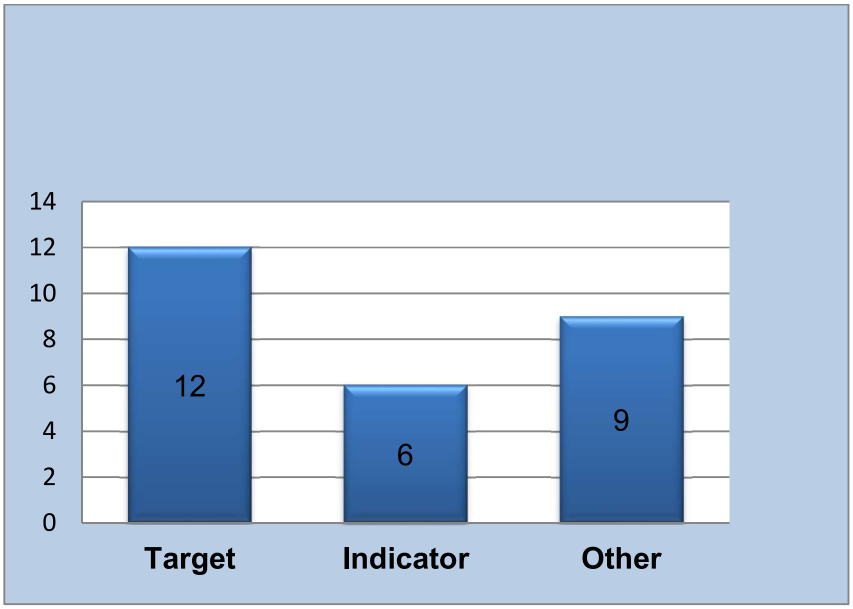


Figure 48 - Fish species richness by fish category catalogued in two FVC stations surveyed during marine ecology baseline assessment in primary and secondary areas of the proposed Holcim Phils., Inc. Inc. Modification of Break Bulk Terminal Project in Barangays Pulong Balibaguhan & Calamias, Mabini, Batangas, January 29, 2017; (Observers: Victor Pantaleon, Ronald Pocon and Weng Quimpo)

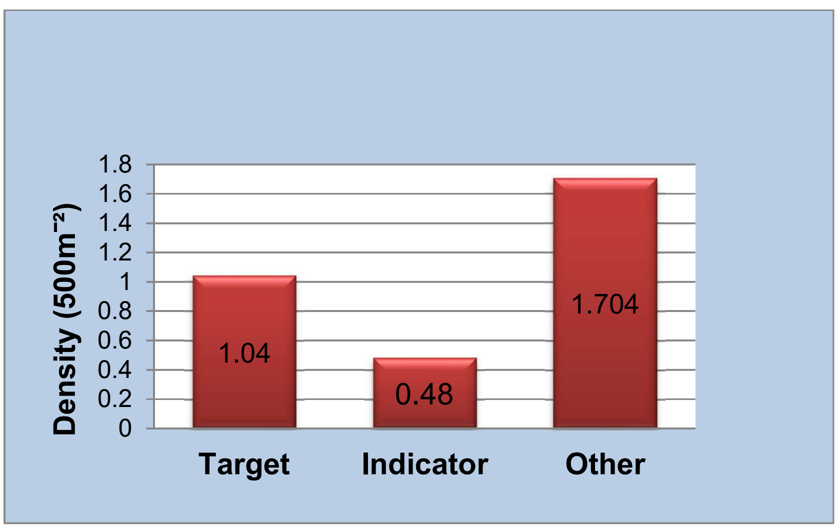


Figure 49 - Average fish density/m2 by fish category catalogued in two FVC stations surveyed during marine ecology baseline assessment in primary and secondary areas of the proposed Holcim Phils., Inc. Modification of Break Bulk Terminal Project in Barangays Pulong Balibaguhan & Calamias, Mabini, Batangas, January 29, 2017; (Observers: Victor Pantaleon, Ronald Pocon and Weng Quimpo)

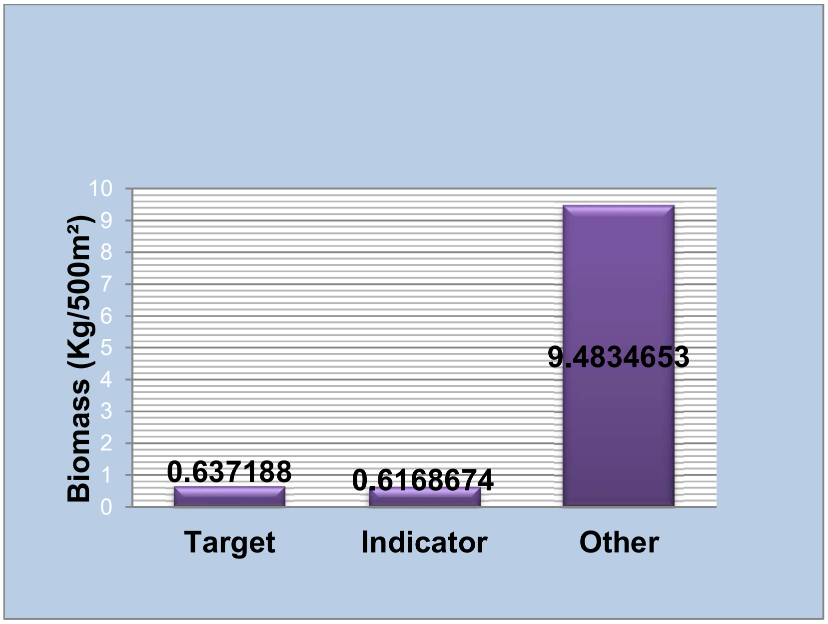


Figure 50 - Fish biomass by fish categories catalogued in two FVC stations surveyed during marine ecology baseline assessment in primary and secondary areas of the proposed Holcim Phils., Inc. Modification of Break Bulk Terminal Project; Barangay Pulong Balibaguhan Mabini, Batangas, January 29, 2017; (Observers: Victor Pantaleon, Ronald Pocon and Weng Quimpo)

Nevertheless, the presence of mature sizes of *Acanthuridae* in Station 1 and *Labridae* in Station 2 indicate that the reefs – in spite of the sedimentation episodes and however deficient as they appear, are favored habitats of a modest diversity of important fish species and reveals as well that the site may be spawning grounds for aggregations of mature food fish, perhaps in the deeper slope. Groups of more *Caesionid*s and *Siganids* were also present in the area, disturbed by the survey team outside of the survey corridor. In the manta tow pathways, *Haemulidae* (sweetlips) were also observed.

2.2.3.3.5 Results of Spot Dives

Two spot dives were conducted proximal to the Holcim wharf area to validate presence or absence of benthic habitats susceptible to increased vessel traffic (Spot Dive Stations 2 and 3). A third station was investigated near the coral reef in Barangay Calamias (Spot Dive Station 1).

Spot Dive Station 1 is located in an area where remnants of a damaged reef patch occur and revealing sporadic colonies of tabulate and massive corals estimated to be comprised of 5% to 10% live hard corals consisting of mostly massive *Porites* sp., few *Acropora* branching corals and isolated colonies of the fire coral *Millepora* sp. Dead corals were estimated at 25%, dead corals with algae at 35% and coral rubble at 15% of the benthic substrate. The profile of this patch of corals is consistent with the results of detailed coral assessment in LIT Station 2 which was located further north of Spot Dive Station 1. Feather stars were likewise abundant in this area.

Figure 51 - Dominant and similar fish species catalogued in two FVC stations surveyed during the marine ecology baseline assessment in primary and secondary areas of the proposed Holcim Phils., Inc. Modification of Break Bulk Terminal Project in Barangays Pulong Balibaguhan & Calamias, Mabini, Batangas, January 29, 2017; (Observers: Victor Pantaleon, Ronald Pocon and Weng Quimpo; map and graphics by Jose Rene Villegas).

Spot Dives 2 and 3, in 15 meters of water near the Holcim wharf confirmed that there were no corals in the vicinity of the wharf area, extending from the shelf to the slope about 30 meters breadth and a stretch of about 300 meters parallel to the wharf and coastline. The substrate seems to be a mixture of sand forced through recent typhoons and remnants of reclamation refilling materials (Plate 8; Figure 22). A used tire was seen at the bottom, serving as refuge for cardinalfishes. Colonies of the blue-spotted sea urchin – *Astropyga radiata* were also profuse.

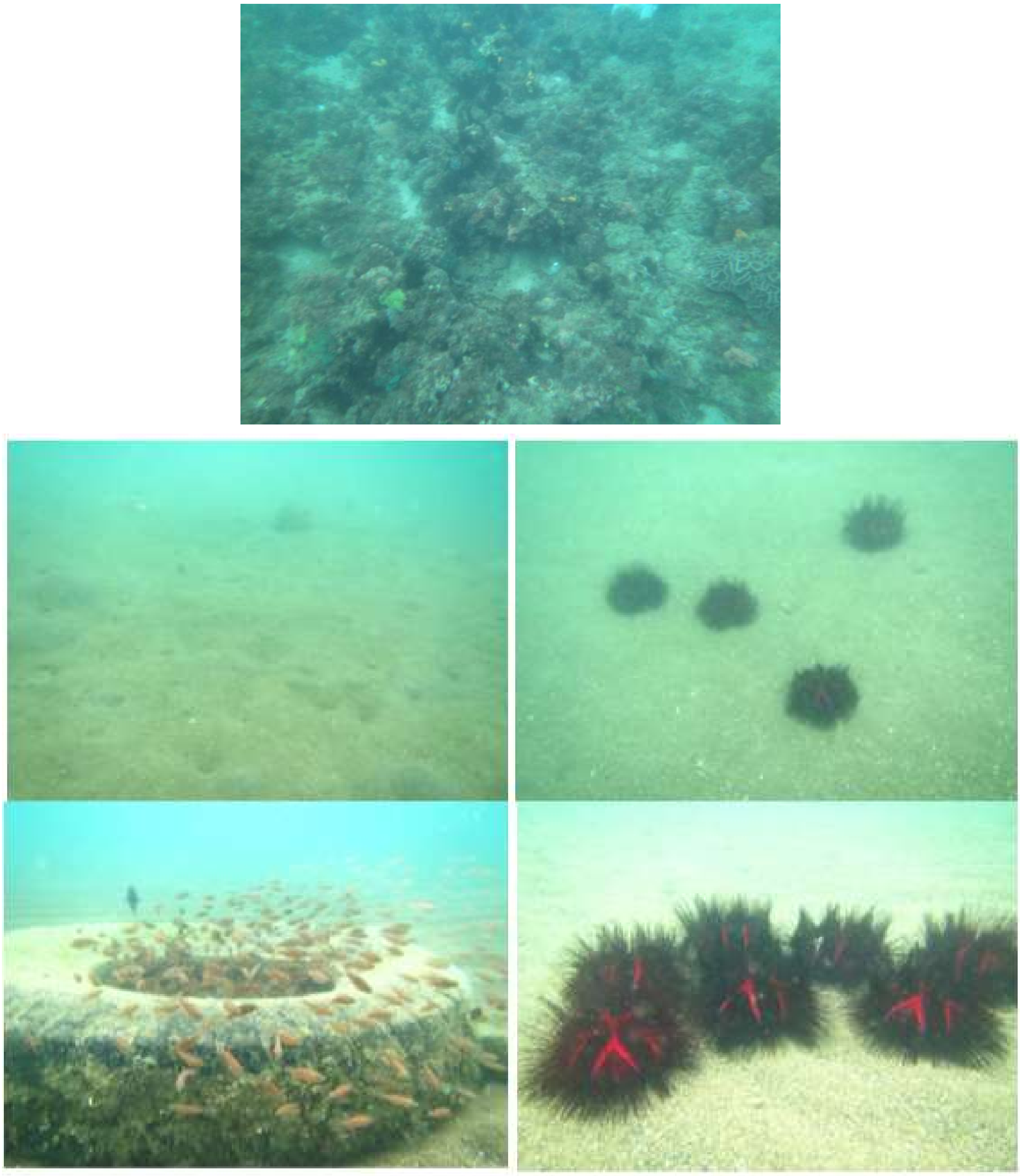


Figure 52 - Sandy substrate mixed with reclamation filling materials seen near the Holcim wharf in Spot Dive Stns 2 and 3. Colonies of the injurious "fire sea urchins" were also abundant (Figure 28 a to 28d)

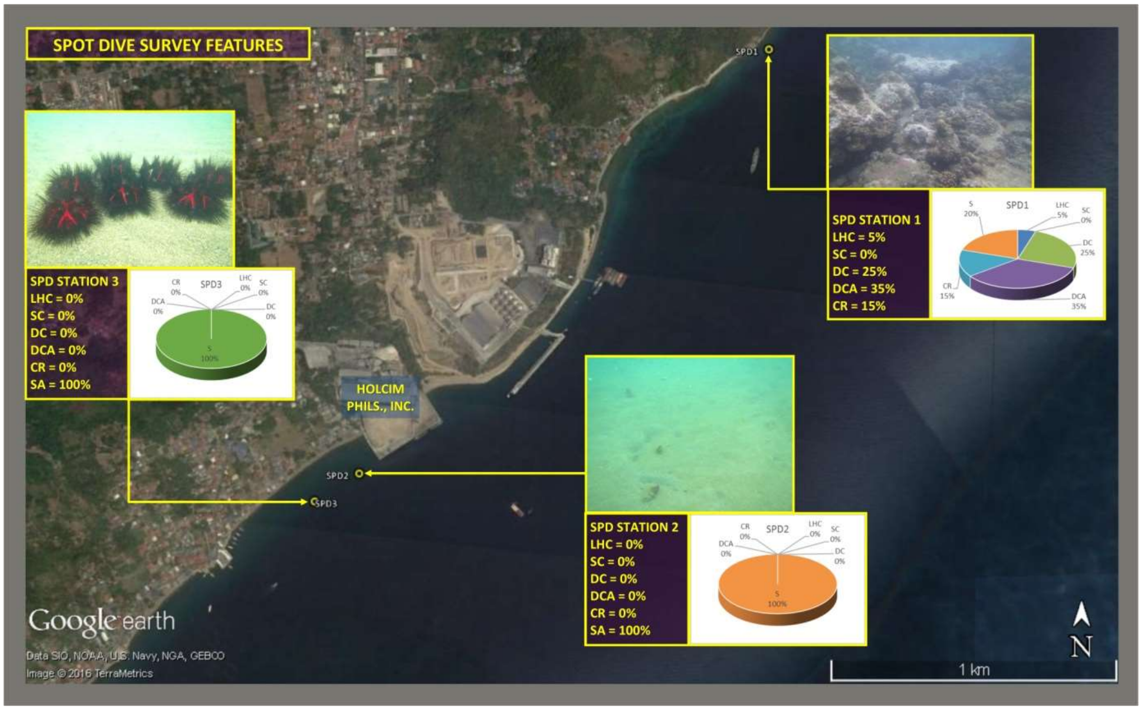


Figure 53 - Results of spot dives depicted by pictures in each location; marine ecology baseline assessment in primary and secondary areas of the proposed Holcim Phils., Inc. Modification of Break Bulk Terminal Project in Barangays Pulong Balibaguhan & Calamias, Mabini, Batangas, January 29, 2017; (Observers: Victor Pantaleon, Ronald Pocon and Weng Quimpo; map and graphics by Jose Rene Villegas).

Table 16 - Tabulated summary of fish abundance and species by family taxa catalogued in two FVC stations during the marine ecology baseline assessment in the primary and secondary impact areas in the proposed Holcim Modification of Break Bulk Terminal Project in Barangays Pulong Balibaguhan & Calamias, Mabini, Batangas, January 29, 2017. (Observers: Victor Pantaleon, Ronald Pocon and Weng Quimpo)

Site Name: **Station 1: Holcim Port to SMMI boundary** **Station 2: Barangay Calamias**	Municipality & Province: **Mabini, Batangas**
Date: **January 29, 2017**	Observers: **Ronald T. Pocon & Rowena R. Quimpo**
Time: **09:01 A.M. and 2:45 P.M.**	Depth(m/ft.): **Station One:12-14 meters Station Two: 4 - 7 meters**
Coordinates	**Station 1- N 13.737520° E 120.943630°** **Station 2 – N 13.748910° E 120.953450°**

FAMILY	COMMON NAME	SCIENTIFIC NAME	LOCAL NAME	Station 1		Station 2		Total # of indivi-duals
				# of ind	Size *(cm)*	# of ind	Size *(cm)*	
Acanthuridae	Slender unicorn	*Naso minor*	Labahita	**30**	**25**			**30**
Acanthuridae	Striated surgeonfish	*Ctenochaetus striatus*	Labahita/Indangan	**30**	**8**			**30**
Balistidae	Orange-lined triggerfish	*Balistapus undulatus*	Pakol			**2**	**15**	**2**
Caseonidae	Banana fusilier	*Pterocaesio pisang*	Dalagang bukid	**80**	**10**	**40**	**8**	**120**
Chaetodontidae	Sunburst butterflyfish	*Chaetodon kleini*	Paru-parong dagat	**2**	**12**			**2**
Chaetodontidae	Melon butterflyfish	*Chaetodon trifasciatus*	Paru-parong dagat	**2**	**10**			**2**
Chaetodontidae	Longnose butterflyfish	*Forcipiger longirostris*	Paru-parong dagat	**2**	**10**			**2**
Chaetodontidae	Threadfin butterflyfish	*Chaetodon auriga*	Paru-parong dagat	**3**	**8**			**3**
Diodontidae	Black-blotched porcupinefish	*Diodon liturosus*	Buktit/Buteteng laot	**1**	**30**			**1**
Haemulidae	Indian Ocean oriental sweetlips	*Plectorhinchus vittatus*	Bakoko/Goliabao	**4**	**15**			**4**
Haemulidae	Harlequin sweetlips	*Plectorhinchus chaetodonoides*	Bakoko/Kayubibi	**1**	**10**			**1**
Labridae	Moon wrasse	*Thalassoma lunare*	Bunak/Bungat			**30**	**10**	**30**
FAMILY	**COMMON NAME**	**SCIENTIFIC NAME**	**LOCAL NAME**	**Station 1**		**Station 2**		

				# of ind	Size (cm)	# of ind	Size (cm)	Total # of indivi-duals
Labridae	Blackeye thicklip	*Hemigymnus melapterus*	Bankilan/Bungat			2	28	2
Lutjanidae	Common bluestripe snapper	*Lutjanus kasmira*	Maya maya	3	18			3
Mullidae	Many bar goatfish	*Parupeneus multifaciastus*	Bisogo/Manitis			3	12	3
Nemipteridae	Two-lined monocle bream	*Scolopsis bilineata*	Tagisang lawin/Tingin			9	10	9
Pomacanthidae	Keyhole angelfish	*Centropyge tibicen*	Alibangbang	1	10			1
Pomacentridae	Tomato clownfish	*Amphiprion frenatus*	Palata			2	10	2
Pomacentridae	Yellowbelly damselfish	*Amblyglyphidodon leucogaster*	Palata			8	9	8
Pomacentridae	Yellow chromis	*Chromis analis*	Palata			40	7	40
Pomacentridae	Threespot dascyllus	*Dascyllus trimaculatus*	Palata	150	8	200	8	350
Pempheridae	Vanikoro sweeper	*Pempheris vanicolensis*	Kampitan	15	12			15
Scaridae	Dusky parrotfish	*Scarus niger*	Luro/Mulmol/Lutiin	10	15			10
Scaridae	Bleeker's parrotfish	*Chlorurus bleekeri*	Luro/Mulmol/Yapot	15	10			15
Synodontidae	Variegated lizardfish	*Synodus variegatus*	Bubule/Kalaso	6	12			6
Tetraodontidae	Valentin's sharpnose puffer	*Canthigaster valentini*	Butete	2	8			2
Zanclidae	Moorish idol	*Zanclus cornutus*	Kalmin-kalmin	100	8	12	10	112
Total # of individuals per transect (500m²)				**457 (20 species)**		**348 (11 species)**		**805**
Species Richness								
Total number of fish families								**17**
Total number of target species▪								**12**
Total number of indicators								**6**
Total number of other species								**9**
Total number of species								**27**

2.2.3.3.6 Seagrass Communities

The seventeen manta tow benthic observation pathways did not reveal the occurrence of seagrass beds in more than 3 kilometers of near-shore areas surveyed. Key informants in Barangay Talaga East claim that seagrass beds used to occur in the sandy shelf fronting the Barangay but were all apparently lost during the passing of Typhoon Nina in 2016. Remnants of the seagrass *Thallassia hemprichii* (sickle seagrass) were observed amongst flotsam but the seagrass blades may have been carried from seagrass colonies existing in Balayan Bay, which is a great distance from the Holcim wharf.

2.2.3.3.7 Mangrove Resources

No mangrove trees were seen in the 3 kilometer stretch of coastline surveyed during the marine ecology baseline assessment. Further observations also point to the fact that not a single mangrove stand are present even in the adjacent Barangays.

2.2.3.3.8 Macro-invertebrates

Macro-invertebrate surveys were undertaken in two stations through opportunistic observations of epi-benthic macro-invertebrates in the sandy inter-tidal flat fronting Barangay Talaga East where gleaners allegedly collect shellfish during low tide. Specimen collection (for purposes of photo-documentation) was also undertaken in the line intercept stations. The objective of the survey is to determine whether significant populations of macro-invertebrates of significant value as food supplement or for trade is present in the area.

Survey results indicate that a diverse community of macro-invertebrates exists in the inter-tidal shelf dominated by sea urchins, including the edible Collector Urchin, *Tripneustes gratilla*. Species abundance is represented by a total of 25 species (Table 10), including 9 species of bivalves, 10 species of gastropods, and 6 species of echinoderms - mostly sea urchins. Based on the FAO's *"Species Identification Guide for Fishery Purpose",* at least thirteen species of the macro-invertebrates, including the lucrative *Tripneustes gratilla*, are noted to have commercial importance or are considered edible. The proliferation of sea urchins is an indication of the absence of predators – principally benthic species of fish that are reef associated (e.g. parrotfish). There are no corals in the stretch of coastal waters fronting Barangay Talaga east.

The results of the macro-invertebrate survey showing species found is also graphically mapped in ***Figure 54*** and shown in ***Photo 9***.

Table 17 - Major macro-invertebrates encountered in two survey stations in the coastline of Barangay Talaga East near the Holcim port complex, Mabini, Batangas (Observers: Weng Quimpo, Rene Villegas, Benj Francisco, Ronald Pocon).

Species Name	Common Name	Habitat	Group
Tripneustes gratilla	Collector Urchin	Sandy substrate	Echinoderm
Trochus niloticus	Top Shell	Sandy substrate	Gastropod
Conus sp. 1	Conus Shell	Sandy substrate	Gastropod
Fragum sp.	Cockle	Rocks	Bivalve
Lioconcha castrensis	Pitar Venus Clam	Sandy substrate	Bivalve
Lithopaga teres	Date Mussel	rocks	Bivalve
Codakia tigerina	Pacific Tiger Lucine	Sandy substrate	Bivalve
Turbo sp.	Turban Shell	Sandy substrate	Gastropod
Katelysia hiantina	Giant Venus Clam	Sandy substrate	Bivalve
Litoria sp.	Periwinkle	sand	Gastropod
Cypraea sp.	Cowrie	corals	Gastropod
Lambis lambis	Spider shell	Sandy substrate	Gastropod
Tonna sulcosa	Banded Tun	Sandy substrate	Gastropod
Architectonica maxima	Sundial Shell	Sandy substrate	Gastropod
Tutofa bubo	Frog Shell	Sandy substrate	Gastropod
Nerita picea	Nerite Shell	rocks	Gastropod
Atrina pectinata	Comb Pen Shell	Sand/rocks	Bivalve
Acanthopleura sp.	Chiton	Sandy substrate	Echinoderm
Spondylus varius	Thorny Oyster	Rocks	Bivalve
Pinna sp.	Penshell	Sandy substrate	Bivalve
Atrina sp.	Sawtooth Penshell	Sandy substrate	Bivalve
Astropyga radiata	Blue-spotted sea urchin	Sandy substrate	Echinoderm
Diadema setosum	Long spined sea urchin	Sandy substrate	Echinoderm
Meoma ventricosa	Red heart sea urchin	Sandy substrate	Echinoderm
Echinotrix calamari	Banded sea urchin	Sandy substrate	Echinoderm

Photo 9 - Some of the macro-invertebrates found in two survey stations and in patches of corals during marine ecology baseline assessment in primary and secondary areas of the proposed Holcim Phils., Inc. Modification of Break Bulk Terminal Project in Barangay Pulong Balibaguhan; January 28-29, 2017.

Top row L-R: Red-Heart Sea Urchin, *Meoma ventricosa;* Sawtooth Penshell, *Atrina sp.*; Date Mussels, *Lithopaga teres;* and edible Collector Urchins *Tripneustes gratilla*. Bottom row L-R*:* Pitar Venus Clam *Lioconcha castrensis;* Long Spine Sea Urchin, *Diadema setosum*; Banded Sea Urchin, *Echinotrix calamari*; and Blue-spotted sea urchin, *Astropyga radiata*.

Figure 54 - Features of major macro-invertebrates encountered in two survey stations in the coastline of Barangay Talaga East near the Holcim port complex, Mabini, Batangas (Observers: Weng Quimpo, Rene Villegas, Benj Francisco, Ronald Pocon).

2.2.3.3.9 Plankton Community

2.2.3.3.9.1 Phytoplankton

The phytoplankton assemblage collected off the coast of Mabini Batangas was typical of tropical coastal waters. A total of six stations were surveyed where four stations (P1-P4) just in front of the project site represent the impact sites and two stations (P5-P6) outside the project site serves as control. A total of 35 phytoplanktons belonging to bacillariophyceae (diatoms) with 21 species, dinophyceae (dinoflagellates) with 13 species and cyanophyceae (blue-green algae) with 1 species were observed from the six stations surveyed. Overall, diatoms were the most dominant group accounting for 96% of the phytoplankton community (***Figure 55***). Of these, the small centric chain-forming diatom belonging to genus *Chaetoceros* was most common and abundant genera which constitute 21% of the community and followed by a pennate chain-forming diatom *Thalassionema* which constitutes 16%. These phytoplankton species have significant role to overall primary productivity of the marine environment in Mabini, Batangas. Dinoflagellates only accounted for almost 3% of the phytoplankton community were represented most by genus *Ceratium* and *Protoperinium*. The only marine cyanobacteria genus observed was *Trichodesmium* only accounts for less than 2%.

The potentially harmful species observed during the survey was *Pseudoniztschia* spp. Some species belonging to this genus are reported to produce domoic acid, a toxin associated with amnesic shellfish poisoning (FAO, 2000). However, exact species identification of this species was a limitation as it requires observation under a more powerful microscope i.e Scanning Electron Microscope and special sample preparation. However, the risk could be very low and can be even ruled out since cell densities observed in stations where very low (70 to 680 cells/L). Moreover, no extensive shellfish farming in the area is observed in the area so possible negative effects due to toxins produced by this diatom species could be ruled out but continued monitoring is highly recommended. Photomicrograph of dominant and common phytoplankton is shown in ***Photo 10***.

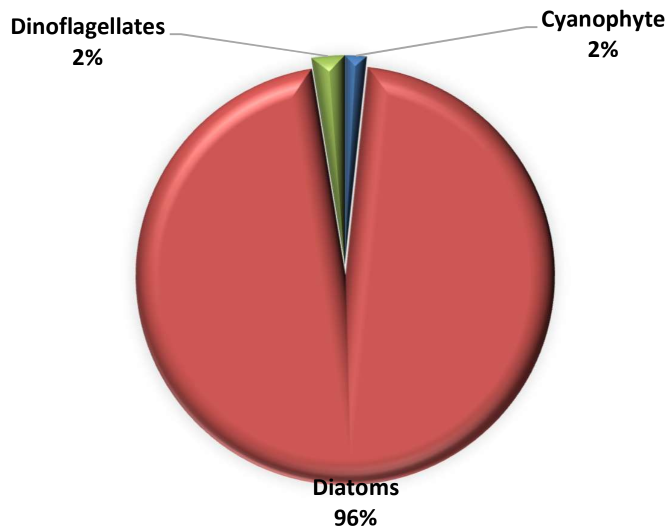


Figure 55 - Percentage composition of major phytoplankton groups observed in six stations during the marine ecology baseline assessment in primary and secondary areas of the proposed Holcim Phils., Inc. Modification of Break Bulk Terminal Project in Barangay Pulong Balibaguhan, Mabini, Batangas, January 28-29, 2017 (researcher: Garry Benico)

Generally, the mean cell density of all the phytoplankton in six stations ranges from 59 to 207 cells/L. In terms of spatial distribution, station Ph1 near the impact site had the most number of phytoplankton genera observed with 27 but station Ph2 had the highest phytoplankton abundance with 7,260 cells/L (Figure 25). The lowest total phytoplankton density and the most depauperate station was observed in station Ph6, one of the control stations with 2,070 cells/L and only 14 taxa observed. The highest computed diversity index based on Shannon Weiner (H) was observed in station Ph1 with 2.74 while the lowest was observed in stations Ph6 with only 2.15. The index of evenness based Pielou (I) were relatively similar among the six stations ranging from 0.74 to 82.

The overall impression of the phytoplankton community during the survey is moderately good as indicated by relatively good diversity measurement and relatively high number of phytoplankton taxa observed. Although high concentration of phytoplankton in the impact site was observed, most species are cosmopolitan with no rare species to be highly susceptible to anthropogenic issues of project activity. Generally, there is insufficient information on the direct and indirect effects of suspended sediment plume during port construction on planktonic communities to judge/assess with certainty the impacts on planktonic activities found in the site. However, the increased load of suspended solids would reduce light penetration which can reduce depth of photosynthetic activity by the phytoplankton. However, it is important to note that increase in turbidity can be also cause by natural process such as storms or typhoons and turbulent waves during monsoons. Plankton communities are resilient and population could be replenished from other parts of Batangas Bay due to water circulation and current system.

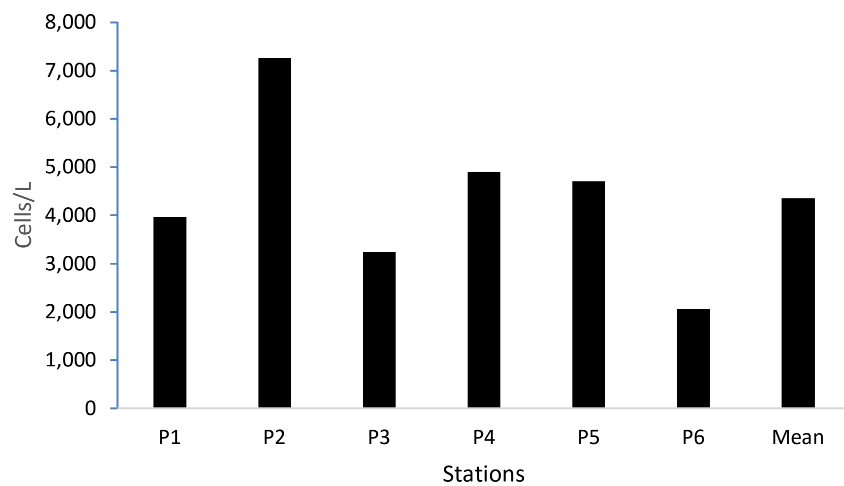


Figure 56 - Total phytoplankton abundance for six stations sampled in Mabini, Batangas during the January 29, 2017 the marine ecology baseline assessment in primary and secondary areas of the *proposed Holcim Phils., Inc. Modification of Break Bulk Terminal Project in Barangay Pulong Balibaguhan, Mabini, Batangas, January 28-29, 2017 (researcher: Garry Benico).*

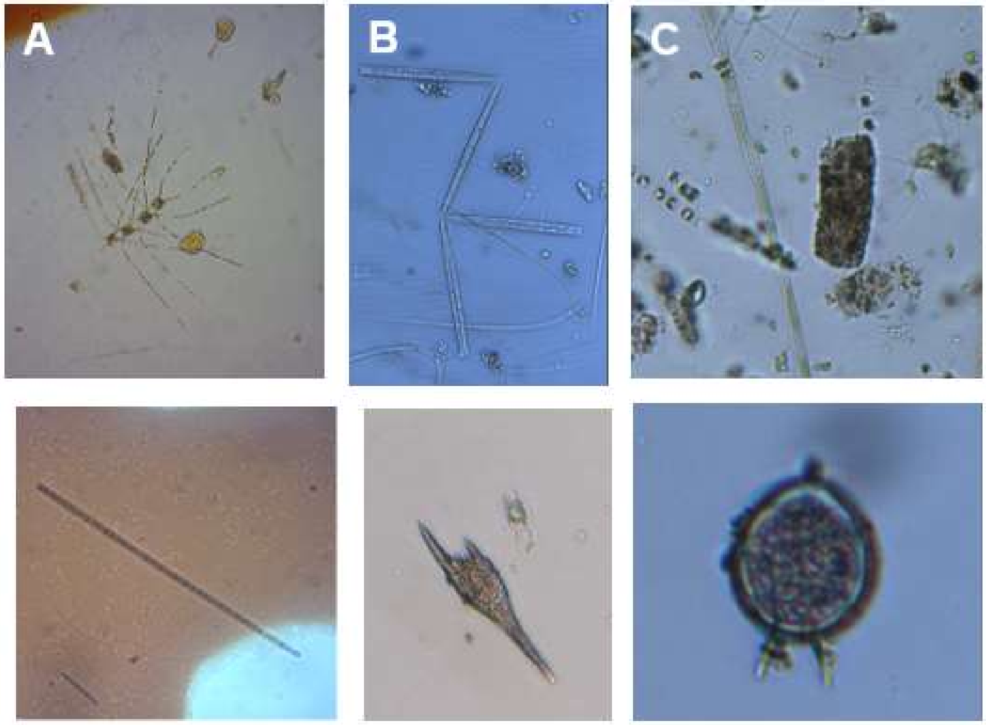


Photo 10 - Photomicrograph of common and dominant phytoplankton in six stations sampled in Mabini Batangas (A) Chaetoceros (B) Thalassionema (C) Trichodesmium (D) Pseudonitzschia (E) Ceratium (D) Protoperidinium

2.2.3.3.9.2 *Zooplankton*

A total of eleven (11) zooplankton groups were identified from the six stations sampled in the site (***Table 18***). Zooplankton observed consisted of larval forms which constitutes 77% and adult forms with 23% of the total zooplankton abundance. Adult zooplankton life forms recorded 5 groups while larval forms recorded 6 groups during this survey. The large portion of the larval zooplankton was represented by copepod Nauplius which comprised 71% and mean abundance of 81,046 ind/m^3 (***Figure 58***). For the adult zooplankton forms, Calanoid copepod accounting for 11% at mean abundance of 12,970 ind/m^3 were the most abundant. Other important groups like Cyclopoid copepod and unidentified eggs contributed significant portion of the zooplankton community with 9% (mean density of 10,086 ind/m^3) and 6% (mean cell density 6,999 ind/ m^3). No fish larvae were observed during the sampling period. There were no rare or endemic zooplankton species found in the area and majority of the groups are common and cosmopolitan in distribution. Photomicrograph of common zooplankton groups is shown ***Photo 11***.

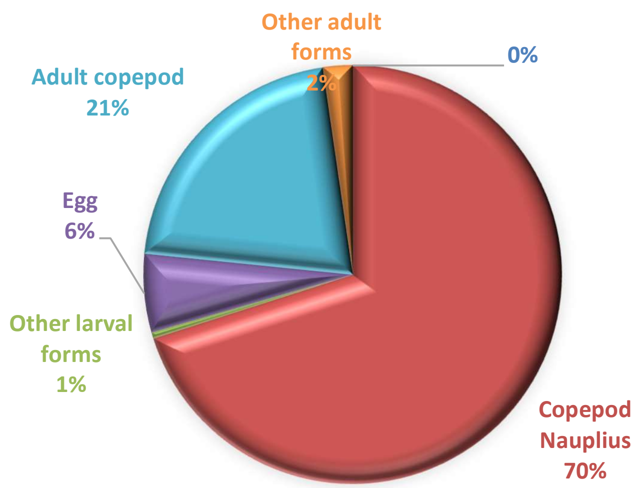


Figure 57 - Percentage composition of major zooplankton groups observed in six stations during the marine ecology baseline assessment in primary and secondary areas of the proposed Holcim Phils., Inc. Modification of Break Bulk Terminal Project in Barangay Pulong Balibaguhan, Mabini, Batangas, January 28-29, 2017 (researcher: Garry Benico)

Table 18 - Zooplankton composition and abundance (ind/m3) observed in six stations in Mabini Batangas during the marine ecology baseline assessment in primary and secondary areas of the proposed Holcim Phils., Inc. Modification of Break Bulk Terminal Project in Barangay Pulong Balibaguhan, Mabini, Batangas, January 28-29, 2017 (researcher: Garry Benico)

TAXA	STATIONS						Grand	Mean	Rel.
	Z1	Z2	Z3	Z4	Z5	Z6	Total	Abund.	Abund.
Adult form	**22,736**	**35,711**	**18,035**	**19,402**	**40,598**	**25,869**	**162,352**	**27,059**	**23.38**
Calanoid	12,914	9,216	7,842	9,701	24,810	13,339	77,821	12,970	11.21
Chaetognaths	364	2,688	784	2,021	376	1,617	7,850	1,308	1.13
Cyclopoid	6,912	19,968	6,273	6,063	12,405	8,892	60,513	10,086	8.71
Harpacticoid	1,091	1,920	1,960	404	1,880	808	8,064	1,344	1.16
Larvacean	1,455	1,920	1,176	1,213	1,128	1,213	8,104	1,351	1.17
Larval form	**14,187**	**49,919**	**60,772**	**129,345**	**175,549**	**102,263**	**532,035**	**88,673**	**76.62**
Bivalve veliger	546	0	0	0	752	0	1,297	216	0.19
Crab zoae	182	0	0	0	1,128	0	1,310	218	0.19
Echinoderm larvae	0	0	0	0	752	0	752	125	0.11
Egg	1,637	384	31,366	4,042	3,759	808	41,997	6,999	6.05
Gastropod veliger	0	0	0	0	0	404	404	67	0.06
Nauplius	11,823	49,535	29,406	125,303	169,159	101,051	486,275	81,046	70.03
Grand Total	**36,924**	**85,630**	**78,807**	**148,746**	**216,147**	**128,132**	**694,387**	**115,731**	**100.00**
Mean Abundance	**3,357**	**7,785**	**7,164**	**13,522**	**19,650**	**11,648**			
Richness	**9**	**7**	**7**	**7**	**10**	**8**			
Evenness (I)	**0.71**	**0.62**	**0.70**	**0.34**	**0.36**	**0.38**			
Diversity (H)	**1.55**	**1.20**	**1.37**	**0.66**	**0.82**	**0.79**			

The mean estimate of abundance ranges from 36,924 to 216,147 individuals/m^3 for all sampling stations recorded during this survey. Spatially, station Z5 had the most number of zooplankton group observed with 10 while the in terms of total density, station Z5, a control station, had the highest total abundance with 216,147 ind/m^3. The lowest zooplankton abundance was observed in station Z1 with 36,924 while the most depauperate station was station Z2, Z3 and Z4 with 7 each. A high density of copepod Nauplius was noticeably observed in station Z5 with maximum density of 169,159 ind/m^3. All diversity measurement were low (<2) with the highest value observed in station Z1 while the lowest in station Z6. The computed index of evenness among the four stations is quite variable ranging from 0.36 to 0.71. These indices indicate that zooplankton communities in the area were low Wilhm criteria (1975) classifying the diversity index <3.0 as low and community stability.

With regards to threat, it is known that high sediment loads would reduce the grazing success of zooplankton. However, it is important to note that zooplankton mostly from larval stages of benthic species and fishes are also generally adapted to episodic high levels of suspended sediments. In addition they also have shorter life cycle and there are studies that showed that their recovery to stressful environmental conditions could be relatively quick (Clarke & Wilbur 2000).

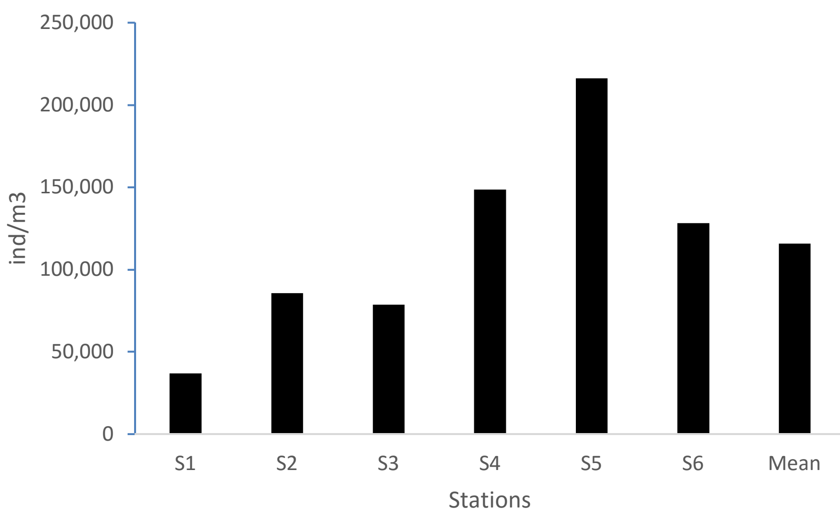


Figure 58 - Total zooplankton abundance in six stations sampled during the marine ecology baseline assessment in primary and secondary areas of the proposed Holcim Phils., Inc. Modification of Break Bulk Terminal Project in Barangay Pulong Balibaguhan, Mabini, Batangas, January 28-29, 2017 (researcher: Garry Benico)

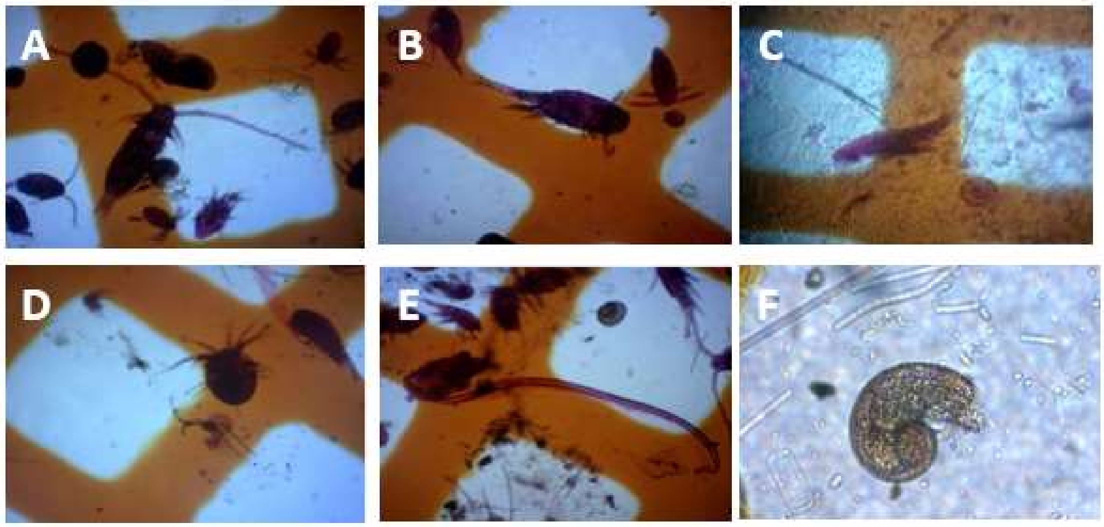


Photo 11 - Photomicrographs of common zooplankton group during the sampling period (A) Calanoid copepod, (B) Cyclopoid copepod, (C) Harpacticoid copepod, (D) Copepod Nauplius, (E) Larvacean, (F) Pteropod veliger.

2.2.3.4 Presence of Pollution Indicator Species

Results from the marine ecology baseline assessment indicate the absence of marine species of significant use as pollution indicators in the primary coastal impact of the project site surveyed.

Plankton – No plankton blooms of significant proportion was observed in the survey. Based on the plankton analysis, the potentially harmful species present in the samples collected was *Pseudoniztschia* spp. Some species in this genus are reported to produce domoic acid, a toxin associated with amnesic shellfish poisoning. Currently, the densities of plankton groups observed in the coastal area within the vicinity of the project site do not indicate proportions that can cause the occurrence of harmful algal blooms (HABs). However, the density of the potentially harmful phytoplankton species observed during the survey – diatoms belonging to the genus *Pseudonitzschia* needs to be continuously observed.

Corals – There were no actual illegal and destructive fishing methods observed during the marine ecology baseline assessment. Nevertheless, coral mortality have been associated to suffocation from sediment intrusion into the coral polyps as corals require clear waters with unimpeded sunlight penetration in the water column. Coral suffocation is therefore associated to increasing suspended solids and silt in the water column, normally attributed to episodes of sediment intrusion from land-based issues such as land conversion and loss of vegetation. The correlation of sediment intrusion and coral suffocation can therefore be a valuable analogy for determining impacts of project-induced silt and sediment pollution in coastal waters.

Bivalves – Hyper-nutrient loading in coastal waters are known to trigger algal blooms that result to shellfish and fish kills, and during intense episodes, can contaminate shellfish with biotoxins from harmful algal bloom. Bivalves have been used to determine biotoxin levels that can be harmful to humans if they are consumed, especially species belonging to the mussel and oyster taxa. However, the bivalve communities in the macro-invertebrate stations are few and insignificant; there are no mussel or oyster farms or harvesting areas of significant scale. Amongst the bivalves encountered in the survey, Venus clams and pen shells would be susceptible to marine pollution but the numbers of these bivalves observed in the survey are extremely low.

Fish - Marine fish species have not been used as indicators of pollution, except where biotoxins are involved (e.g. plankton-filtering fish species in PSP-affected areas such as Anchovies). No species of fish capable of filtering harmful plankton-contaminated water were encountered in the survey.

2.2.3.5 Threats to existence or loss of important habitats of local species

Coral reefs and associated demersal fisheries

There are no coral colonies of significant susceptibility near the Holcim port complex. The spot dives revealed extensive sandy substrate beneath the wharf and its surrounding seabed. Remaining corals in a small patch near the impact area of the proposed project are too few and are already heavily stressed such that any anthropogenic issue emanating from the Project will have little incremental impacts on the few coral species. There were small patches of remaining coral reef about 2 kilometers northeast of the wharf and the primary threat to coral reefs in this site may come from inadvertent episodes of sediment plumes, if such waste streams are carried northward by strong currents. The corals in the area are already vividly stressed with turbid waters and accelerated sediment intrusion may intensify the possibility of causing coral polyp suffocation.

Demersal fish species

Extreme impairment of photosynthetic function and primary production due to siltation in coastal waters around the project site can have far reaching impacts on fisheries reproductive morphology, decreased reproductive output, shortened larval duration and subsequently, low larval recruitment and survival. Mortality of fish species is not anticipated as the fishes can simply avoid areas of high turbidity, oil spills and contaminated benthic environments due to accidental spills of processing materials from the Holcim complex.

Macro-invertebrates utilized for food and supplementary incomes

With the current situation of environmental pressures, the Project will have little impact on benthic fisheries and macro-invertebrate resources. Any further disturbance to the few benthic stocks of mollusks will be temporary and will have no lasting, serious effects on macro-benthos growth and recruitment. However, any serious alteration of the inter-tidal shoreline due to conversion or establishment of physical facilities for boat docking and support facilities, if any, can lead to the loss of habitats for mollusks. If contaminated by land-based pollutants that are persistent, the damage to bivalve habitats, such as sandy beaches and inter-tidal areas can be far reaching and a decrease in the population of communities of edible mollusks, even as they are currently low in numbers, can be significant.

Plankton community

Sediment streams from project construction, if any, will likely amplify coastal water turbidity, in the form of total suspended solids (TSS) and further reduce sunlight penetration into the water column. In extreme cases, turbidity will lead to reduced photosynthetic function which can affect microscopic primary producers of phytoplankton and dependent zooplankton communities, and depress seagrass and macrobenthic algae settlement. Intensification of turbidity in the water column through spillage of various materials being unloaded in the Holcim Port can reduce phytoplankton grazing. Likewise, marine pollution from shipboard wastes and domestic wastes from land can potentially cause die-out of some algae species over long exposures. Excessive pollution may cause euthrophication or the loss of oxygen through excessive algal blooms which in turn causes algal communities to wilt over long periods of anoxic conditions. Euthropication will have far-reaching impacts on the lower base of the marine food web. However, the plankton community in the impact area can easily be replenished through water currents and tidal influences from other areas unaffected by spills as planktons are passively drifting organisms.

Seagrass

There are no seagrass communities in the primary and secondary impact areas of the project.

2.2.3.6 Potential impacts arising from climate change scenarios

The possible impacts of climate change in the marine environment have been documented to include, among others, (i) rise in surface seawater temperature that may cause coral bleaching, (ii) rising sea level that may inundate shallow-water aquatic animals and cause changes in population structure, and (iii) saltwater intrusion into the land-sea interface. Present knowledge and experiences on mitigating measures are largely inadequate, and strategies to protect corals and associated habitats from CC-induced abnormalities are largely deficient. Climate change projections of the PAGASA indicate that mean temperatures in all areas in the Philippines are expected to rise by 0.9 °C to 1.1 °C in 2020 and by 1.8 °C to 2.2 °C in 2050, with the largest seasonal temperature increase anticipated to occur during the summer season (PAGASA, 2011). Corals have low tolerance limits on warm seawater temperatures and may bleach in seawater temperatures that breach an increase of 3 degrees Celsius. In times of El Nino episodes, such a possibility can happen if the situation is exacerbated by climate-induced seawater temperature rise.

The fundamental safety net and adaptation strategy is *protect as much habitats as possible* at the local and regional levels. Currently the most acceptable adaptation strategy is to enhance the establishment of marine protected areas that will integrate coral reef areas, mangrove forests and seagrass beds into a network of MPAs. The strategy seeks to ensure the gene banks are replicated over broad areas. In support of this overall strategy, the Project will seek to:

(i) Support the establishment, expansion and effective management of marine protected areas (MPAs);
(ii) Support the establishment of mangrove rehabilitation projects that will serve as carbon sinks;
(iii) Enhance seagrass habitats by considering feasible transplantation strategies;
(iv) Support the protection of areas where fish spawning aggregations are found.

2.2.3.7 Proposed Mitigation Measures

The primary impact area around the Holcim Port Complex hosts few fragile benthic habitats that can be susceptible to anthropogenic issues that can potentially arise from increased port operations, materials handling and vessel traffic. Nonetheless, the underpinning strategic consideration in order to reduce potential damage to remaining corals, even as they are few and a great distance from the port, and disturbance to fish populations in front of the project's facilities, is to ensure that any construction activity and its accompanying sediment plumes will not contaminate coastal waters in a substantive degree. To protect coral areas and benthic ecological structures currently serving as fish habitats, the following measures are to be adopted:

1. *Prevention of siltation and sedimentation.* Sediment streams from project port activities, if any, earthworks, road construction, or in cases of inadvertent spillage of materials being handled in the port that have the potential to intrude into the sea can be prevented first and foremost by controlling erosion at source, thence diverting all loose or fugitive soil and sediments into project waterways fitted with filter systems before being diverted into containment ponds. Silt curtains consisting of geo-textile screens will be installed during episodes of potential sediment spillage, especially during the rainy season to minimize escape of silt and filter liquids with sediment run-off, especially focusing on potential spill points leading to the coastal waters. This will be reinforced by the construction of sediment entrapment screens in the drainage canals. In areas of heavy port activities, loose materials shall be stockpiled in areas away from canals and natural waterways where erosion control measures can easily be applied. The objective is to reduce sediment invasion to the highest degree possible. Periodic environmental monitoring of the impacts of siltation in the coastal waters and coral reef habitats will be undertaken and results of monitoring

2. *Accidental oil spills*. Accidental spillage of oil and grease from project facilities, as well as spills of materials from ship to port and vice versa can cause seawater pollution that can end up in substrates within the shelf, and can potentially contaminate benthic invertebrate populations in the area. In certain times, such oil slicks can be forced to the bottom by tidal action and thereafter pollute coral colonies within its pathway. While this issue is not anticipated to happen, oil slicks caused by unintentional spills in the project wharf or from shipboard dispensing may remain sequestered in coastal waters and can be dispersed in small blotches towards the direction of tidal movement affecting benthic niches far from the project site. An oil and grease containment and waste containment plan will be formulated and enforced in all aspects of project operations.

3. *Curtailment of domestic wastewater pollution.* The use of 3-chambered septic tanks shall be installed in all project facilities where wastewaters and other effluents are generated. Waste minimization will be practiced in all aspects of project operation. The objective is to ensure that pollution-causing effluents that can be potentially carried downstream are treated at the source.

2.3 The Air

2.3.1 Meteorology/Climatology

2.3.1.1 Methodology

2.3.1.1.1 Meteorology/Climatology

Climatological data from two (2) synoptic stations of PAGASA, namely: PAGASA-Ambulong Station and PAGASA-Calapan Station were used to describe the long-term data on rainfall, air temperature, wind speeds and wind directions. These stations were selected as these are the closest synoptic stations from the project site. PAGASA-Ambulong Station is located about 47.3 km north-northeast of the project site while PAGASA-Calapan Station about 31.7 km southeast of the project site. ***Table 19*** and ***Figure 59*** show the technical descriptions and the locations of the above-mentioned synoptic stations of PAGASA.

In addition, prognostic surface and upper air data covering the period January 1, 2014 to December 31, 2016, which were generated by Lakes Environmental Software, Inc (Lakes Environmental) for the project, were also presented to describe the meteorological site conditions. Axceltechs, Inc. purchased the said prognostic meteorological data from Lakes Environmental.

Table 19 - Coordinates and elevations of PAGASA's synoptic stations used in the study

Station/Type	Location	Period Covered	Latitidue (deg)	Longitude (deg)	Elev (amsl)[1]	Distance (km)[2]
PAGASA-Ambulong Station	Ambulong, Batangas	1981 to 2010	14° 5'24.27"N	121° 3'18.86"E	11.0	47.286
PAGASA-Calapan Station	Calapan, Oriental Mindoro	1981 to 2010	13°24'35.18"N	121°11'22.77"E	41.0	31.715
Notes: (1) amsl – above mean sea level, (2) distance from project site to PAGASA station, (3) Prognostic meteorological data (surface and upper air) were extracted from the MM5 model with nearest grid cell corner at 13.683N (latitude) and 120.883E (longitude)						

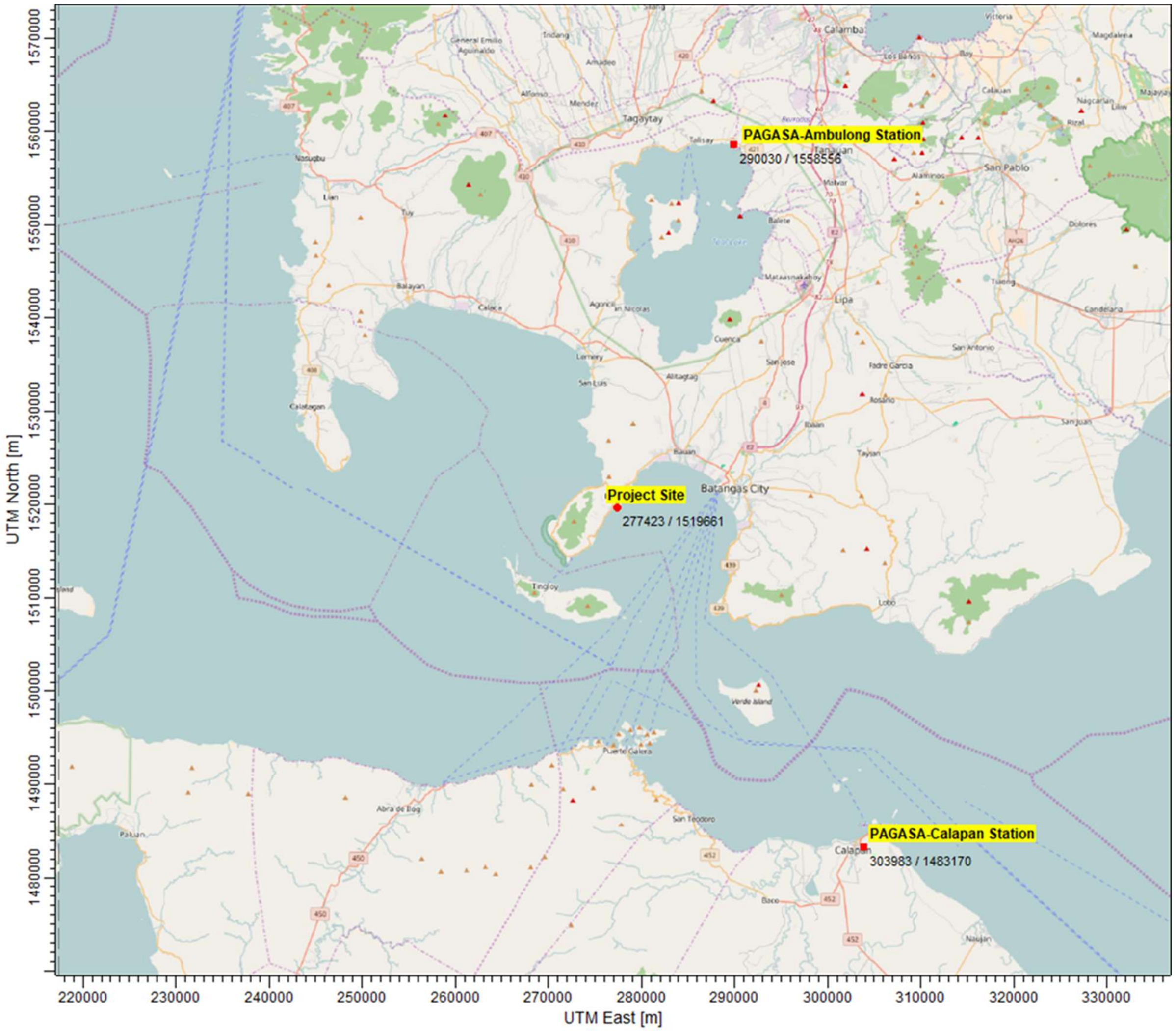


Figure 59 - Locations of PAGASA-Ambulong and Calapan Stations relative to the project site

The projected changes of rainfall, air temperature, and extreme weather events as derived by PAGASA (2011) were used to determine the changes of climate from 2006 to 2035 (centered in 2020) and from 2036 to 2065 (centered in 2050) for the meteorological parameters, namely: rainfall, air temperature, number of dry days (days with rainfall less than 2.5 mm), number of days greater than 35 ºC, and days with rainfall greater than 200 mm.

Table 20 shows the list of the meteorological data used in this study. ***Table 21*** to ***Table 24*** present the climatological normal and extremes of PAGASA-Ambulong and Calapan Stations, in which climatological averages of rainfall, air temperature, wind speeds and wind directions were derived.

Table 20 - Meteorological data and information used in the study

Data/Information	***Source***	***Period Covered***	***Purpose/Remarks***
Climate map of the Philippines	PAGASA	1951 to 2010	Determine the climate type of the project site
Climatological normals for Ambulong, Batangas and Calapan, Oriental Mindoro	PAGASA	1981 to 2010	Determine the 30-year average rainfall, air temperature, wind speeds and wind directions
Climatological extremes for Ambulong, Batangas and Calapan, Oriental Mindoro	PAGASA	As of 2014	Determine the extreme recorded rainfall, air temperature, and wind speeds at two (2) synoptic stations of PAGASA near the project site
Climate Change in Philippines	PAGASA	Baseline (1971 to 2010) and projected change in 2020 and 2050	Describe the medium and long-term climate change projections in Batangas
Surface and upper air data	Lakes Environmental Software, Inc.	January 1, 2014 to December 31, 2016	Describe the annual, monthly and three-hourly wind roses at the project site; describe the annual wind frequency distribution
Typhoon incidence map of the Philippines	Manila Observatory and DENR	Not specified	Determine the incidence occurrence of typhoon at the project site

Data/Information	Source	Period Covered	Purpose/Remarks
Typhoon risk map of the Philippines	Manila Observatory and DENR	Not specified	Determine the risk of the project site in terms of typhoon passage
Notes: Climatological normal and extremes – latest available data as per inquiry in PAGASA last July 2017			

2.3.1.1.2 Greenhouse Gas Emissions (GHG)

The potential sources of GHG emissions of the project were grouped according to the following scopes.

- Scope 1 emission – emissions from equipment or activity that are directly owned and controlled by the proponent. These include emissions from the grinding mill stack and vehicles owned by the proponent;
- Scope 2 emissions – emissions from purchased electricity; and
- Scope 3 emissions – indirect emissions from vehicles not owned or controlled by the company (or from haul trucks used by contractors).

The GHG emissions were then computed using the a) GHG Protocol tools developed by the World Resources Institute (WRI) and b) the following data and information:

- Fuel consumption of vehicles owned and controlled by the proponent, including those used by contractors;
- Estimated fuel consumption of the two (2) units ecohopper gensets, as derived from technical specifications of a 440 KVA genset; and
- Electricity consumption as reported in the SMR

Further, GHG emissions from the grinding mill stack (CO_2 emission in g/sec) was provided by the proponent (Holcim) and its annual emission was computed by determining the numbers of hours of operation per year, as reported in the SMR.

2.3.1.2 Result and Discussion

2.3.1.2.1 Climate

The project site belongs to an area zoned as Type 1 Climate, as indicated in the Modified Coronas Classification of Philippine Climate covering1951 to 2010 (***Figure 60***). Type 1 climate is characterized by two pronounced seasons, namely: dry and wet season. November to April fall under dry season while the rest of the year as wet season. Areas or regions west of Luzon and some western parts of Visayas fall under Type 1 Climate.

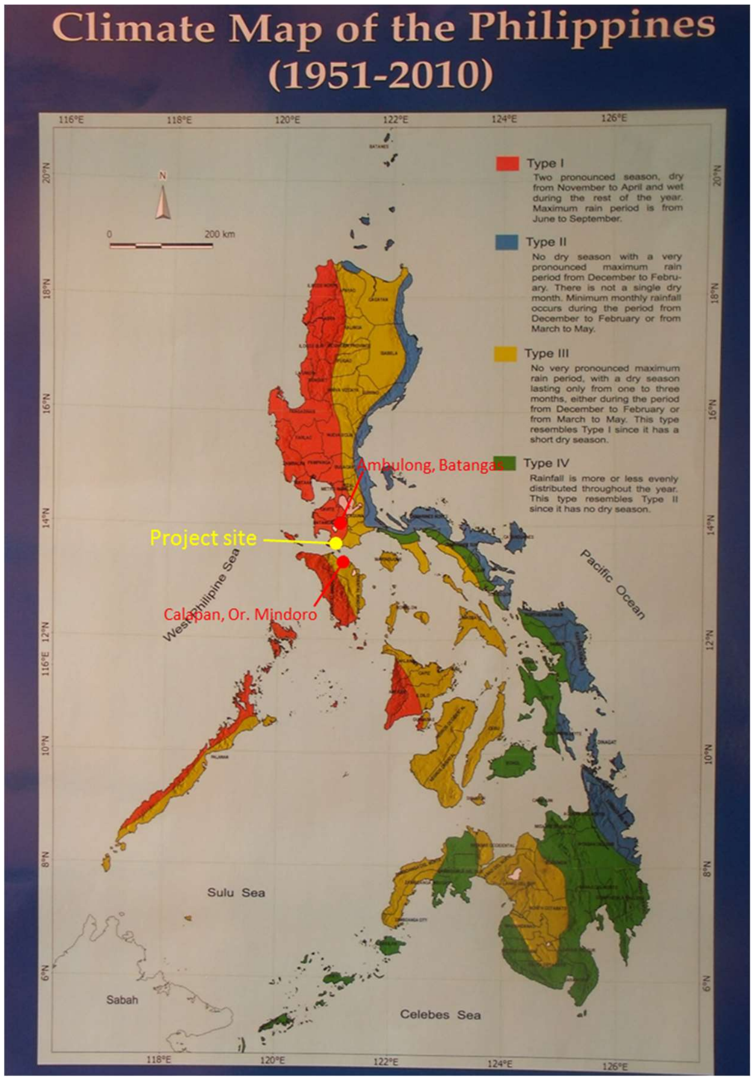


Figure 60 - Climate map of the Philippines and the locations of the project site and two (2) synoptic stations of PAGASA

Table 21 - Climatological Normals of PAGASA- Ambulong Synoptic Station (1981-2010)

	Rainfall			Temperature (°C)								Wind			No. of Days	
	Amount (mm)	No. of Rainy Days	Max	Min	Mean	Dry Bulb	Wet Bulb	Dew Pt.	Vapor Pressure (mbar)	%RH	MLSP (mbar)	Direction (16pt)	Speed (m/s)	Cloud Amt. (okta)	TSTM	LTNG
JAN	22.7	5	30.4	22.2	26.3	25.9	23.1	22.0	26.3	79	1012.7	NE	2	5	0	0
FEB	16.0	3	31.6	22.1	26.9	26.4	23.3	22.1	26.5	77	1012.6	NE	2	4	0	0
MAR	21.5	3	33.2	22.9	28.1	27.7	24.1	22.8	27.5	74	1011.7	NE	2	4	1	1
APR	35.0	4	34.5	23.9	29.2	29.0	25.1	23.8	29.2	73	1010.2	NE	1	4	5	5
MAY	116.6	10	33.9	24.6	29.2	29.1	25.7	24.6	30.7	76	1008.5	NE	1	5	13	14
JUN	228.7	16	32.5	24.6	28.6	28.4	25.6	24.7	30.9	80	1008.3	SW	1	6	15	15
JUL	329.6	19	31.4	24.1	27.8	27.6	25.3	24.5	30.6	83	1008.2	SW	1	6	17	16
AUG	286.9	18	31.0	24.3	27.6	27.5	25.3	24.5	30.7	84	1007.6	SW	2	6	12	12
SEP	255.0	17	31.4	24.1	27.8	27.5	25.3	24.5	30.7	84	1008.5	SW	1	6	14	14
OCT	218.4	15	31.6	23.9	27.7	27.4	25.1	24.3	30.3	83	1009.4	NE	1	6	9	14
NOV	144.7	13	31.4	23.6	27.5	27.1	24.6	23.7	29.2	81	1010.3	NE	2	5	2	6
DEC	92.0	9	30.2	22.8	26.5	26.2	23.6	22.6	27.3	80	1011.8	NE	2	5	0	1
Annual	1767.0	132	31.9	23.6	27.8	27.5	24.7	23.7	29.2	80	1010.8	NE	2	5	88	98

Source: Climate and Agrometeorology Division, PAGASA

Latitude: 13°08'18" N
Longitude: 123°44'00" E
Elevation: 17.0 m

Table 22 - Climatological Normals for Calapan, Oriental, Mindoro (1981 to 2010)

Month	Rainfall (mm)	No of rainy days	Temperature(°C)						VP (mbs)	RH (%)	MSLP (mbs)	Wind (m/s)		Clouds (Okta)	No. of days With	
			Max	Min	Mean	Dry Bulb	Wet Bulb	Dew Pt.				Dir.	Speed		TSTM	LTNG
Jan	112.9	17	29.2	22.1	25.7	25.4	23.4	22.6	27.4	84	1013.1	E	2	6	1	0
Feb	64.7	11	30.1	22.3	26.2	25.8	23.6	22.8	27.6	83	1013.1	E	2	6	0	0
Mar	75.9	10	31.2	23.1	27.2	26.8	24.3	23.4	28.6	81	1012.4	E	2	5	2	1
Apr	116.0	10	32.5	24.1	28.3	28.1	25.7	24.3	30.3	80	1010.9	E	2	5	6	4
May	196.4	13	33.0	24.2	28.6	28.4	25.7	24.8	31.1	81	1009.2	E	2	6	18	12
Jun	263.6	16	32.6	23.9	28.2	28.0	25.7	24.9	31.4	83	1008.5	E	2	6	19	14
Jul	253.0	17	32.0	23.6	27.8	27.5	25.4	24.7	31.0	84	1008.2	NW	1	7	16	12
Aug	195.4	15	32.0	23.7	27.9	27.6	25.5	24.8	31.2	84	1007.8	NW	1	7	12	9
Sept	235.5	16	32.0	23.6	27.8	27.4	25.4	24.7	31.0	85	1008.7	NW	1	7	14	12
Oct	326.5	19	31.5	23.5	27.5	27.2	25.2	24.5	30.7	85	1009.7	E	2	6	14	10
Nov	281.0	19	30.7	23.3	27.0	26.7	24.9	24.2	30.2	86	1010.7	E	2	6	7	4
Dec	216.1	20	29.4	22.5	26.0	25.7	23.9	23.2	28.4	86	1012.3	NE	2	7	2	1
Annual	2337.1	183	31.3	23.3	27.3	27.1	24.9	24.1	29.9	84	1010.4	E	2	6	111	79

Source: Climate and Agrometeorology Division, PAGASA

Latitude: 13°24’48” N
Longitude: 121°10’12” E
Elevation: 40.50 m

Notes:
VP – Vapor Pressure
mbs – millibar
MSLP – mean sea level pressure
Dir – direction
TSTM – thunderstorm
LTNG – lightning

Table 23. Climatological Extremes in PAGASA-Ambulong, Batangas (as of 2014)

MONTH	TEMPERATURE (°C)				GREATEST DAILY RAINFALL (mm)		HIGHEST WIND (m/s)			SEA LEVEL PRESSURE			
	HIGH	DATE	LOW	DATE	AMT.	DATE	SPD	DIR	DATE	HIGH	DATE	LOW	DATE
JAN	34.9	01-03-1958	16.0 / 16.0	01-09-1985/ 01-24-2014	118.1	01-01-1960	20	ENE	01-29-1989	1022.1	01-30-1998	1004.1	01-05-1999
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
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
JUN	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
JUL	36.8	07-15-1999	19.2	07-19-2014	218.5	07-13-2010	75	W	07-15-1983	1015.9	07-22-1959	972.1	07-04-2001
AUG	36.7	08-23-1969	20.5	08-11-1996	283.6	08-24-1990	40	NNE	08-12-1987	1015.3	08-23-1999	995.2	08-12-1987

MONTH	TEMPERATURE (°C)				GREATEST DAILY RAINFALL (mm)		HIGHEST WIND (m/s)			SEA LEVEL PRESSURE			
	HIGH	DATE	LOW	DATE	AMT.	DATE	SPD	DIR	DATE	HIGH	DATE	LOW	DATE
SEP	35.7	09-14-1984	19.5	09-04-1991	270.8	09-05-1962	54	SSW	09-09-1982	1015.7	09-05-1953	987.7	09-09-1982
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 / 18.3	11-29-1974/ 11-22-1975	277.2	11-03-1995	45	NE	11-25-1987	1020.0	11-27-2001	978.6	11-03-1995
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 / 16.0**	**01-09-1985/** 01-24-2014	**499.2**	**05-21-1976**	**75**	**W**	**07-15-1983**	**1024.2**	**12-27-2001**	**972.1**	**07-04-2001**
Period of Record	**1919-2014**				**1949-2014**		**1950-2014**			**1949-2014**			

Source: Climate and Agrometeorology Division, PAGASA

Table 24 - Climatological Extremes in PAGASA-Calapan, Oriental Mindoro Station (as of 2014)

MONTH	TEMPERATURE (°C)				GREATEST DAILY RAINFALL (mm)		HIGHEST WIND (m/s)			SEA LEVEL PRESSURE			
	HIGH	DATE	LOW	DATE	AMT.	DATE	SPD	DIR	DATE	HIGH	DATE	LOW	DATE
JAN	33.5	01-05-1995	17.5	01-03-2002	220.0	01-16-1988	20	NE	01-08-1986	1023.5	01-13-1955	998.7	01-16-1988
FEB	34.0	02-23-1995	16.2	02-08-1916	123.7	02-21-2013	15	NE	02-09-1996	1023.5	02-25-1983	1002.8	02-01-1999
MAR	34.5	03-29-1995	18.4	03-06-1911	180.6	03-14-1991	14	E	03-23-1998	1022.2	03-30-1958	1002.0	03-27-2001
APR	36.5	04-20-1990	16.4	04-02-1972	117.0	04-08-2009	14	WNW	04-14-1992	1019.5	04-01-1958	1002.0	04-21-1956
MAY	37.2	05-27-1912	14.0	05-15-1972	263.0	05-17-1989	30	NW	05-17-1989	1016.5	05-01-1963	985.7	05-12-2007
JUN	37.1	06-19-1912	14.7	06-18-1972	177.6	06-21-2007	23	SE	06-25-1971	1015.3	06-12-1963	986.9	06-29-1964
JUL	36.5	07-07-1987	19.0	07-09-1993	131.4	07-15-2014	36	E	07-10-1983	1017.5	07-28-1987	990.9	07-10-1983
AUG	37.6	08-01-1914	17.6	08-10-1993	140.2	08-09-1993	46	SE	08-12-1987	1016.0	08-25-1988	976.5	08-12-1987
SEP	36.8	09-08-1998	19.4	09-30-1995	197.6	09-30-1995	40	NW	09-27-1978	1016.6	09-01-1978	885.7	09-27-1978

MONTH	TEMPERATURE (°C)				GREATEST DAILY RAINFALL (mm)		HIGHEST WIND (m/s)			SEA LEVEL PRESSURE			
	HIGH	DATE	LOW	DATE	AMT.	DATE	SPD	DIR	DATE	HIGH	DATE	LOW	DATE
OCT	35.5	10-17-1995	18.4	10-15-1918	266.4	10-28-2005	37	NW	10-10-1989	1018.1	10-28-1960	972.2	10-22-1952
NOV	35.0	11-30-1916	16.2	11-04-1967	277.4	11-11-2008	44	NW	11-25-1987	1021.7	11-30-1989	968.7	11-26-1987
DEC	34.0	12-13-1995	18.0	12-27-2001	228.8	12-09-2011	35	NW	12-06-1993	1021.3	12-08-1960	893.7	12-12-1993
Annual	37.6	08-01-1914	14.0	05-15-1972	277.4	11-11-2008	46	SE	08-12-1987	1023.5	02-25-1983	885.7	09-27-1978
Period of Record	1949 - 2014				1919 - 2014		1966 - 2014			1949 - 2014			

Source: Climate and Agrometeorology Division, PAGASA

2.3.1.2.1.1 Monthly and Annual Average Rainfall

Monthly plots of rainfall from three (3) stations (PAGASA-Calapan Station, PAGASA-Ambulong Station and MM5 prognostic station) show higher rainfall in the wet season for Type 1 climate, which generally starts in June (***Figure 61***). Rainfall at the above-mentioned stations are relatively lower in January to April, and starts to increase in May until the onset of the wet season.

The annual average rainfall at PAGASA-Calapan Station is 2337.1 mm while at PAGASA-Ambulong Station is 1767.1 mm. For the prognostic meteorological data covering three (3) years of sequential hourly data (2014 to 2016), the annual average is 2265.9 mm.
There is no significant difference on the means of the three (3) foregoing stations, as analyzed using the ProUCL Statistical Software of the U.S.EPA (2017). This could mean that rainfall at the three (3) locations come from the same population or location.

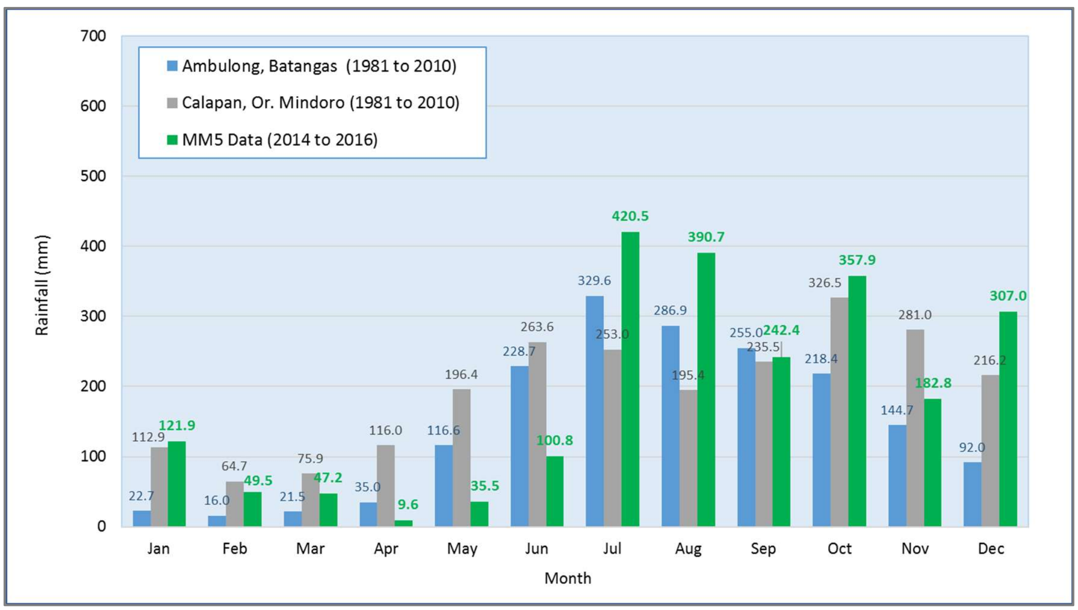


Figure 61 - Monthly average rainfall

2.3.1.2.1.2 Projected Rainfall in 2020 and 2050

The projected change of rainfall in Batangas suggest increasing amount of rainfall during the wet season, but "drier period" in dry season than the baseline years (1971 to 2000) (***Figure 62***). The projected amount of rainfall from 2016 to 2035 (centered in 2020) and from 2036 to 2065 (centered in 2050) in June to August and September to November showed increasing rainfall amount as compared to the baseline years (1971 to 2000). Conversely, there appears reduction of rainfall amount from the baseline years (1971 to 2000) in the months of December to February and March to May.

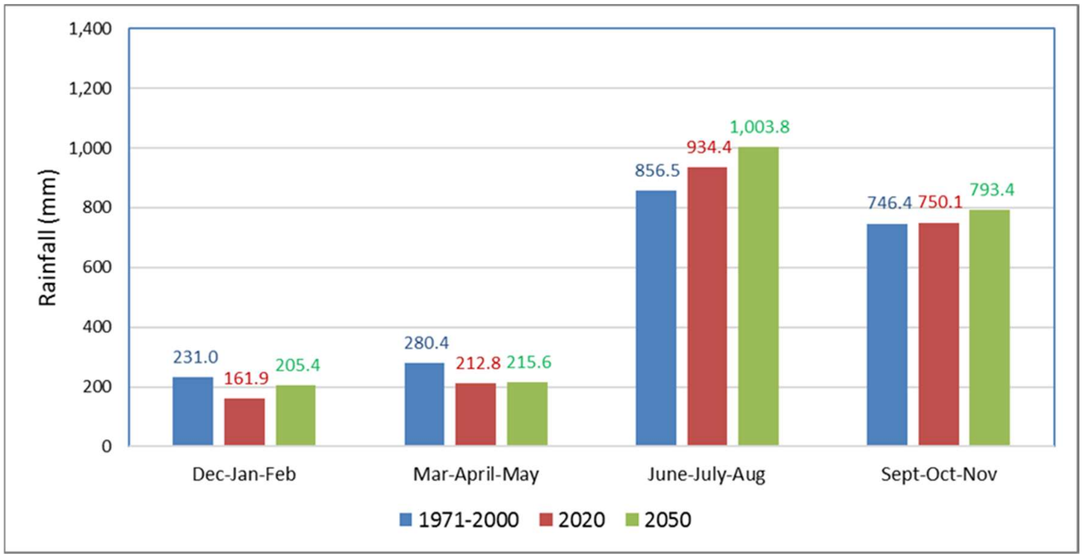


Figure 62 - Projected change of rainfall in Batangas province in 2020 and 2050

2.3.1.2.1.3 <u>Extreme Recorded Rainfall Events</u>

The highest recorded rainfall at the two (2) synoptic stations (PAGASA-Ambulong and Calapan Stations) was 499.2 mm on May 21, 1976 at PAGASA-Ambulong Station ***(Figure 63).*** This occurred during the passage of Typhoon Olga (Didang) in Central Luzon. The second highest recorded rainfall was 301.5 mm also at PAGASA-Ambulong Station on June 27, 1961.

At PAGASA-Calapan Station, the highest recorded rainfall was 277.4 mm on November 11, 2008 and the second highest was 263.0 mm on May 17, 1989. The highest recorded rainfall at PAGASA-Calapan Station occurred during the passage of Severe Tropical Storm Maysak (Quinta-Siony), which originated from west Philippine sea and moved towards Visayas.

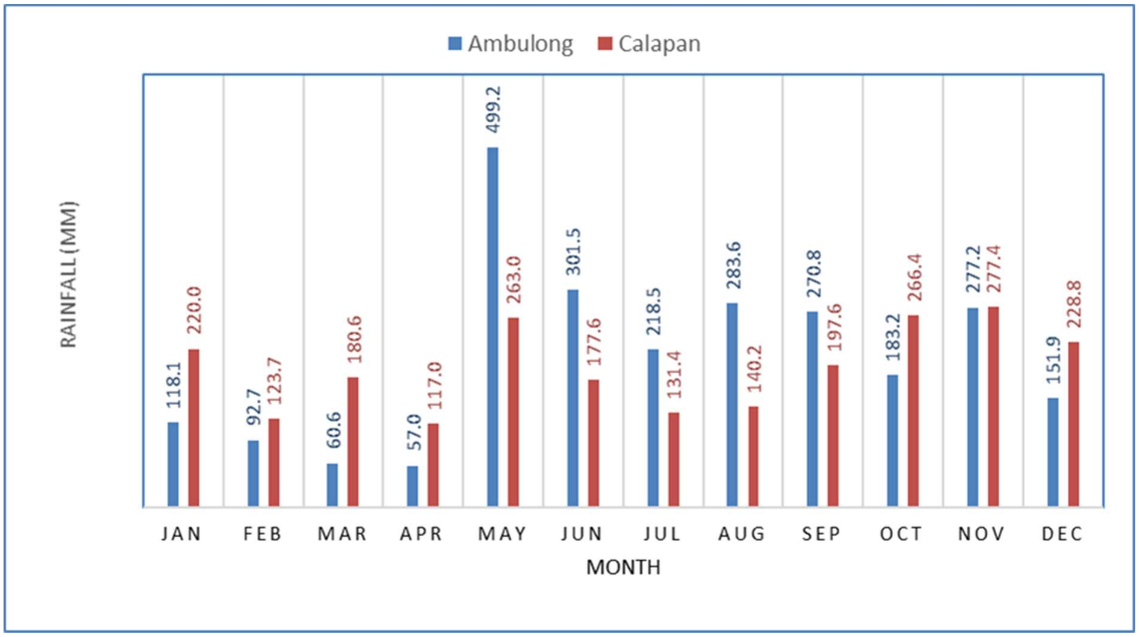


Figure 63 - Plot of extreme recorded daily rainfall in each month (Data source: PAGASA Ambulong and Calapan Stations)

2.3.1.2.1.4 *Projected Extreme Rainfall Events*

The projected number of dry days from 2006 to 2035 (centered in 2020) and from 2036 to 2065 (centered in 2050) appear to decrease from the baseline years (1971 to 2020). Dry days are days with rainfall less than 2.5 mm (PAGASA, 2011) (***Figure 64***)

On the projected number of days with rainfall greater than 200 mm, there appear an increase of the projected number of days of rainfall from 2006 to 2035 (centered in 2020), though it decrease to 9 days from 2036 to 2065 (centered in 2050. The projected number of days greater than 200 mm are greater than those of the baseline years (1971 to 2000) **(*Figure 65*)**.

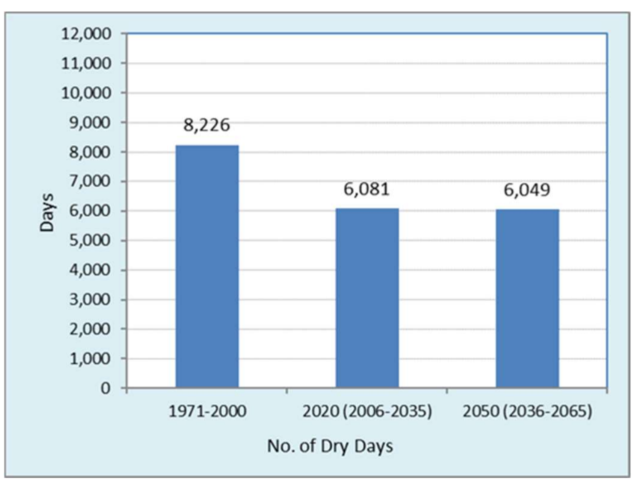


Figure 64 - Projected number of dry days (days with rainfall less than 2.5 mm)

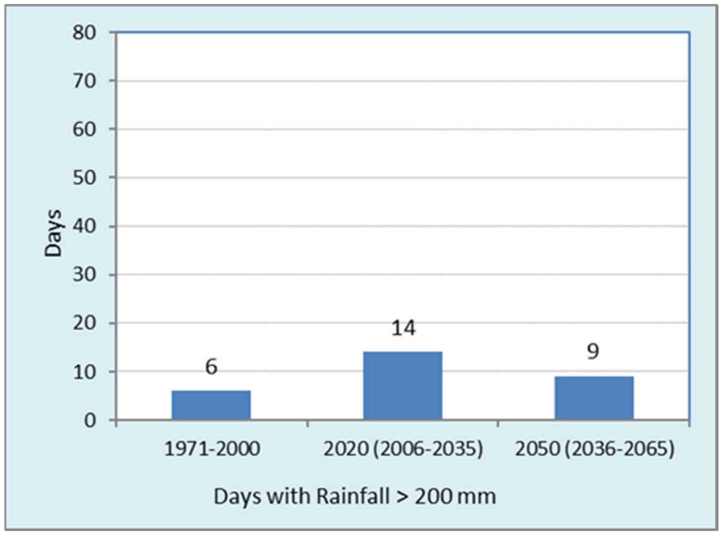


Figure 65 - Projected number of days with rainfall greater than 200 mm

2.3.1.2.2 Ambient Air Temperature

The plots of monthly average air temperature depict expected high temperature in April and May and lower temperatures in December and January at the two (2) synoptic stations (PAGASA-Calapan and Ambulong Stations) (***Figure 66***). Monthly average air temperatures at PAGASA-Ambulong Station are generally higher than PAGASA-Calapan Station as the former is located at lower elevation (17 m) than the latter (40.5 m).

For the prognostic meteorological data (MM5), the monthly average air temperatures show highest monthly average in June and lowest in February. MM5 data only represents about three (3) years of data, which may result to high or low monthly averages than those averaged over long term periods (e.g., 30 year).

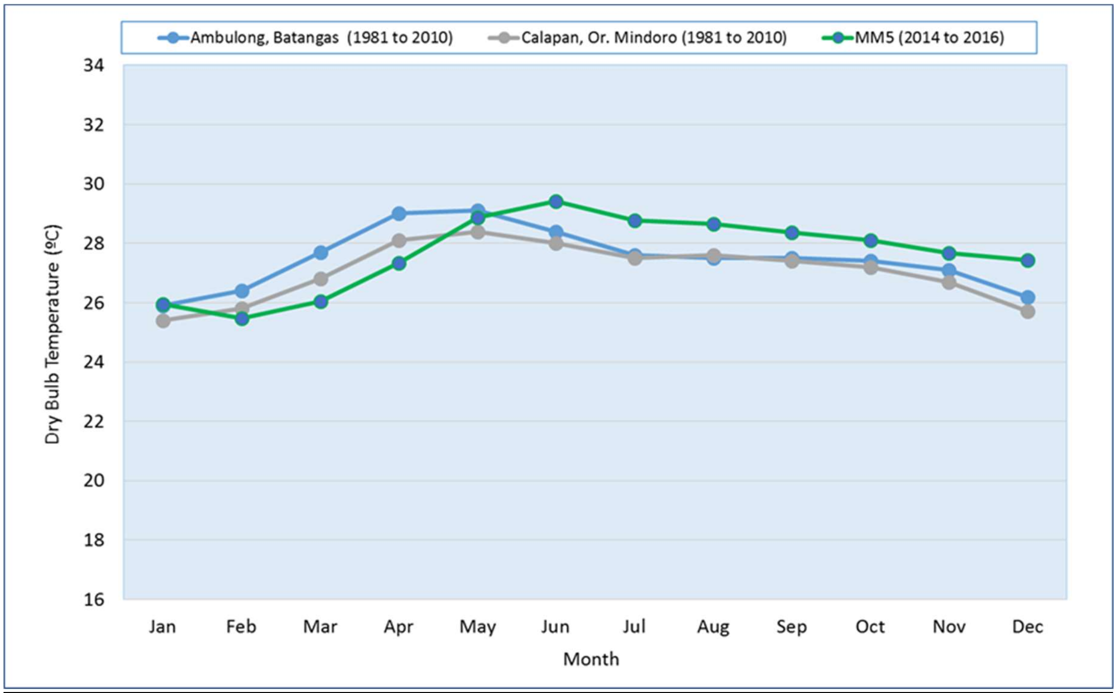


Figure 66 - Plot of average air temperature and relative humidity for PAGASA-Ambulong, Calapan, and MM5 data

2.3.1.2.2.1 <u>Projected Temperature in 2020 and 2050</u>

There appears an increase of the projected air temperatures in all seasons and transition periods of the year in Batangas from 2006 to 2035 (centered in 2020) and from 2035 to 2065 (centered in 2050) (***Figure 67***). This increasing trend of air temperatures were consistent with those projected for almost all areas in the Philippines.

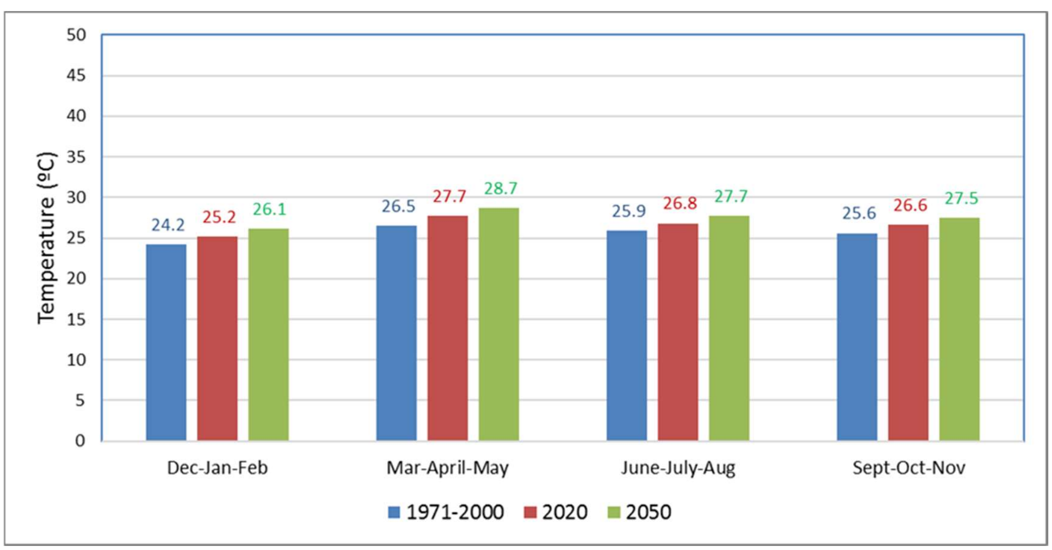


Figure 67 - Projected change in temperature in 2020 and 2050

2.3.1.2.2.2 Extreme Temperature Events

The highest recorded air temperature at PAGASA-Ambulong Station was 38.8 ºC on May 21, 1974. The second highest was 38.3 ºC on April 5, 1987 (***Figure 68*** and ***Table 5***). This occurred during months with relatively higher monthly average air temperatures.

At PAGASA-Calapan, the highest observed was 37.6 ºC on August 1, 1914 and the second highest was 37.2 ºC on May 27, 1912.

The lowest recorded air temperature was 14.0 ºC on May 15, 1972 at PAGASA-Calapan Station and the second lowest at 14.7 ºC also at PAGASA-Calapan Station.

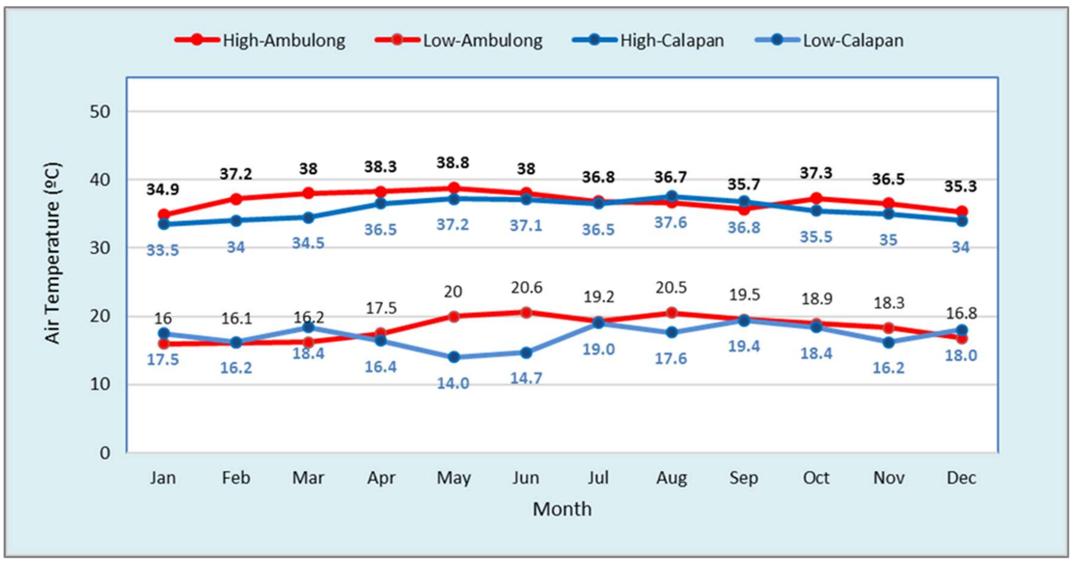


Figure 68 - Monthly highest and lowest temperatures at PAGASA-Ambulong and Calapan

2.3.1.2.2.3 Projected Extreme Temperature Events

The projected number of days with air temperature greater than 35 ºC showed significant increase from 2006 to 2035 (centered in 2020) and from 2036 to 2065 (centered in 2050) from the baseline years (1971 to 2000) of only 928 days (***Figure 69***). This is about 8 to 9 times increase from the baseline years (1971 to 2000).

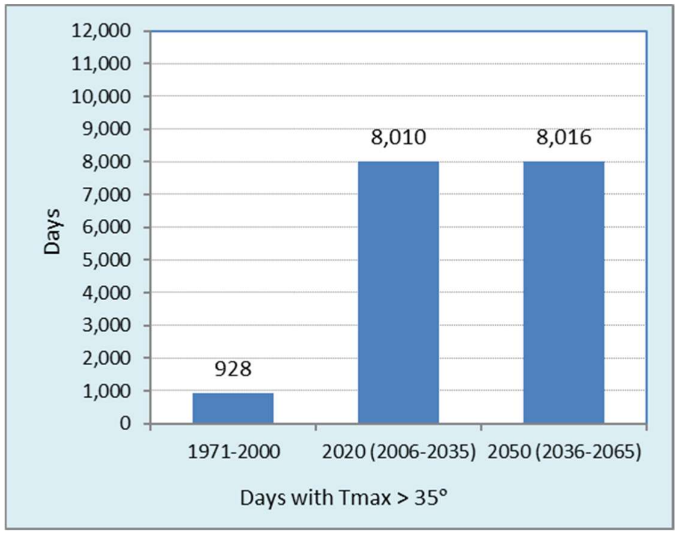


Figure 69 - Projected number of days with air temperature greater than 35 ºC

2.3.1.2.3 Wind Speeds and Wind Directions

Monthly average wind directions from the two (2) synoptic stations (PAGASA-Ambulong and Calapan Stations) were tabulated to compare differences in directions. ***Table 25*** shows that the prevailing northeasterly winds in the country prevail at PAGASA-Ambulong Station during the northeast monsoon, however, at PAGASA-Calapan Station, easterly winds prevail over the area. The presence of complex terrain located northeast of PAGASA-Calapan Station could probably shift the prevailing northeasterly winds to easterly.

Table 25 - Climatological monthly average wind speed and directions at PAGASA-Ambulong and Calapan Stations (1981 to 2010)

Month	***Ambulong, Batangas***		***Calapan, Oriental Mindoro***	
	Wind Direction	***Wind Speed (m/s)***	***Wind Direction***	***Wind Speed (m/s)***
January	NE	2	E	2
February	NE	2	E	2
March	NE	2	E	2
April	NE	1	E	2
May	NE	1	E	2
June	SW	1	E	2
July	SW	1	NW	1
August	SW	2	NW	1
September	SW	1	NW	1

Month	Ambulong, Batangas		Calapan, Oriental Mindoro	
	Wind Direction	Wind Speed (m/s)	Wind Direction	Wind Speed (m/s)
October	NE	1	E	2
November	NE	2	E	2
December	NE	2	NE	2
Annual	NE	2	E	2

The MM5 data also reflects prevailing easterly winds, as shown in ***Figure 70***. Winds from the east and east-southeast generally prevail over the project site. Light to moderate wind speeds represent about 85% of the prognostic wind generated for the project site (right inset *in* ***Figure 70***).

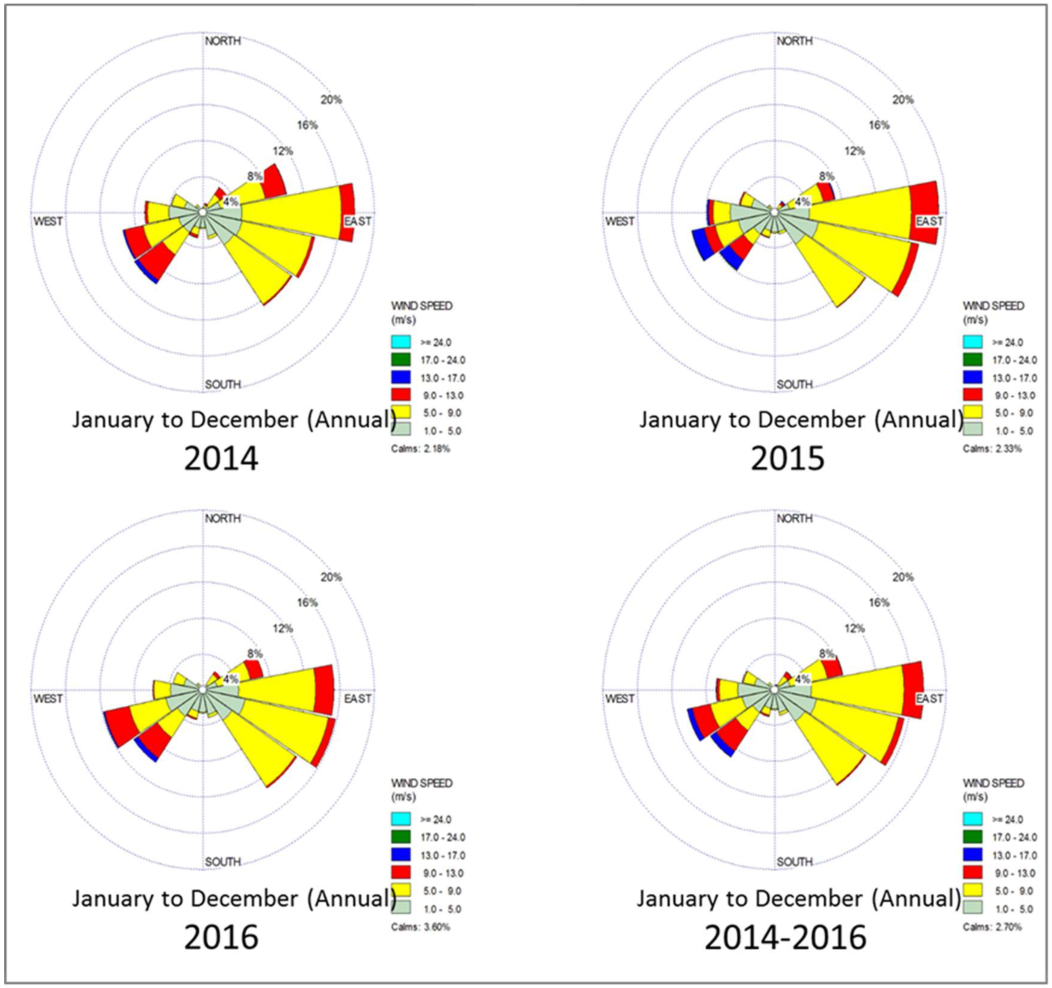
For the MM5 data, winds coming from the S-E and S-W quadrants prevail over the project site during the northeast and southwest monsoon, respectively (***Figure 71*** and ***Figure 72***). Monthly MM5 coincides with the southwest wind flows that generally occur during the southwest season. During the northeast monsoon, however, complex topography or terrain northeast of the proposed project site (specifically inland of Batangas) possibly blocks the prevailing northeast winds, thereby altering the wind flows to southeast.

The three-hourly wind roses of the MM5 data show no apparent wind patterns that possibly deflect occurrence of land and sea breezes at the project site (***Figure 73*** and ***Figure 74***). There appears an increase of wind flows in the early afternoon (1:00 P.M. to 3:00 P.M.) and late afternoon (4:00 P.M. to 6:00 PM.), although winds from other directions (e.g., easterly winds) show increase in frequencies in the early evening until early morning. The project site is between two (2) bays (Batangas Bay and Balayan Bay), in which pronounced local circulation may be affected by nearby water bodies and land masses

2.3.1.2.3.1 Extreme Recorded Winds:

The area belongs to a zone where high incidence and risk to typhoons are expected (***Figure 75*** and ***Figure 76***).

At PAGASA-Ambulong Station, the greatest recorded wind speed was 75 m/s, which occurred during the passage of Typhoon Vera (or Typhoon Bebeng in the Philippines) on July 15, 1983. The greatest recorded wind speed at PAGASA-Calapan Station was 46 m/s during Typhoon Betty (or known as Typhoon Herming in the Philippines) on August 12, 1987.



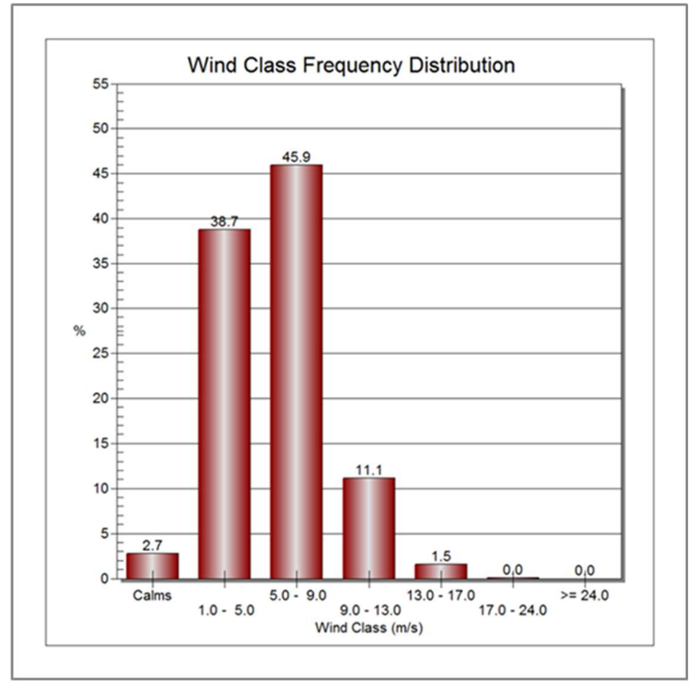


Figure 70 - Annual wind rose diagrams for the MM5 wind data

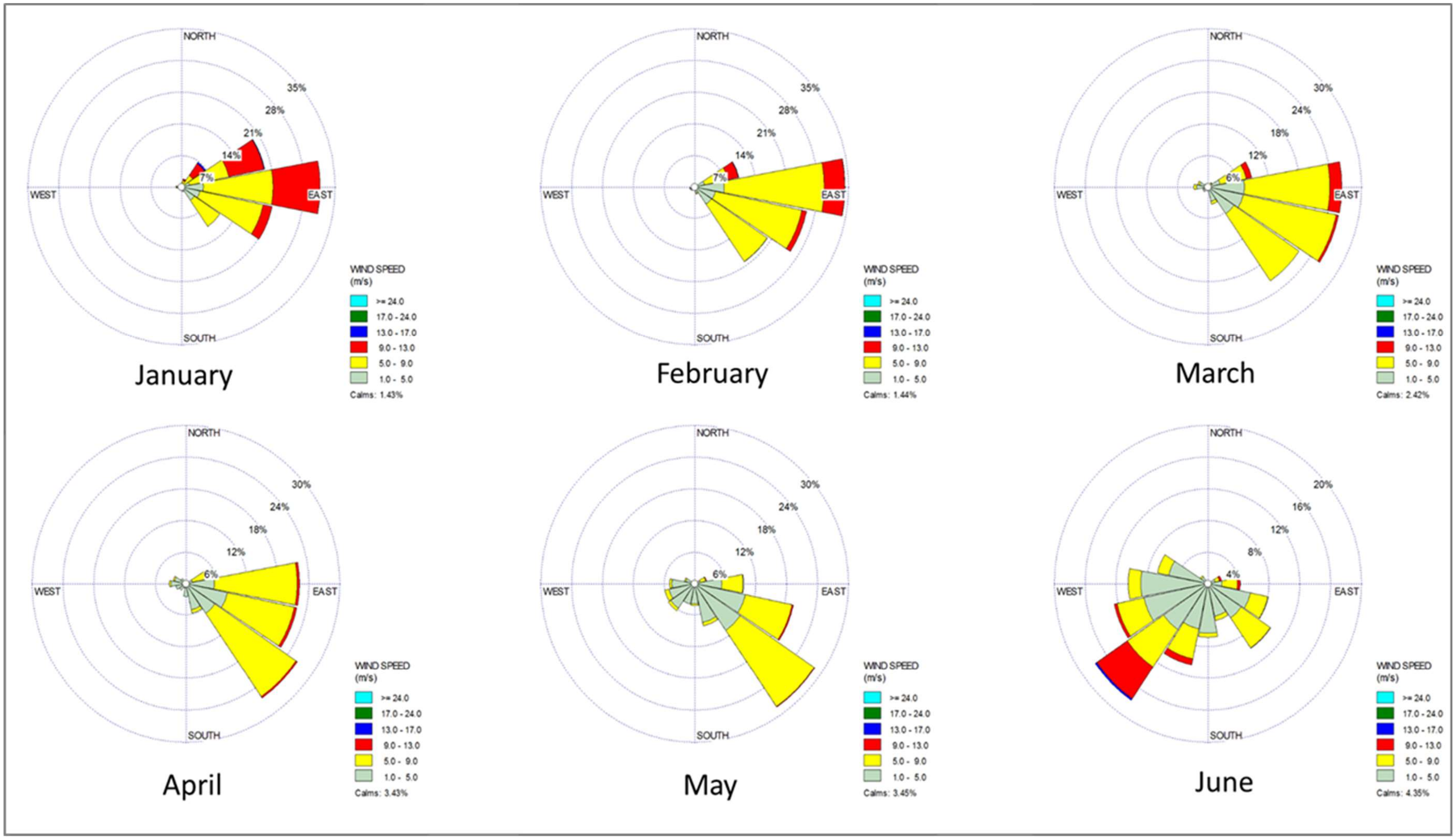


Figure 71 - Monthly wind roses from January to June (MM5 data from 2012 to 2014)

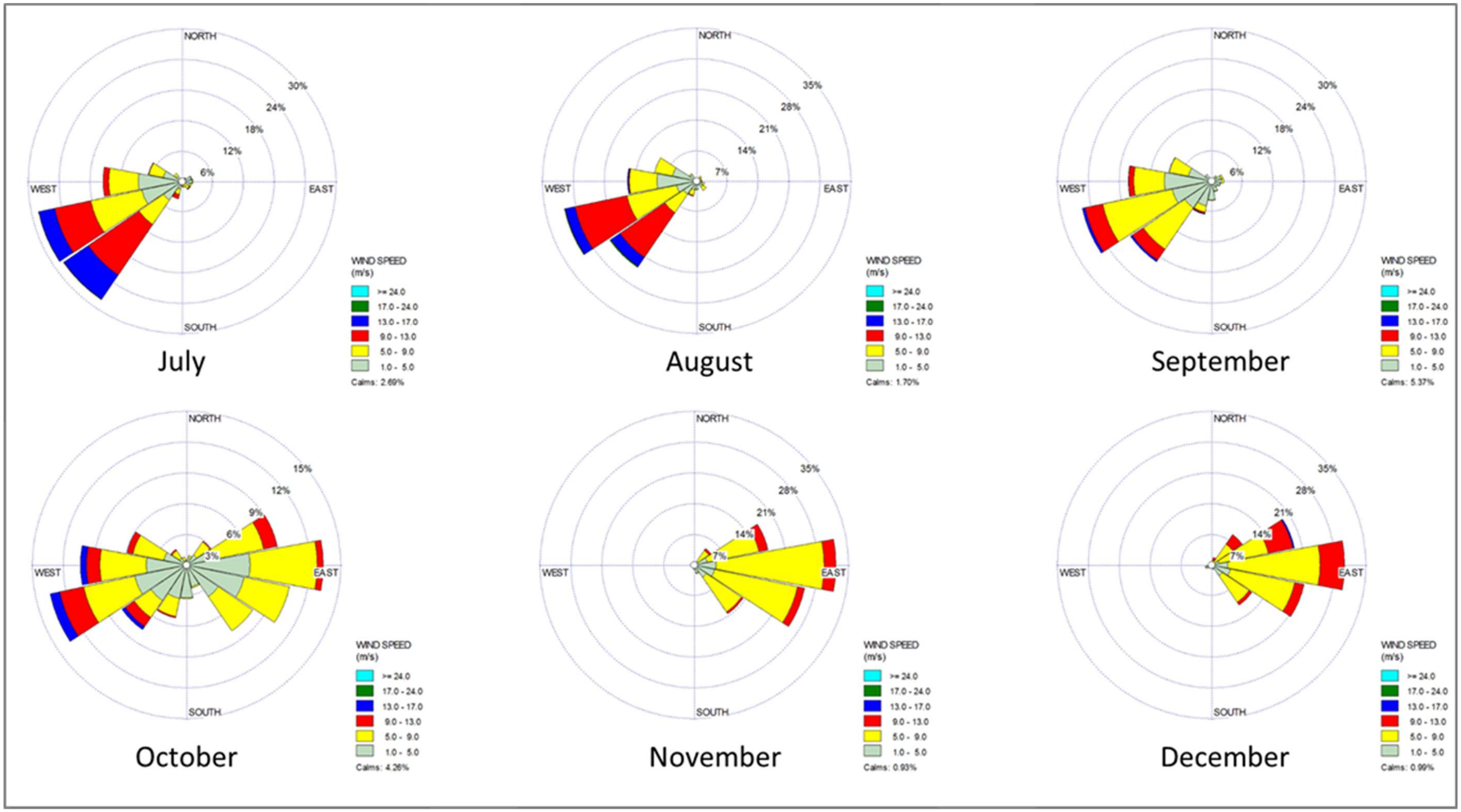


Figure 72 - Monthly wind roses from January to July to December (MM5 data from 2012 to 2014)

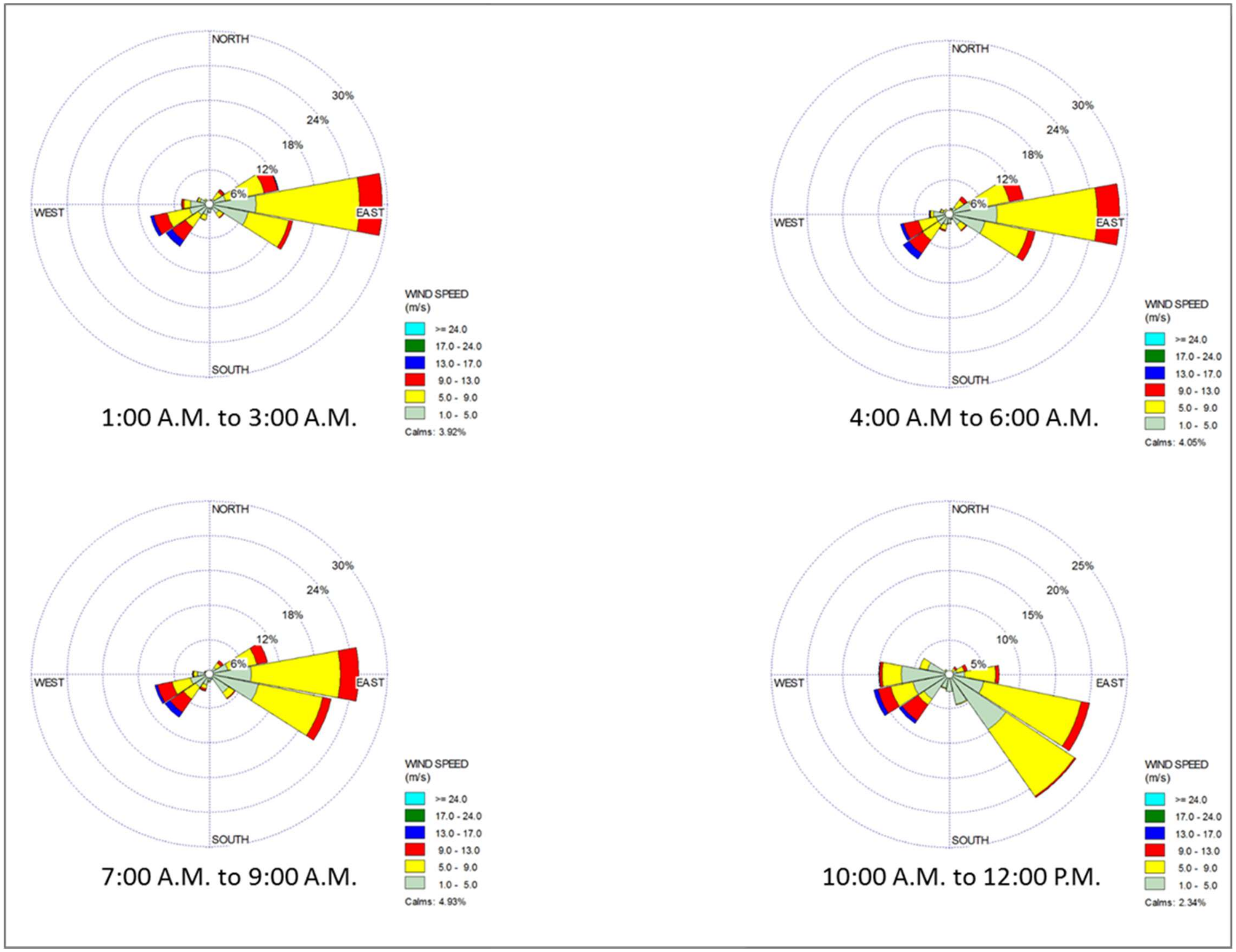


Figure 73 - Three-hourly wind roses from 1:00 A.M. to 12:00 P.M. (MM5 data from 2012 to 2014)

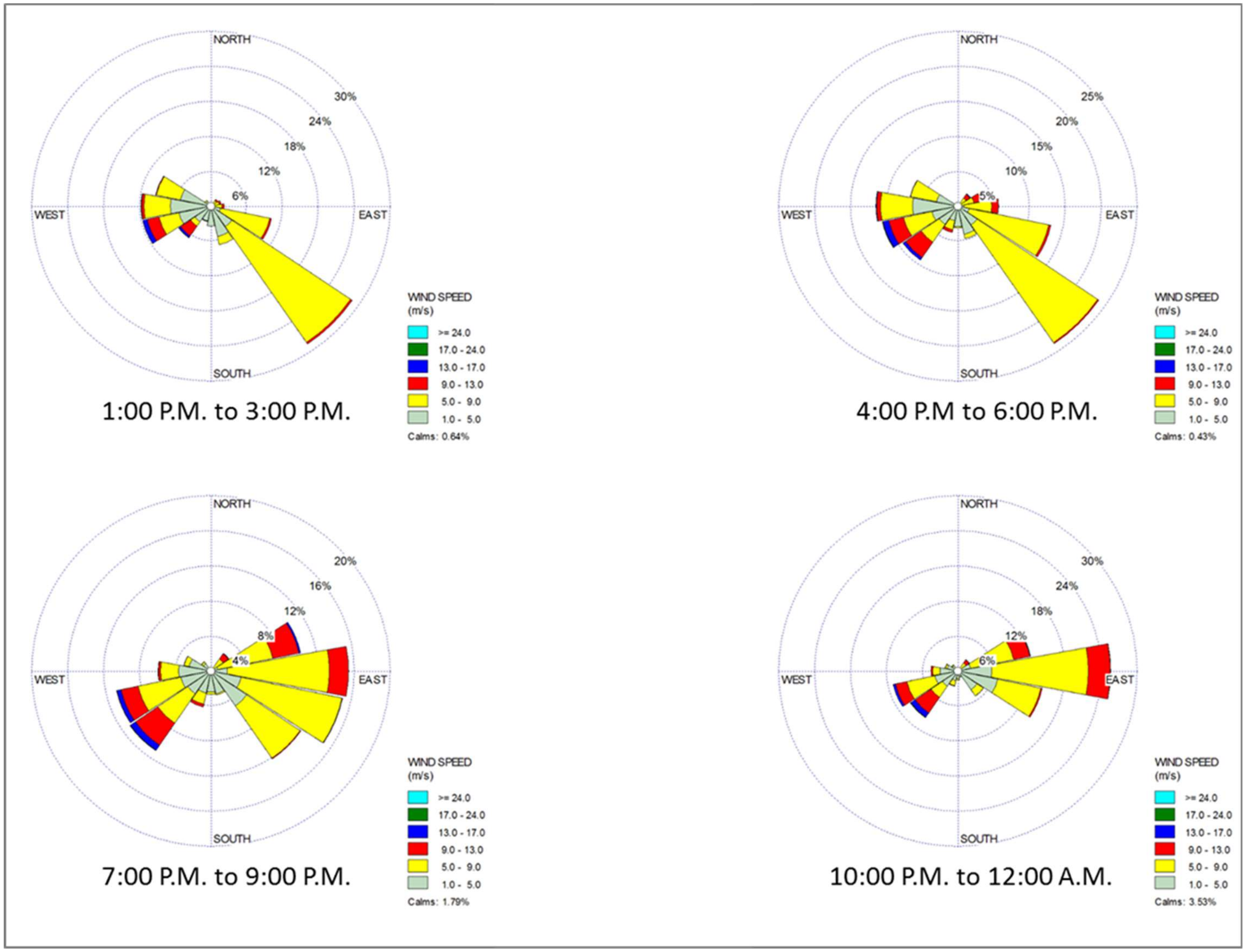


***Figure 74 - Three-hourly wind roses from 1:00 P.M. to 12:00 A.M. (MM5 data from 2012 to* 2014)**

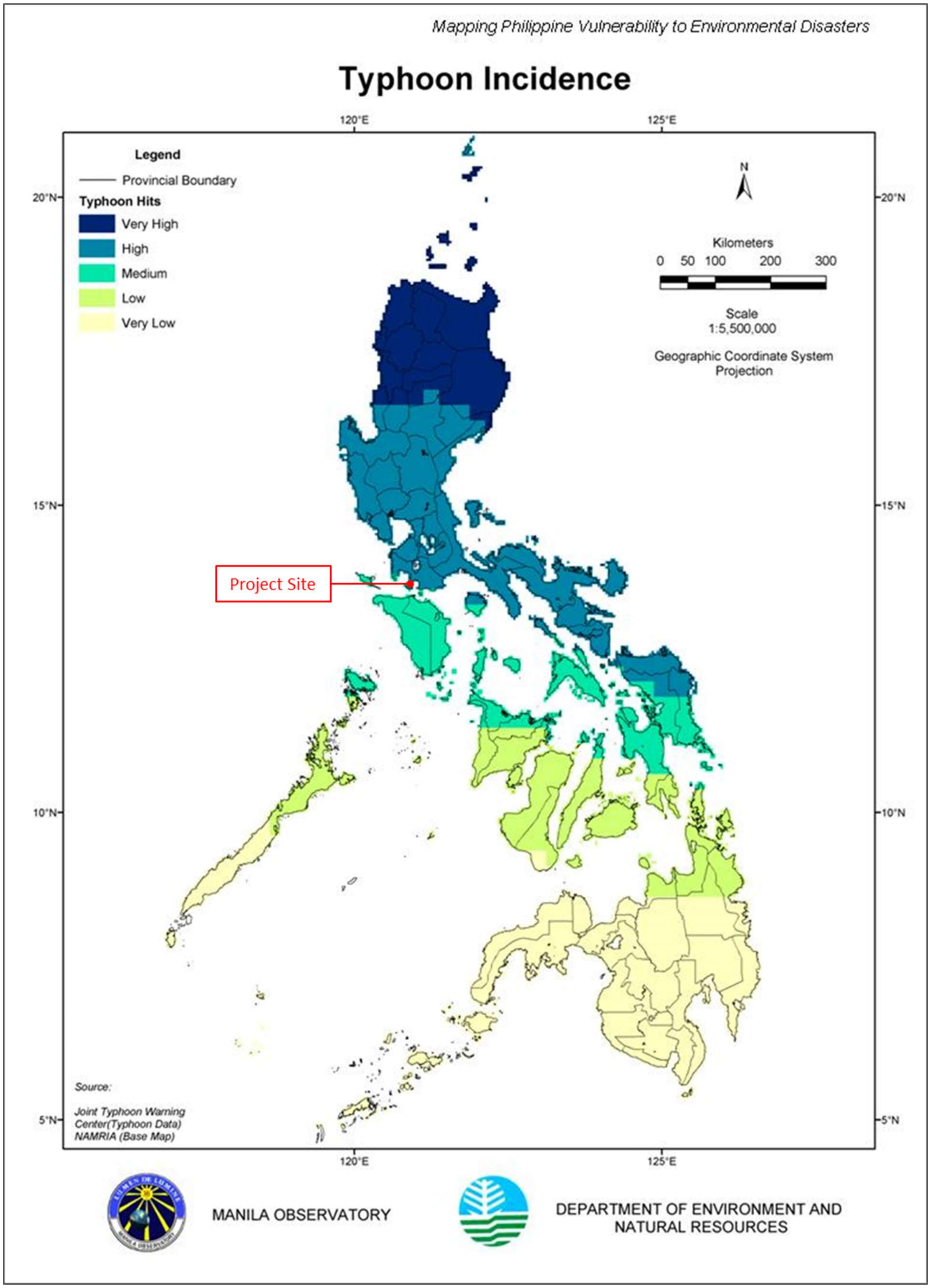


Figure 75 - Typhoon incidence map

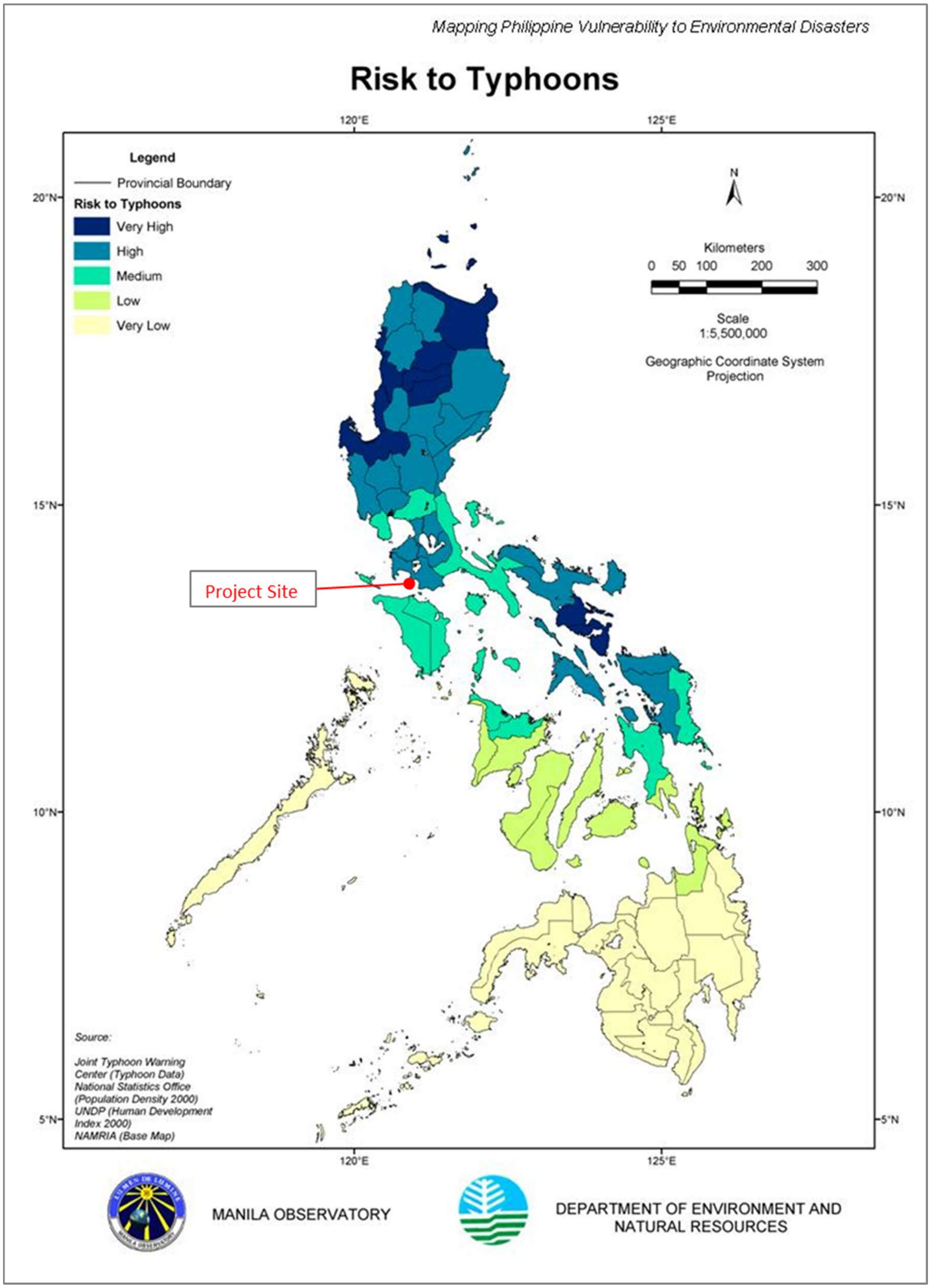


Figure 76 - Typhoon incidence map

2.3.1.2.4 Greenhouse Gas Emission

Figure 77 shows the equivalent CO_2 emissions (CO_2e) for the existing and proposed modification project. The details of the GHG computations are shown in ***Table 26***.

For the existing project using 2016 data, GHG emissions that are owned and controlled by the proponent, such as the process CO^2 emission, service vehicles, and forklift, account to about 66.6% of the total GHG emissions (Scope 1, Scope 2 and Scope 3). Purchased electricity (Scope 2) accounts to about 23.3% while emissions from contractors (Scope 3) about 9.1%.

The proposed modification will increase from total existing GHG emission of 44,816.497 tons per year to 69,652.367 tons with the proposed modification, or about 35.7% increase on GHG emissions. This is due to the increase of process CO_2 emissions arising from the operation of the hot gas generator, use of ecohopper gensets, and increase frequency on the use of trailer, cargo trucks, and bulk trucks.

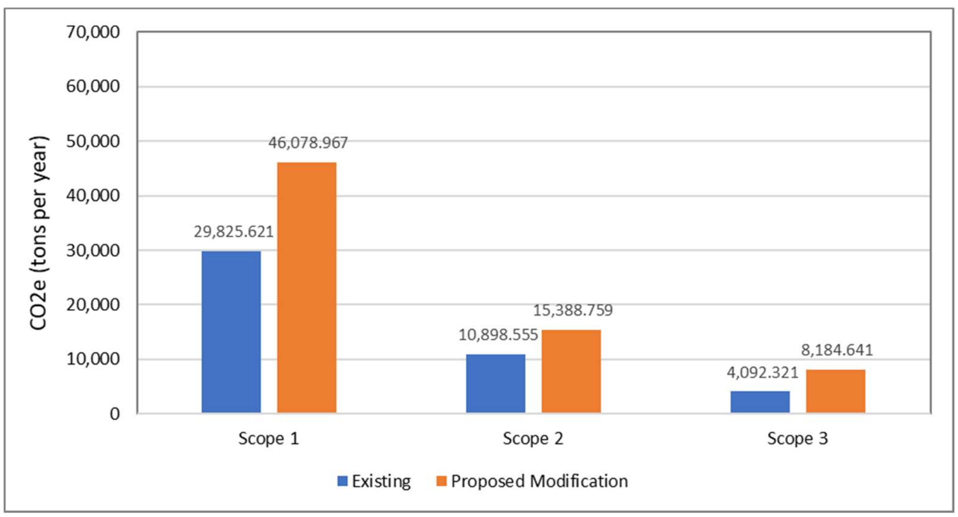


Figure 77. Computed GHG emissions for the existing and proposed expansion

Table 26 - Estimated GHG emissions of the project (existing and proposed)

Equipment/Source	***Existing (2016)***		***Proposed***	
	Fuel Consumption (l)	***CO2e (tons per year)***	***Fuel Consumption (l)***	***CO2e (tons per year)***
Scope 1 Emission	**Total CO2e =29,825.621**		**Total CO2e =46,078.967**	
Process (hot gas generator)	-	28,310.552	-	39,974.502

Equipment/Source	***Existing (2016)***		***Proposed***	
	Fuel Consumption (l)	***CO2e (tons per year)***	***Fuel Consumption (l)***	***CO2e (tons per year)***
Service vehicles (8 units)	24,100	64.499	24,100	64.499
Forklift (2 units)	540,000	1445.217	810,000	2,167.825
Truck sweeper (1 unit)	2,000	5.353	2,000	5.353
Ecohopper genset (440 kVA)	-	-	1,440,000	3,866.788
Scope 2 Emission	**Total CO2e =10898.555**		**Total CO2e =15,388.759**	
Purchased Electricity (kWH)	21,694,122.81	10,898.555	30632101.41	15,388.759
Scope 3 Emission	**Total CO2e =4,092.321**		**Total CO2e =8,184.641**	
Trailer (12 units)	57,600	154.156	115,200	308.313
Cargo trucks (95 units	1,426,481	3,817.730	2,852,962	7,635.459
Bulk trucks (4 units)	45,000	120.435	90,000	240.869

2.3.1.3 Impact Assessment

2.3.1.3.1 Effect on Microclimate

The proposed project will not involve opening or clearing new areas for expansion. It will utilize the existing project area, though additional facilities and equipment will be added in the modification project to increase production capacity.

Thus, the proposed modification project will not likely affect existing local climate in the project area and its vicinities in terms of increase of air temperature. Slight increase of air temperature is expected due to increase of operational activities, such as movement of vehicular traffic. This increase in air temperature, however is confined in the immediate vicinity of the project area or within the perimeter of the project site.

2.3.1.3.2 Mitigation and Sequestration Measures to Reduce GHG Emissions

As discussed on the previous sections, the proposed modification project will increase GHG emissions by about 35.7%. This increase in emissions is significant, and thus measures to offset or reduce GHG emissions should be implemented. The following are the proposed GHG monitoring program and proposed measures to reduce GHG emissions.

1) Prepare and implement a GHG accounting program that records and estimate emissions according to the GHG protocol developed by World Resources Institute (WRI) and the World Business Council on Sustainable Development (WBCSD). GHG Protocol sets the global standard to measure, manage, and report greenhouse gas emission.

2) Report GHG emissions according to the following scope:

   - Scope 1 emissions – measure emissions that are directly owned and controlled sources. These include emissions from the exhaust stacks and vehicles owned by the proponent.
   - Scope 2 emissions – measure emissions from purchase electricity or acquired electricity, steam, heat, and cooling; and
   - Scope 3 emissions – indirect emissions, such as extraction and production of purchase materials, transport-related activities in vehicles not owned or controlled by the proponent and electricity related activities (e.g., Transmission and distribution losses) not covered in Scope 2 (source:www.ghgprotocol.com)

3) The significant GHG emissions of the project are from vehicles owned and controlled by the company and those used by contractors. Thus, measures to lessen GHG emissions arising from operation of vehicles should be implemented, as follows:

   a. Reduce idling time of vehicles;
   b. Regular maintenance of all vehicles used for the project;
   c. Use of more efficient haul trucks that consumed less fuel and emit less emissions.

4) Offset GHG emissions by implementing reforestation program for the project. This could be part of the overall reforestation program of the company.

2.3.2 Noise Quality

2.3.2.1 Methodology

Noise impact assessment involved the following:

- Discussion on the applicable ambient noise standards;

- Methodology on the measurement of noise levels and the locations of the sampling stations;
- Environmental performance of the project (comparison of the measured noise levels with the applicable noise standards); and
- Impact assessment of proposed project upgrade and proposed mitigation measure and monitoring program.

2.3.2.1.1 Ambient Noise Standards

The then National Pollution Control Commission (NPCC) in 1978 established the ambient noise quality standards in general areas (***Table 27***). In 1980, NPCC issued Memorandum Circular No. 2, Series of 1980 (NPCC 1980), which amended Sections 75 to 78 in Article 1 (Noise Control Regulation) of the NPCC (1978) rules and regulations, by inclusion of corrector factors on areas directly facing roads.

Table 27 - Environmental quality standards for noise in general areas (NPCC 1980)

Category	Maximum Allowable Noise (dBA) by time periods		
	Daytime (9:00 A.M. to 6:00 P.M).	Morning/Evening (5:00 A.M. to 9:00 AM/ 6:00 P.M. to 10:00 P.M.	Nighttime (10:00 P.M. to 5:00 A.M).
AA	50	45	40
A	55	50	45
B	65	60	55
C	70	65	60
D	75	70	65

- Class AA- a section of contiguous area which requires quietness, such as areas within 100 meters from school site, nursery schools, hospitals and special house for the aged
- Class A - a section of contiguous area which is primarily used for residential area
- Class B - a section of contiguous area which is primarily a commercial area
- Class C - a section of contiguous area reserved as light industrial area
- Class D – a section of contiguous area reserved for heavy industrial area

2.3.2.1.2 Environmental Performance/Existing Condition Methodology

Noise monitoring data reported in the SMR and the noise data based on monitoring by CRL Calabarquez Corporation (CRL) in April 2017 were used to assess the performance of the project in terms of noise quality. The following presents the details of the said data sets.

2.3.2.1.2.1 <u>Noise data reported in SMR</u>

Noise monitoring data from the 1st quarter of 2014 to 4th quarter of 2016 were tabulated and compared with the ambient noise standards set by the NPCC (1980). Noise monitoring stations located within the project complex, such as at the material storage area and mill area, were excluded in the analysis (except Holcim main gate and the guesthouse) because said locations are within workplaces, in which the applicable noise standards are those set by the Department of Labor and Employment (DOLE).

2.3.2.1.2.2 <u>Noise sampling by CRL in April 2017</u>

CRL conducted noise sampling at four (4) locations in April 2017. A Lutron sound level meter was used in monitoring sound levels. This SLM complies with ANSI-SI.4 1983 standard and was capable of measuring sound levels from 30 dB TO 130 dB. The SLM has an internal oscillation system with 1 KHz square wave generator for calibration.

Monitoring by CRL involved hourly sampling of noise levels and computation of equivalent noise levels (Leq). Measurements covered the time periods specified in NPCC (1980), namely: daytime, morning, evening, and nighttime.

Figure 78 shows the locations of the noise sampling stations.

2.3.2.2 Environmental Performance/Existing Condition

2.3.2.2.1 Noise Levels as Reported in the SMR

Figure 79 and ***Figure 80*** show the plots of noise levels as measured at the residential area (communities) and within the project site, respectively. Noise data were based in the SMR from 1st quarter of 2014 to 4th quarter of 2016.

At the community or residential areas (***Figure 79***), noise levels were generally lower than daytime noise standard set at 55 dBA, but on some occasions greater than said standard. Noise sources at the time of monitoring, however, were not indicated or reported in the SMR, making it difficult to assess whether the recorded noise levels were from the project or from other sources. Except on 2nd quarter of 2015, sources of noise were indicated (i.e., “busy residential area” and “passing of public utility vehicles”).

The discussion below presents the proposed sampling methodology, specifically on the locations and how to measure and record noise levels.

For noise levels measured within the project site (Holcim main gate and guesthouse) (***Figure 80***), these were within the ambient daytime noise standard set at 75 dBA for heavy industrial area. These sampling stations were located within the project premises, but close to project boundaries wherein noise standards set for heavy industrial area could be used.

Except on dust emissions, there were no issues and concerns regarding noise emissions of the project, as discussed during FGDs in Barangay Talaga East and Brgy. Balibaguhan.

2.3.2.2.2 Noise Monitoring by CRL in April 2017

Table 28 to ***Table 31*** show the hourly measured noise levels in comparison with the ambient noise standards. Measured noise levels at the guest house of the proponent and parking area of the project site showed levels within the ambient noise standards set for heavy industrial area (morning, daytime, evening, and nighttime).

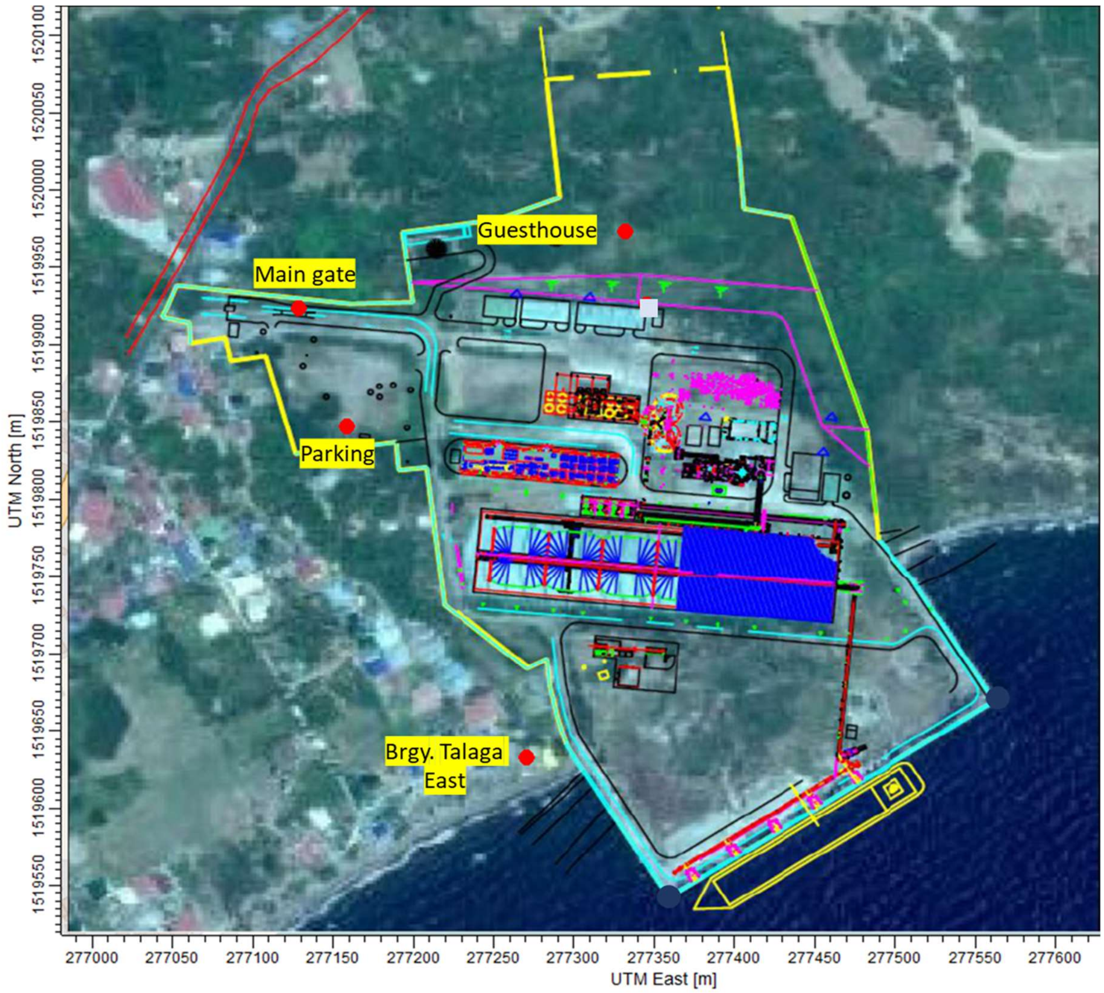


Figure 78 - Location of the noise sampling stations

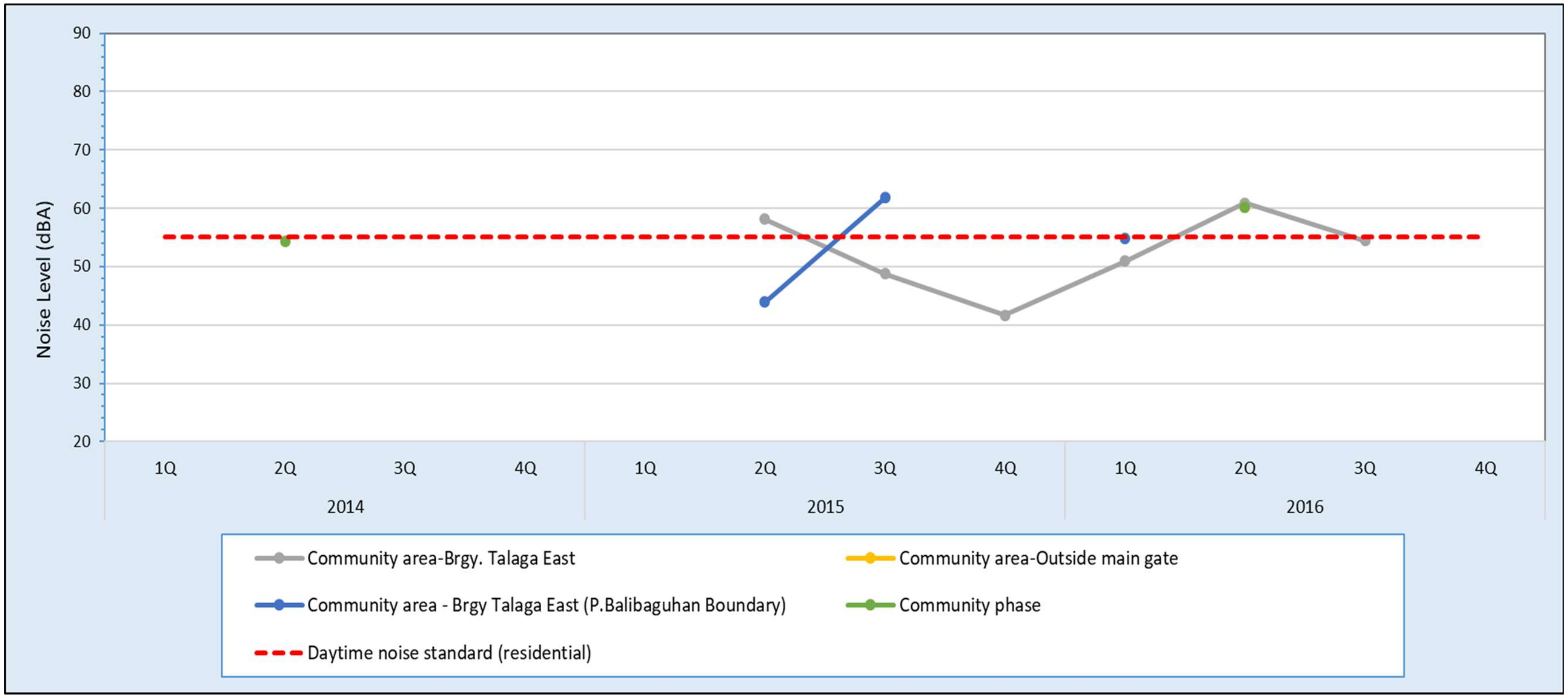


Figure 79 - Measured noise levels at residential areas (as reported in the SMR)

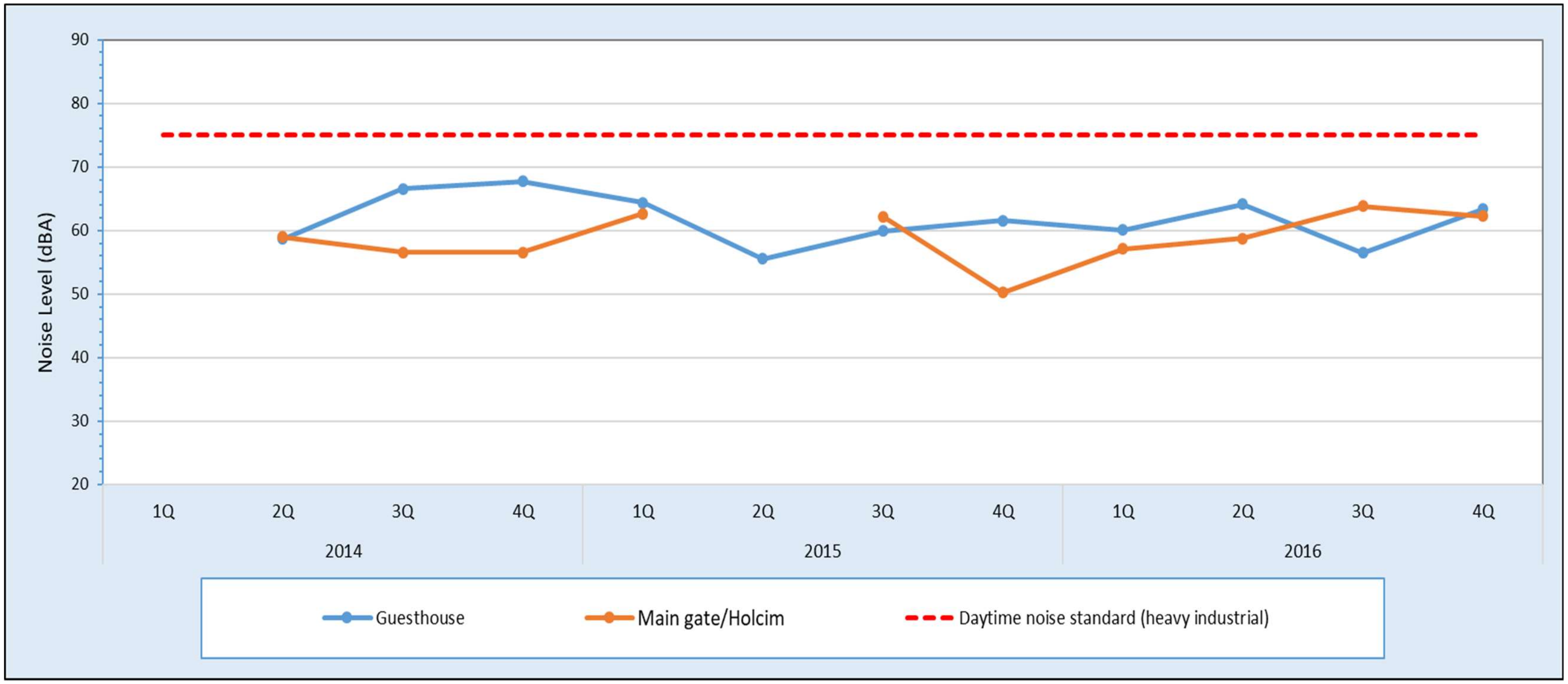


Figure 80 - Measured noise levels within the project site (main gate and guesthouse (as reported in the SMR)

At the two (2) noise stations located in Brgy. Pungo Talaga and Brgy. Balibaguhan, measured noise levels were higher than the noise standards applicable for residential areas. As indicated in the CRL (2017) report, noise levels exceeding the residential noise standards in Brgy. Pungo Talaga and Brgy. Balibaguhan "*mostly came from animals, occasional passing of vehicles and from wind propagation*".

Table 28. Measured noise levels on April 18-19, 2017 at the guesthouse of Holicm

Sampling Time	*Average dB(A)*	*DENR Standard (Dba)*	*Remarks*
1340H - 1540H	58.1	75	Within
1540H - 1740H	60.0	75	Within
1740H - 1940H	60.0	75	Within
1940H - 2140H	59.4	70	Within
2140H - 2340H	59.7	70	Within
2340H - 0140H	60.1	65	Within
0140H - 0340H	59.8	65	Within
0340H - 0540H	58.6	65	Within
0540H - 0740H	58.7	70	Within
0740H - 0940H	59.4	70	Within
0940H - 1140H	60.2	75	Within
1140H - 1340H	60.2	75	Within

*AveLeq = $10*\text{Log}\{[(10^{(\text{Min}/10)}+10^{(\text{Max}/10)})/2]\}$

Table 29 - Measured noise levels on April 19-21, 2017 in Brgy. Pungo Talaga

Sampling Time	*Average dB(A)*	*DENR Standard*	*Remarks*
1650H - 1850H	***59.1***	55	Exceeded
1850H - 2050H	***59.4***	50	Exceeded
2050H - 2250H	***59.0***	50	Exceeded
2250H - 0050H	***58.7***	45	Exceeded
0050H - 0250H	***59.5***	45	Exceeded
0250H - 0450H	***59.5***	45	Exceeded
0450H - 0650H	***56.2***	45	Exceeded
0650H - 0850H	46.1	50	Within
0850H - 1050H	***57.5***	50	Exceeded
1050H - 1250H	***58.0***	55	Exceeded

Sampling Time	***Average dB(A)***	***DENR Standard***	***Remarks***
1250H - 1450H	***57.8***	55	Exceeded
1450H - 1650H	***59.0***	55	Exceeded

*AveLeq = $10*Log\{[(10^{(Min/10)}+10^{(Max/10)})/2]\}$

Table 30 - Measured noise levels on April 20-21, 2017 in Pulong Balibaguhan

Sampling Time	***Average dB(A)***	***DENR Standard***	***Remarks***
1900H - 2100H	***58.3***	50	Exceeded
2100H - 2300H	***57.2***	50	Exceeded
2300H - 0100H	***56.7***	45	Exceeded
0100H - 0300H	***55.7***	45	Exceeded
0300H - 0500H	***55.6***	45	Exceeded
0500H - 0700H	***58.2***	50	Exceeded
0700H - 0900H	***59.0***	50	Exceeded
0900H - 1100H	***59.2***	55	Exceeded
1100H - 1300H	***60.7***	55	Exceeded
1300H - 1500H	***60.7***	55	Exceeded
1500H - 1700H	***60.0***	55	Exceeded
1700H - 1900H	***60.0***	55	Exceeded

*AveLeq = $10*Log\{[(10^{(Min/10)}+10^{(Max/10)})/2]\}$

Table 31 - Measured noise levels on April 25-26 at the parking area of Holcim

Sampling Time	***Average***	***DENR Standard***	***Remarks***
1315H - 1515H	61.0	75	Within
1515H - 1715H	59.1	75	Within
1715H - 1915H	57.9	70	Within
1915H - 2115H	57.7	70	Within
2115H - 2315H	57.0	65	Within
2315H - 0115H	57.3	65	Within
0115H - 0315H	56.4	65	Within
0315H - 0515H	53.7	65	Within
0515H - 0715H	57.0	70	Within
0715H - 0915H	58.4	70	Within
0915H - 1115H	58.0	75	Within
1115H - 1315H	57.7	75	Within

*AveLeq = $10*\text{Log}\{[(10^{(Min/10)}+10^{(Max/10)})/2]\}$

2.3.2.3 Key Impact Assessment

The installation and replacement of outdated/old equipment and operation of the proposed project upgrade (or project modification) are expected to increase the background noise levels adjacent the project site. The expected additional noise sources are those from the operation of the generator sets (2 units), increase rate of trucks use for hauling raw materials and cement, and increase activity and period of loading and unloading of materials at the pier.

Hence, mitigation measures should be constructed and implemented to ensure compliance with the noise standards, particularly ambient noise standards for residential areas, and to avoid nuisance at households adjacent the project site. The following are the proposed mitigation measures.

- Continue strict implementation of speed limits within the project site;
- Require all heavy equipment and other vehicles to install efficient/effective mufflers;
- Use of noise enclosures around high emanating noise source (e.g., generator sets) and use of efficient/effective silencers at exhaust stacks of generator sets;
- Restrict or limit activities at nighttime to avoid nuisance at nearby residential areas; and
- Limit or restrict use of noise equipment at nighttime, particularly equipment that emanates high noise levels.

It is also required to conduct noise monitoring at households nearest the project site to check compliance with applicable noise regulations during installation/replacement and operation of the project upgrade.

2.3.3 <u>Air Quality</u>

2.3.3.1 Methodology

2.3.3.1.1 Air Quality Standards and Guidelines Used in this Study

This study used the following air quality standards and guideline values.

- **National Emission Standards for Source Specific Air Pollutants (NESSAP)** – assess compliance of the project's air emissions (particularly stack emissions) with the emission standards (NESSAP); and
- **National Ambient Air Quality Guideline (NAAQG) values** – determine if the dispersed emissions of the project to the ambient air environment comply with the ambient guideline (NAAQG) values, as demonstrated using air dispersion modelling techniques. This is in accordance with Section 3 (Increment Consumption), Rule X (New/Modified Sources in Attainment Areas) of DAO 2000-81 (IRR of the PCAA in 1999), which states that emissions of the proposed new project or existing source to be modified shall not exceed the National Ambient Air Quality Guideline (NAAQG) values or an increase in the increment consumption based on computer dispersion modelling, as indicated in ***Plate 1*** below.

Section 3. Increment Consumption

No new source may be constructed or existing source modified if emissions from the proposed source or modification will, based on computer dispersion modeling, result in:

Exceedance of the National Ambient Air Quality Guideline Values; or
An increase in existing ambient air levels above the levels shown below

PM-10, annual arithmetic mean	17 micrograms per cubic meter
PM-10, 24-hr maximum	30 micrograms per cubic meter
Sulfur Dioxide, annual arithmetic mean	20 micrograms per cubic meter
Sulfur Dioxide, 24-hr maximum	91 micrograms per cubic meter
Nitrogen Dioxide, annual arithmetic mean	25 micrograms per cubic meter

In the case of multiple point sources at a single facility, the net emissions from all affected sources shall be included in a single increment analysis.

Plate 1 - Section 3, Rule X of DAO 2000-81

Section 2.1.2 of DMC 2008-003 (Guidelines for Air Dispersion Modelling) refers to Rule X, Section 3 (Increment Consumption) of DAO 2000-81 as the basis of dispersion modelling for regulatory application in the Philippines.

Further, Section 2.1.1 of MC 2008-003 stipulates that "all ground level concentrations (GLCs) predicted by dispersion modelling will be converted to 98 percentiles to allow direct comparison to be made with the CAA air quality guidelines."

2.3.3.1.2 Characterization of Ambient Air Quality

Environmental performance of the project was assessed based on available air quality data, as follows:

- Ambient air quality data as reported in the SMR/CMR since 1st quarter of 2014 to 4th quarter of 2016 – these are the available ambient air quality data (TSP, SO_2, NO_2, and PM_{10}) as provided in the SMR and CMR of the project (please see ***Annex D*** and ***Annex E***);

- Ambient air quality data as monitored by CRl Calabarquez Corporation (CRL) in April 2017 – monitoring data included total suspended particulates (TSP), particulate matter with diameter equal to or less 10 µm (PM_{10}), particulate matter with diameter equal to or less 2.5 µm ($PM_{2.5}$), sulfur dioxide (SO_2), nitrogen dioxide (NO_2) and metals in ambient air, such as antimony (Sb), arsenic (As), cadmium (Cd), copper (Cu), lead (Pb), mercury (Hg), nickel (Ni), zinc (Zn), and chromium (Cr). Please refer ***Annex F*** on the ambient monitoring report by CRL (2017);

- Emission test results for the stack of the grinding mill – monitoring data as reported in the a) SMR since 2014 and b) by CRL emission test report in 2016. Reported in the SMR are the stack test results of PM, SO_X, and NO_X.

In the CRL (2016) report, which was based on stack monitoring on July 3, 2016, the results of PM were reported, including the measured stack gas velocity, stack gas temperature, stack diameter, etc. These source stack parameters were used as input data in this modelling study. Please refer ***Annex G*** on the emission test report by CRL

2.3.3.1.3 Methods of Air Sampling and Analysis

2017).

Table 32 shows the methods of air sampling and analysis, as reported in the SMR/CMR and CRL (2017).

Table 32 - Methods of air sampling and analysis

Parameter	*Sampling Methodology / Analysis*	*Brand/Model*
Ambient Air Quality:		
TSP, Sb, As, Cd, Cu, Pb, Hg, Ni, Zn, and Cr	High Volume Sampler - Gravimetric Method	Tish Environmental/5009 and Graseby -high volume sampler
PM_{10} and $PM_{2.5}$	High Volume Sampler - Gravimetric Method	Instrumex – dust channel dust sampler
SO_2 and NO_2	Pararosaniline Method	SKC (Personal sampler)
Stack Emissions:		

Parameter	Sampling Methodology / Analysis	Brand/Model
Particulate Matter (PM) (als referred to as TSP)	U.S.EPA Method 5 (Determination of Particulate Matter emissions from Stationary Sources)	Isokinetic stack sampler
Stack gas velocity, stack gas temperature and other stac gas parameters	Isokinetic stack sampler – U.S.EPA Methods 1 to 4)	Isokinetic stack sampler
Notes: As reported by CRL (2016) and CRL (2017)		

Sampling site map

The consolidated locations and coordinates of the ambient air sampling station are shown in ***Table 33*** and ***Figure 81***. Note that the first and last three (3) stations in ***Table 33*** are the monitoring stations of CRL in 2017. The rest of the air stations are reported in the SMR/CMR.

Table 33. Locations and coordinates of air sampling stations

Location	Latitude (deg)	Longitude (deg)	Remarks
Guesthouse	13.740667°	120.940639°	Also CRL sampling station in April 2017
Main gate/Holcim	120.940639°	120.939472°	
Community area-Brgy. Talaga East			
Community area-Outside main gate			
Community area - Brgy Talaga East (P.Balibaguhan Boundary)			
Community phase	13.738250°	120.939833°	
Vacant lot near entrace gate			
A. Sandoval Memorial National High School			
Talaga Elementary School			
Sitio Silangan Montessori, Brgy. Chapel			

Location	Latitude (deg)	Longitude (deg)	Remarks
Mill area	13.738917°	120.941056°	
Brgy. Pungo Talaga			CRL sampling station in April 2017
Pulong Balibaguhan			CRL sampling station in April 2017
Parking area inside Holcim			CRL sampling station in April 2017

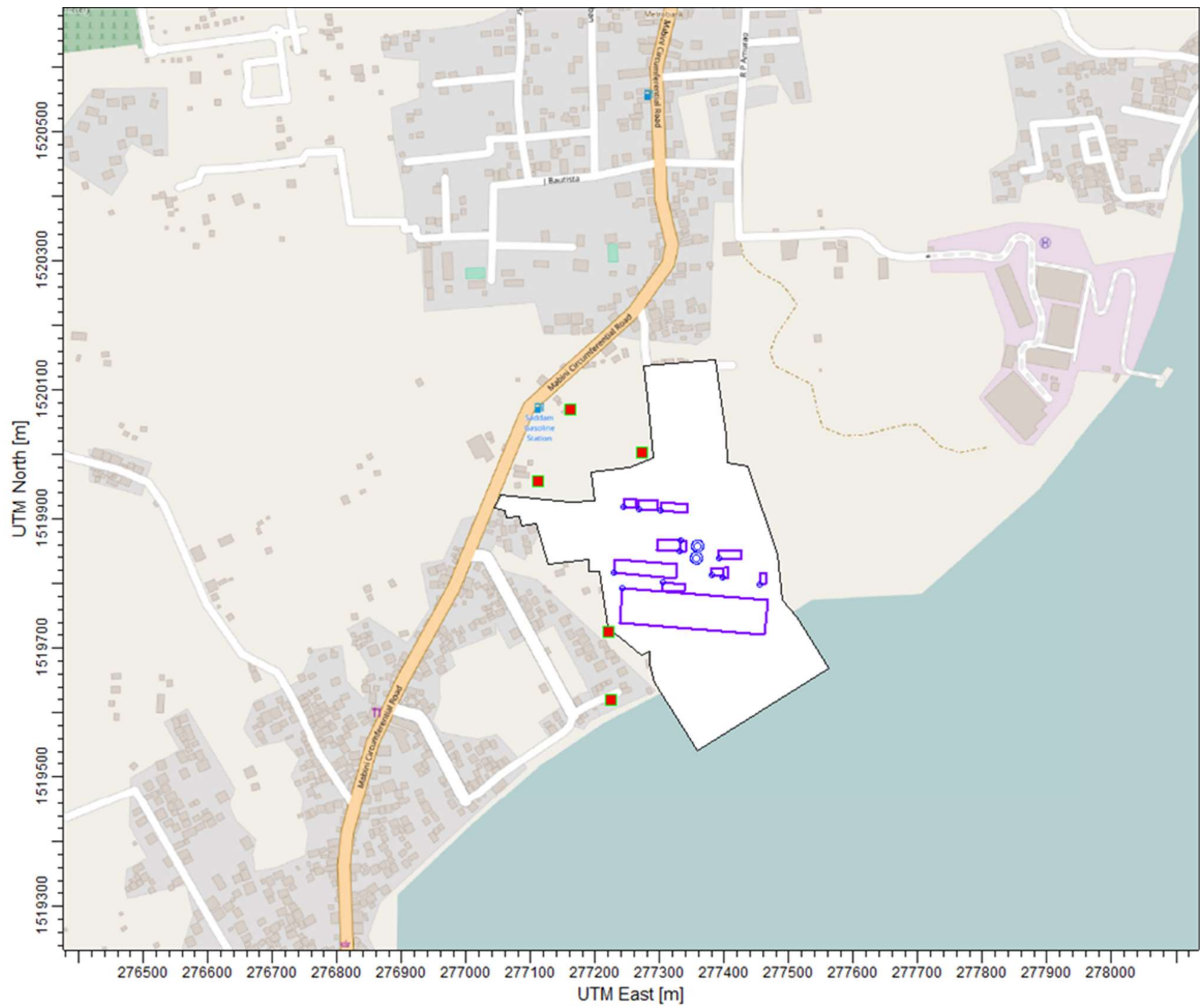


Figure 81 - Air sampling location map

2.3.3.1.4 Dispersion Modelling Methodology

The following presents the sub-sections under dispersion modelling methodology:

- **Air dispersion model** – presents the dispersion model used in this study;
- **Emission sources and emission factors** - presents the source input data (point and non-point sources) and the emission factors for the non-point sources
- **Control inputs and source pathways** – presents the reports as generated by AERMOD View on control pathway and source pathways (i.e., source input parameters and building downwash data);
- **Receptor pathway** – describes the topography generated for the project site and vicinities using AERMAP View, and the receptors used in the modelling;
- **Meteorological pathway** – presents the surface and upper air data used in the modelling; and
- **Modelling scenarios** – describes the modelling scenarios in the study. The modelling scenarios are divided into two (2) major parts, namely: without project modification (or existing condition) and with the proposed project upgrade or project modification.

2.3.3.1.4.1 Air Dispersion Model

A licensed AERMOD View Air Dispersion Model Version 9.4.0 (Serial No. AER0006927) was used to determine dispersion of air pollutants arising from the project operation (please refer ***Annex H*** on the licensed certificate on AERMOD View).

AERMOD View is a Graphic User Interface (GUI) developed for U.S.EPA's AERMOD. AERMOD is one of the required air dispersion models to be used in Tier 4 assessment, pursuant to DENR MC 2008-003 (Guidelines for Air Dispersion Model).

Two (2) pre-processors, namely: AERMET View and AERMAP View, were used to process and generate the meteorological and terrain/receptor input data, respectively (***Figure 82***). AERMET was used to generate the surface and upper air (or profile) input data while AERMAP on the coordinates, elevation, and hill heights of the receptors. AERMAP View utilized the Shuttle Radar Topography Mission (SRTM) data (Global ~ 30 m, Version 3) in generating the terrain or elevations of the receptors.

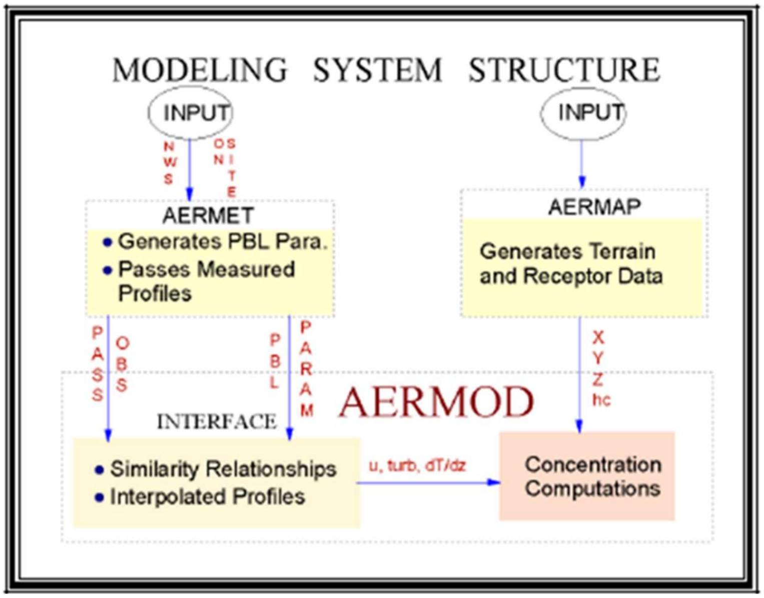
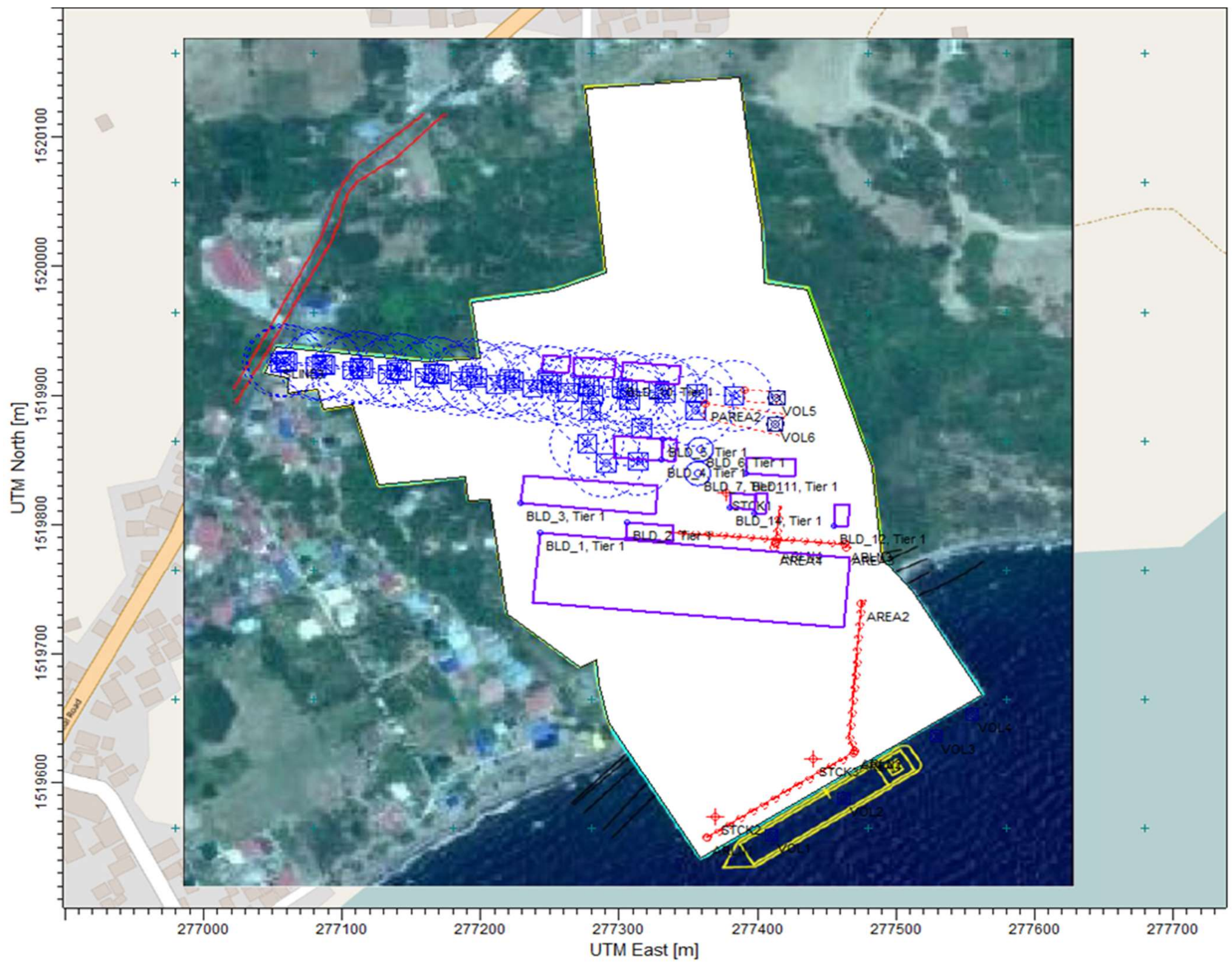


Figure 82 - Data flow in AERMOD modelling system (Source: U.S.EPA 2004)

2.3.3.1.4.2 *<u>Emission Sources and Emission Factors</u>*

Table 34 shows the sources of emissions (particularly TSP and PM_{10}) and the types of sources used in modelling without and with the proposed project upgrade. Due to increase in capacity of the proposed upgrade plus addition of two (2) unitsof ecohopper generator sets with rated capacity of 440 kVA each, there are expected increase of air emissions (TSP, PM_{10}, SO_2 and NO_2) of the project.



Note: Polygons and circles at the project site represent the emission sources and building tiers used in the modelling

Figure 83 - Location of Emission Sources

Figure 83 shows the locations of the emission sources. The description and details of the emission sources are presented in the sub-sections below.

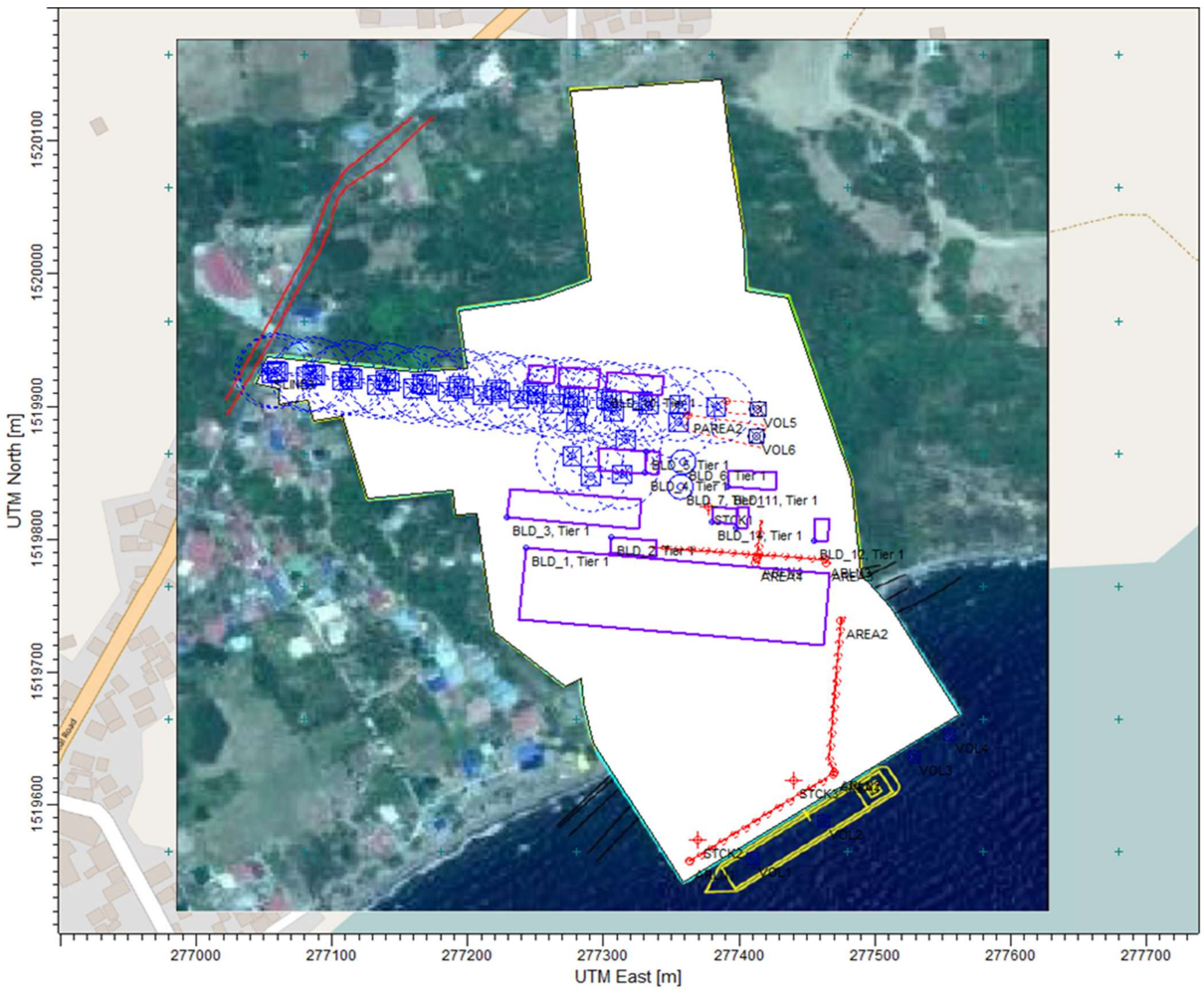
Annex I and ***Annex J*** present the details of the input data (e.g., spreadsheets used to compute emissions) of the point and non-point sources, respectively.

Succeeding sections presents the summary of emissions and the results of the air dispersion modeling, including the proposed mitigation measures and monitoring program ***Plate 2*** to ***Plate 7*** show photographs taken during site visit on January 27, 2017.

Table 34 - Sources of air emissions and type of sources used in dispersion modelling (with and without the proposed upgrade)

Emission Source	Type of Source	Without the Proposed Upgrade	With the Proposed Upgrade
Emissions from stack	Point source	Baghouse stack	Baghouse stack (with increase in emission rates) and proposed two (2) units of generator sets
Materials handling	Volume source	• Unloading of limestone at pier • Unloading of slag at pier • Handling of limestone stockpile • Handling of gypsum stockpile	• Unloading of limestone at pier • Unloading of slag at pier • Handling of limestone stockpile • Handling of gypsum stockpile (Note: With increase in volume of materials)
Wind erosion at stockpiles	Area polygon source	• Limestone stockpile • Gypsum stockpile	• Limestone stockpile • Gypsum stockpile (Note: With increase in size of stockpile)
Paved road	Line volume source	• Main gate to packhouse to main gate • Main gate to limestone stockpile • Main gate to gypsum stockpile	• Main gate to packhouse to main gate • Main gate to limestone stockpile • Main gate to gypsum stockpile (Note: With increase on the number of trucks use per hour)
Transfer points	Area source	• Transfer point 1 • Transfer point 2 • Transfer point 3 • Transfer point 4	• Transfer point 1 • Transfer point 2 • Transfer point 3 • Transfer point 4 (Note: With increase in volume of materials)
Conveyor	Line area	• Conveyor 1 • Conveyor 2 • Conveyor 3 • Conveyor 4	• Conveyor 1 • Conveyor 2 • Conveyor 3 • Conveyor 4 (Note: With increase in volume of materials)

Emission Source	Type of Source	Without the Proposed Upgrade	With the Proposed Upgrade
Motor vehicle emissions	Line volume source	• Main gate to packhouse to main gate • Main gate to limestone stockpile • Main gate to gypsum stockpile	• Main gate to packhouse to main gate • Main gate to limestone stockpile • Main gate to gypsum stockpile (Note: With increase on the number of trucks use per hour)



Note: Polygons and circles at the project site represent the emission sources and building tiers used in the modelling

Figure 84 - Locations of emission sources used in the dispersion modelling

Plate 2 - Packing building (left) and storage building (right) (Photo taken on 1/27/2017)

Plate 3 - Silos of the grinding facility (Photo taken on 1/27/2017)

Plate 4 - Covered conveyor system at the pier (Photo taken on 1/27/2017)

Plate 5 - Residences located adjacent the project's pier. Shown are buffer strips of bamboos along east side of the property of the project site (Photo taken on 1/27/2017)

Plate 6 - Stockpiles at open areas (Photo taken on 1/27/2017)

Plate 7 - Grinding facility of the project (Photo taken on 1/27/2017)

2.3.3.1.4.2.1 Emissions from Stack (point source)

Emissions test sampling were conducted at the baghouse stack of the grinding facility. CRL (2016) provided details of the emissions monitoring results, in which measured parameters such particulate emission rates, exit gas velocity and exit gas temperature, were used in the modelling. ***Annex G*** shows the emission test report of CRL (2016)

Table 35 and **Table 36** show the source input data used in modelling point source without and with proposed upgrade, respectively.

Please refer ***Annex I*** on the details of the source input data used in the modelling (e.g.,. screenshots of the location sources). The other supporting documents are as follows:

- ***Annex I*** – screenshots of the locations of the point sources and the details of the source input data/emission factors used for the ecohopper gensets;
- ***Annex K*** – topographic map as source of information on the base elevations of the emission sources and buildings/structures; and
- ***Annex K*** – elevation drawings of the buildings used in the modelling.

The source input data used in modelling dispersion of emissions from two (2) units of generator sets (at 440 KVA each) were based on a 440 kVA Caterpillar genset. ***Annex I*** shows the technical specificatIons of the generator set, as provided by the manufacturer.

Table 35 - Sources input data used in modelling dispersion from point source (or main stack of the grinding facility) (Note: No modification or no upgrade).

Data	*Unit*	*Value*	*Remarks*
X-coordinate	m	277,377.16	Coordinate was extracted by determining the location of the point source (or stack) in the CAD drawing file imported in AERMOD View (please see ***Annex I***)
Y-coordinate	m	1,519,824.36	Same as above (please see ***Annex I***)
Base Elevation	m	4.88	Topographic map provided by the proponent (please see ***Annex K***)
Release Height	m	35.0	Elevation drawings provided by the proponent (please see ***Annex L***)
Emission rate	g/s	0.9719	Emission test report of CRL (2016) (please refer ***Annex G***)

Data	*Unit*	*Value*	*Remarks*
Gas Exit Temperature	ºC	102.2	Emission test report of CRL (2016) (please see ***Annex G***)
Stack inside diameter	m	2.8	Emission test report of CRL (2016) (please see ***Annex G***)
Gas Exit Velocity	m/s	7.16	Emission test report of CRL (2016) please see ***Annex G*)**

Table 36- Source input data used in modelling dispersion from point source (or main stack of the grinding facility) (Note: With proposed upgrade)

Data	*Unit*	*Value*	*Remarks*
X-coordinate	m	277,377.16	Coordinate was extracted by determining the location of the point source (or stack) in the CAD drawing file imported in AERMOD View (please see ***Annex I***)
Y-coordinate	m	1,519,824.36	Same as above (please see ***Annex I***)
Base Elevation	m	4.88	Topographic map provided by the proponent (please see ***Annex K***)
Release Height	m	35.0	Elevation drawings provided by the proponent (please see ***Annex K***)
Emission rate	g/s	1.93	Provided by the proponent (per email in July 2017)
Gas Exit Temperature	ºC	102.2	Same value as in ***Table 35***
Stack inside diameter	m	2.8	Same value as in ***Table 35***
Gas Exit Velocity	m/s	7.16	Same value as in ***Table 35***
Notes: Please refer Table 37 for the source input data of the generator sets			

Table 37 - Source input data used in modelling dispersion from the proposed generator sets

Data	*Unit*	*Proposed Unit 1*	*Proposed Unit 2*	*Remarks*
X-coordinate	m	277369.44	277440.13	Please refer ***Annex I***
Y-coordinate	m	1519573.04	1519618.58	Please refer ***Annex I***

Data	***Unit***	***Proposed Unit 1***	***Proposed Unit 2***	***Remarks***
Base Elevation	m	2	2	Based on topographic map provided by the proponent (***Annex K***)
Release Height	m	5	5	Assumed height of 5 m
Emission rate of PM	g/s	0.1299	0.1299	Computed using U.S.EPA emission factor for small gensets
Gas Exit Temperature	ºC	513.9	513.9	Based on data for a 440 KVA genset (please see ***Annex I***)
Stack inside diameter	m	0.23	0.23	Computed based on gas flow of a 440 KVA genset (***Annex I***)
Gas Exit Velocity	m/s	29.24	29.24	Computed based on gas flow of a 440 KVA genset (***Annex I***)

.

The emission factors used in determining particulate emissions from non-point emission sources/activities, such as materials handling, stockpile erosion and paved roads, are discussed in detail below. ***Annex J*** shows the spreadsheets used in determining the emission rates for non-point sources.

2.3.3.1.4.2.2 Materials Handling

Emissions of particulates (TSP, PM_{10} and $PM_{2.5)}$ (in kg/ton of materials) due to unloading of materials from the barges and/or ship and handling of stockpile were estimated using Section 13.2.4 of AP-42, as follows.

$$\mathbf{E_{Materials\ Handling}} = \mathbf{k\ (0.0016)} \frac{\left(\frac{\mathbf{U}}{\mathbf{2.2}}\right)^{\mathbf{1.3}}}{\left(\frac{\mathbf{M}}{\mathbf{2}}\right)^{\mathbf{1.4}}} \qquad \textbf{Equation 1}$$

where U and M are the mean wind speed (m/s) and the material moisture content (%), respectively. The particle size multiplier, k, is 0.74 for TSP and 0.35 for PM_{10}.
A maximum control efficiency of 90% was assumed in computing the emission rates with mitigation or control measures.

2.3.3.1.4.2.3 Stockpile Wind Erosion

Emission factor used by RWDI (2012) in determining TSP emission rates due to wind erosion at stockpiles was adopted in this study, as follows:

$$E_{stockpile} = 0.0019 \, x \, \frac{s}{1.5} x \, \frac{f}{15} \qquad \textbf{Equation 2}$$

where, *s,* is the silt content (%) and, *f*, is the percentage of time unobstructed wind speed greater than 5.4 m/s. PM_{10} emissions were based on ratio of $TSP/PM_{10} = 0.5$. Hence, PM_{10} is one-half of TSP emissions (in kg/day/m^2).

2.3.3.1.4.2.4 Haul Trucks Travelling along Paved Roads

Emissions of haul trucks passing along paved roads (in g/VKT) were obtained from AP-42 (Chapter 13.2), as follows:

$$E_{pavedRoad} = k \, (sL)^{0.91} (W)^{1.02} \qquad \textbf{Equation 3}$$

where:

K	=	particle size multiplier for particle size range
sL	=	road surface silt loading (g/m^2);
W	=	average weight (tons) of the vehicles travelling the road

The particle size multipliers for TSP and PM_{10} are 3.23 and 0.62, respectively.

The emission factor (**Equation 3**) was adjusted to account for the natural mitigation by rainfall using the formula,

$$E_{pavedRoad(cor)} = k \, (sL)^{0.91} (W)^{1.02} (1 - \frac{P}{4N}) \qquad \textbf{Equation 4}$$

where:

P	=	number of “wet” days with at least 0.254 mm (0.01 in) of rainfall, and
N	=	number of hours in the averaging period

2.3.3.1.4.2.5 Transfer Points

Emission rates of particulates at transfer point were estimated (Crushed Stone Processing and Pulverized Mineral Process) of AP-42 (U.S.EPA 2004). The emission factors (in kg/ton of transferred material) are as follows:

$$E_{TSP} = 0.0015\ kg\ tonne_{transferred} \quad \textbf{Equation 5}$$

$$E_{PM10} = 0.00055\ kg\ tonne_{transferred} \quad \textbf{Equation 6}$$

The control efficiency was set at about 95% using the ratio of controlled and controlled emissions factors at conveyor transfer points in Table 11.19.2-1 of AP-42.

2.3.3.1.4.2.6 Conveyors

Emission factors presented in the EIS for a coal terminal in Portsmouth, Virginia particularly related to estimate emissions arising from operation of conveyors were adopted in this study, as follows:

$$E_{TSP} = 0.33\ x\ (head\ emission\ factor) \quad \textbf{Equation 7}$$

where the head emission factor is the average emission factor of 0.0002175 lb/ton. PM_{10} emission rates were estimated as 36% to those of TSP.

2.3.3.1.4.2.7 Motor Vehicle Emissions (Trucks)

Vehicle exhaust emissions (TSP and PM_{10}) of trucks used to haul raw materials and cement products were estimated using the emission factor published by the National Pollution Inventory (NPI) of the Department of the Environment, Water, Heritage and Arts in Australia (NPI 2008).

The emission factor of PM_{10} for very heavy goods vehicle (HGV) was computed at 1.2 kg/m^3 (Table 22 of NPI, 2008) where the volume (m^3) is the diesel fuel consumption. For TSP, the emission factor was computed at 1.5 kg/m^3 using particle size difference of 30% between TSP and PM_{10}.

Control Inputs and Source Pathways

Table 38 and ***Table 39*** show the source pathways for the source inputs and the building inputs. Due to file size, only Page 1 of the source input pathway presented in AERMOD View is shown below. ***Annex M*** presents the complete list of the source input data.

Annex L shows the control pathway as reported in AERMOD View.

Table 38 - Screenshot of source pathway (source inputs) in AERMOD View (Note: Due to file size, only Page 1 of 8 is shown above, the complete list is presented in Annex M)

Source Pathway - Source Inputs

AERMOD

Point Sources

Source Type	Source ID	X Coordinate [m]	Y Coordinate [m]	Base Elevation (Optional)	Release Height [m]	Emission Rate [g/s]	Gas Exit Temp. [K]	Gas Exit Velocity [m/s]	Stack Inside Diameter [m]
POINT	STCK1	277377.16 01-Stack	1519824.36	4.48	35.00	0.97190	375.35	7.16	2.80

Volume Sources

Source Type	Source ID	X Coordinate [m]	Y Coordinate [m]	Base Elevation (Optional)	Release Height [m]	Emission Rate [g/s]	Length of Side [m]	Building Height [m]	Initial Lateral Dim. [m]	Initial Vertical Dim. [m]
VOLUME	VOL1	277410.47 02a~Materials handling (unloading clinker at pier)	1519559.27	3.00	3.00	0.01228	8.71	Surface-Based	2.03	0.70
VOLUME	VOL2	277462.55 02b~Materials handling (unloading clinker at pier)	1519587.78	3.00	3.00	0.01228	8.71	Surface-Based	2.03	0.70
VOLUME	VOL3	277529.00 03a~Materials handling (unloading slag at pier)	1519636.00	3.00	3.00	0.02986	8.71	Surface-Based	2.03	0.70
VOLUME	VOL4	277554.84 03b~Materials handling (unloading slag at pier)	1519652.70	3.00	3.00	0.02986	8.71	Surface-Based	2.03	0.70
VOLUME	VOL5	277414.01 04~Materials handling (limestone stockpile)	1519897.79	5.00	3.00	0.00716	10.91	Surface-Based	2.54	0.70
VOLUME	VOL6	277413.05 05~Materials handling (gypsum stockpile)	1519877.57	5.00	3.00	0.00274	10.91	Surface-Based	2.54	0.70

Table 39 Screenshot of source pathway (building downwash information) in AERMOD View (Note: complete list of downwash information is presented in Annex M)

Source Pathway

AERM

Building Downwash Information

Source ID: STCK1

Heights [m] (10 to 360 deg)

10-60 deg	40.56	40.56	40.56	40.56	40.56	40.56
70-120 deg	40.56	40.56	42.65	42.65	42.65	42.65
130-180 deg	42.65	40.56	40.56	40.56	40.56	40.56
190-240 deg	40.56	40.56	40.56	40.56	40.56	40.56
250-300 deg	40.56	40.56	42.65	42.65	42.65	42.65
310-360 deg	42.65	40.56	40.56	40.56	40.56	40.56

Widths [m] (10 to 360 deg)

10-60 deg	38.24	38.60	38.60	38.60	38.60	38.60
70-120 deg	38.60	38.60	37.16	36.93	35.57	34.98
130-180 deg	33.94	36.41	37.78	38.31	38.60	37.72
190-240 deg	38.24	38.60	38.60	38.60	38.60	38.60
250-300 deg	38.60	38.60	37.16	36.93	35.57	34.98
310-360 deg	33.94	36.41	37.78	38.31	38.60	37.72

Lengths [m] (10 to 360 deg)

10-60 deg	36.93	35.57	34.98	33.94	36.41	37.78
70-120 deg	38.31	38.60	20.40	19.59	21.98	25.56
130-180 deg	28.97	45.87	44.75	42.58	40.04	37.16
190-240 deg	36.93	35.57	34.98	33.94	36.41	37.78
250-300 deg	38.31	38.60	20.40	19.59	21.98	25.56
310-360 deg	28.97	45.87	44.75	42.58	40.04	37.16

Along Flow [m] (10 to 360 deg)

10-60 deg	2.20	-1.48	-6.04	-10.72	-19.62	-27.92
70-120 deg	-35.38	-41.77	-29.56	-33.10	-37.53	-41.74
130-180 deg	-45.00	-61.25	-59.02	-54.99	-49.30	-42.98
190-240 deg	-39.13	-34.09	-28.94	-23.22	-16.79	-9.86
250-300 deg	-2.93	3.16	9.16	13.51	15.55	16.18
310-360 deg	16.02	15.38	14.27	12.42	9.26	5.82

Across Flow [m] (10 to 360 deg)

10-60 deg	32.63	36.17	38.15	38.82	38.32	36.64
70-120 deg	33.70	29.28	24.40	20.67	16.31	11.45
130-180 deg	6.25	-1.41	-9.03	-16.23	-22.46	-28.02
190-240 deg	-32.63	-36.17	-38.15	-38.82	-38.32	-36.64
250-300 deg	-33.70	-29.28	-24.40	-20.67	-16.31	-11.45
310-360 deg	-6.25	1.41	9.03	16.23	22.46	28.02

2.3.3.1.4.3 Receptor Pathway

The modelling domain in this study was set at 5 km x 5 km with the grid center located within the project site (***Figure 85***). The two- and three-dimensional views of the topography within the modelling domain are shown in ***Figure 86*** and ***Figure 87***, respectively. These were derived from SRTM data, which can be automatically downloaded in AERMAP View. As shown in the topographic maps (***Figure 86*** and ***Figure 87***), terrain within the project site and vicinities is gently to moderately sloping, though a hill or complex terrain is located northeast of the project site. Within the modelling domain are three (3) sets of receptors used in this study, as follows:

1) Discrete Cartesian receptors – total of 17 (please refer ***Table 40***);
2) Plant boundary receptors – assigned along the boundaries of the project site (please refer ***Table 41***; and
3) Muti-tier grid (risk receptors) –minimum of 100 m grid spacing within 3 km from the grid center (within the project site) and 200 m grid spacing from 3 to 5 km from the grid center (please refer ***Table 42***).

Annex N shows the list of receptor pathways generated in this study.

Table 40 - Screenshot of discrete Cartesian receptors

Receptor Pathway

AERM

Receptor Networks

Note: Terrain Elevations and Flagpole Heights for Network Grids are in Page RE2 - 1 (if applicable)
Generated Discrete Receptors for Multi-Tier (Risk) Grid and Receptor Locations for Fenceline Grid are in Page RE3 - 1 (if applicable)

Discrete Receptors

Discrete Cartesian Receptors

Record Number	X-Coordinate [m]	Y-Coordinate [m]	Group Name (Optional)	Terrain Elevations	Flagpole Heights [(Optional)
1	277277.94	1519644.18		3.12	
2	277221.26	1519724.06		8.05	
3	277187.60	1519805.59		11.71	
4	277224.63	1519619.00		6.89	
5	277163.91	1519721.18		9.50	
6	277092.83	1519878.16		12.31	
7	277095.79	1519835.21		13.30	
8	277039.52	1519885.56		13.50	
9	277030.63	1519981.82		20.58	
10	277112.08	1519956.64		20.75	
11	277172.73	1519946.42		20.70	
12	277240.07	1520006.97		29.76	
13	277255.96	1520114.86		43.23	
14	277162.70	1520067.94		35.55	
15	277115.69	1519768.87		11.99	
16	277420.77	1520030.99		47.84	
17	277512.59	1519795.52		16.45	

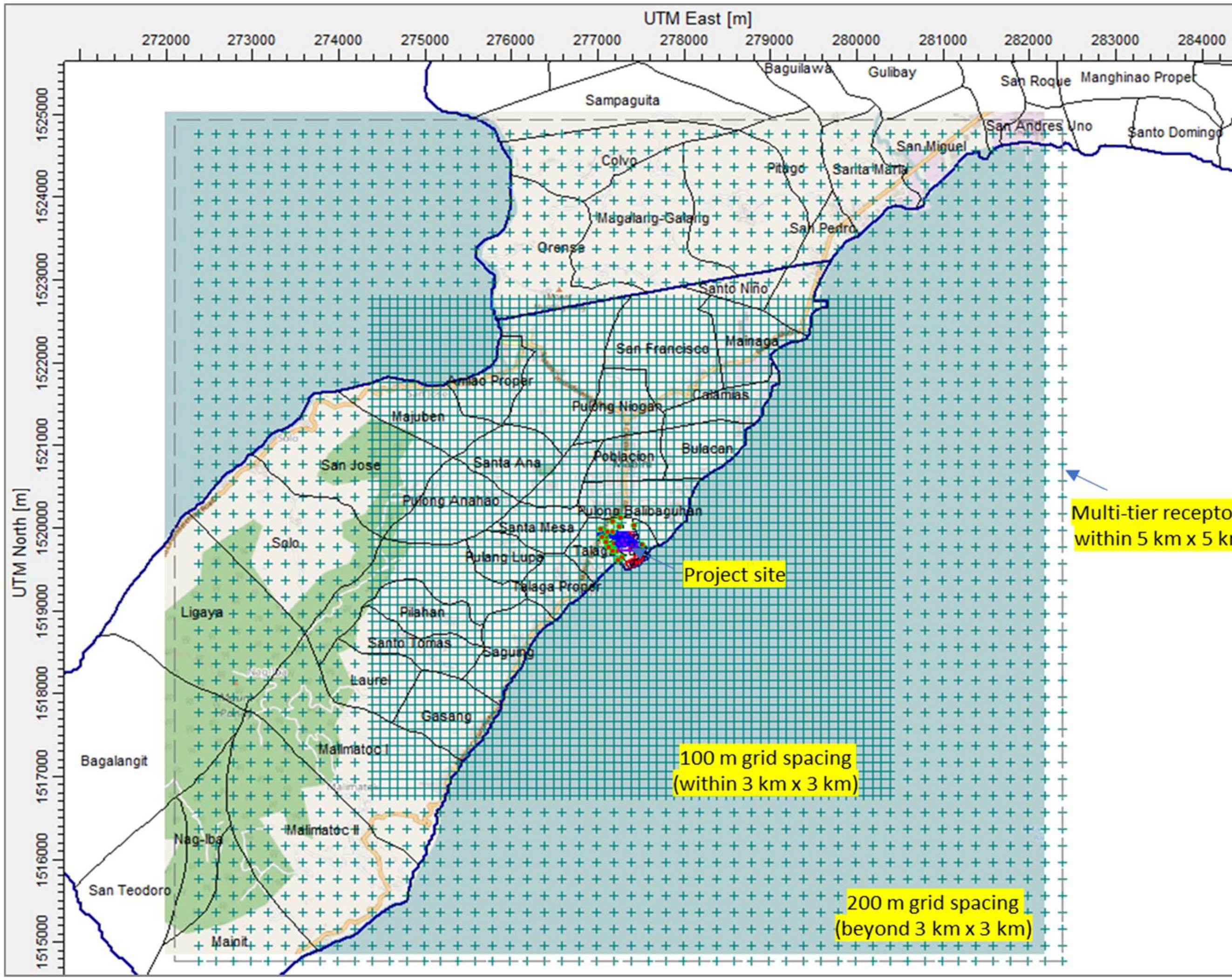


Figure 85 Modelling domain and receptors

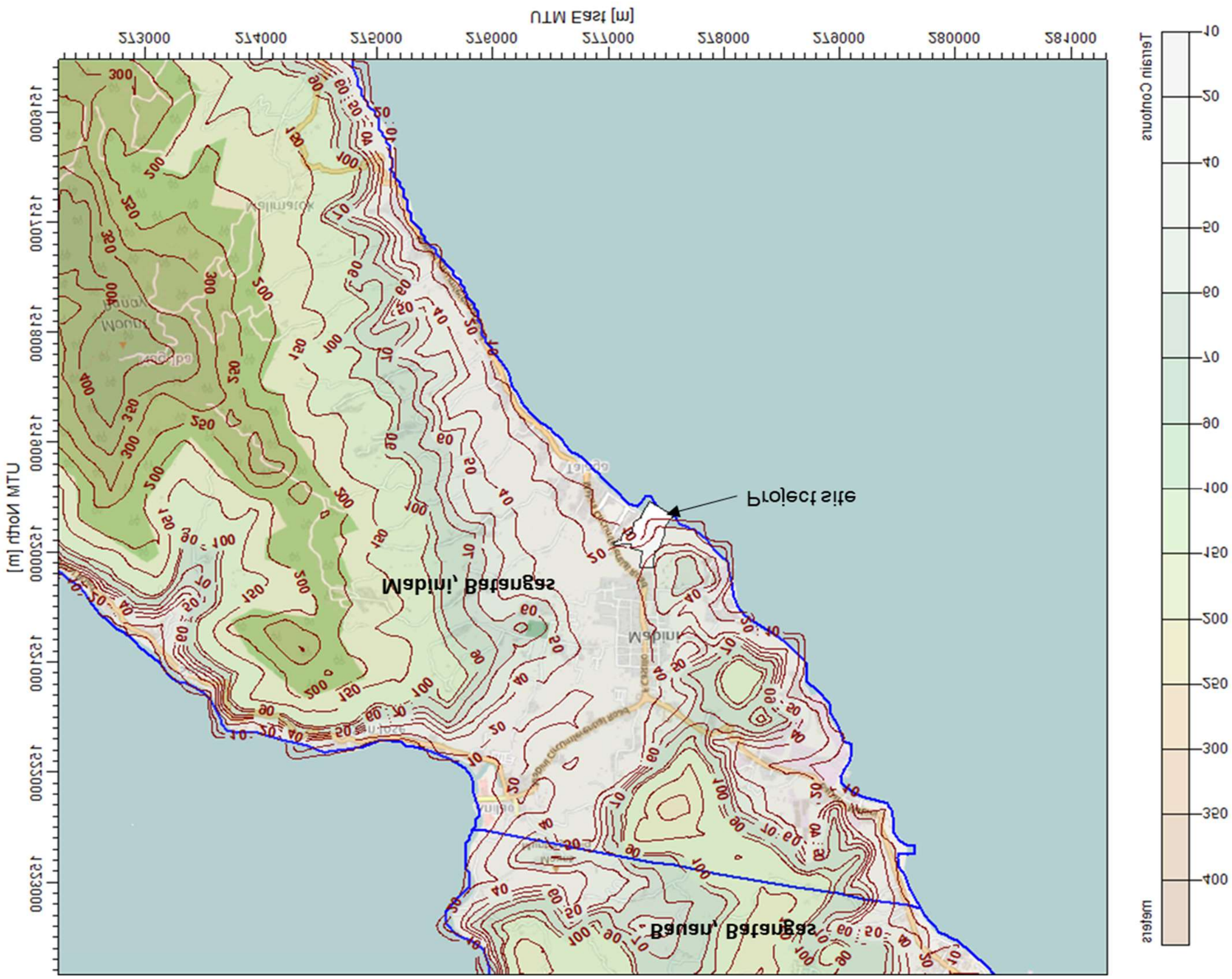


Figure 86 - Topography (two-dimensional) within and in the vicinities of the modelling domain

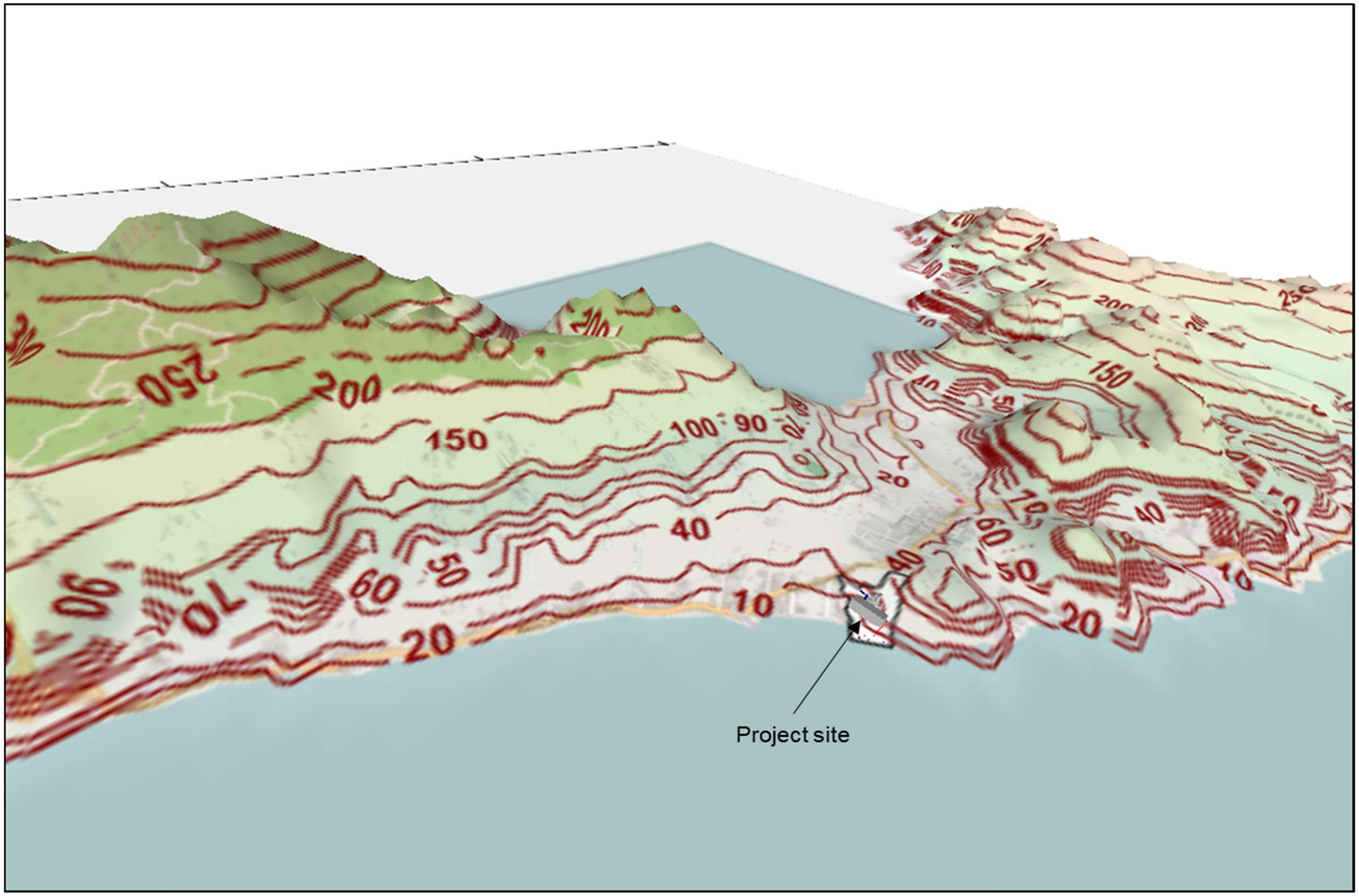


Figure 87 - Three-dimensional view of the topography of the project area and vicinities

Table 41 - Screenshot of Cartesian plant boundary receptors

Receptor Pathway

AERM

Cartesian Plant Boundary

Primary

Record Number	X-Coordinate [m]	Y-Coordinate [m]	Group Name (Optional)	Terrain Elevations	Flagpole Heights (Optional)
1	277562.33	1519668.29	FENCEPRI	0.92	
2	277512.09	1519748.37	FENCEPRI	5.51	
3	277489.71	1519773.73	FENCEPRI	10.56	
4	277482.74	1519844.86	FENCEPRI	27.89	
5	277435.99	1519981.64	FENCEPRI	45.63	
6	277405.15	1519987.11	FENCEPRI	41.82	
7	277402.66	1520030.39	FENCEPRI	45.55	
8	277395.20	1520080.13	FENCEPRI	49.19	
9	277386.75	1520145.78	FENCEPRI	51.11	
10	277275.83	1520137.32	FENCEPRI	45.83	
11	277282.79	1520072.17	FENCEPRI	40.81	
12	277290.75	1519995.07	FENCEPRI	30.07	
13	277252.45	1519980.65	FENCEPRI	25.61	
14	277193.76	1519972.19	FENCEPRI	23.55	
15	277200.23	1519928.42	FENCEPRI	13.68	
16	277160.93	1519926.43	FENCEPRI	15.89	
17	277052.50	1519937.87	FENCEPRI	18.16	
18	277044.55	1519916.98	FENCEPRI	16.52	
19	277060.96	1519913.50	FENCEPRI	15.98	
20	277061.46	1519901.56	FENCEPRI	14.77	
21	277082.35	1519904.55	FENCEPRI	14.34	
22	277086.82	1519889.13	FENCEPRI	12.55	
23	277108.21	1519892.11	FENCEPRI	11.40	
24	277126.61	1519830.44	FENCEPRI	12.44	
25	277189.28	1519836.90	FENCEPRI	13.00	
26	277190.78	1519818.50	FENCEPRI	12.35	
27	277207.19	1519819.49	FENCEPRI	11.82	
28	277219.13	1519730.96	FENCEPRI	8.42	
29	277271.85	1519689.68	FENCEPRI	4.13	
30	277283.79	1519695.15	FENCEPRI	4.40	
31	277285.28	1519676.74	FENCEPRI	3.89	
32	277292.74	1519646.40	FENCEPRI	2.95	
33	277358.89	1519541.46	FENCEPRI	3.84	

Table 42 - Screenshot of multi-tier grid receptors

Receptor Pathway

AERM

Multi-Tier Grid (Risk)

Grid Settings

Grid Origin:	277379.95	1519764.46
Number of Tiered Segments:	2	

Segment Number	Distance from Center (Origin) [m]	Spacing [m]
1	3000.00	100.00
2	5000.00	200.00

2.3.3.1.4.4 *<u>Meteorological Pathway</u>*

Meteorological input data (surface and upper air) used in this study covered the period January 1, 2014 to December 31, 2016. These represent three (3) years of sequential hourly prognostic meteorological surface and upper air data, which were purchased from Lakes Environmental Consultants, Inc. (Lakes Environmental). ***Annex - O*** shows the meteorological data information, particularly on the transactions made on the purchased of the said meteorological data and the spreadsheets of the meteorological input data. Due to file size, only portions of the meteorological are shown ***Annex - O*.**

AERMET View, a meteorological processor of AERMOD View, was used to generate the surface (*.sfc) and upper air (*.pfl) data. ***Table 44*** and ***Table 45*** show the foreshortened screenshots of the surface and profile data files, respectively.

Table 43 - Screenshot of meteorology pathway (meteorological data information)

Meteorology Pathway

AERM

Met Input Data

Surface Met Data

Filename: D:\PROJ\2017\8P2017-010-AXC_HOLC\06-Met Data\HOLCIM.SFC

Format Type: Default AERMET format

Profile Met Data

Filename: D:\PROJ\2017\8P2017-010-AXC_HOLC\06-Met Data\HOLCIM.PFL

Format Type: Default AERMET format

Wind Speed

Wind Speeds are Vector Mean (Not Scalar Means)

Wind Direction

Rotation Adjustment [deg]:

Potential Temperature Profile

Base Elevation above MSL (for Primary Met Tower): 6.00 [m]

Meteorological Station Data

Stations	Station No.	Year	X Coordinate [m]	Y Coordinate [m]	Station Name
Surface		2014			
Upper Air		2014			

Data Period

Data Period to Process

Start Date: 1/1/2014 Start Hour: 1 End Date: 12/31/2016 End Hour: 24

Table 44 - Screenshot of the surface data file used in the dispersion modelling

Met View [Pre-Processed Surface Met Data File]

File Header Data

Surface File Name: HOLCIM.SFC

Station Latitude: 13.683N | Upper Air Station ID: 00066666 | Onsite Station ID: N/A

Station Longitude: 120.883E | Surface Station ID: 66666 | Version: 16216 CCVR_SUB TEMP_SUB

Filter

Year: All | Month: All | Day: All | Julian Day: All | Show A

Data Quality

Calms: 152 [hours] 0.58 [%] | Missing: 10 [hours] 0.04 [%]

Table | Graph

Jan 1, 2014 to Dec 31, 2016

	Year	Month	Day	Julian Day	Hour	Sensible Heat Flux [W/m^2])	Surface Friction Velocity [m/s]	Convective Velocity Scale [m/s]	Vertical Potential Temperature Gradient above PBL	Height of Convectively-Generated Boundary Layer - PBL [m]	Height of Mechanically-Generated Boundary Layer - SBL [m]	Monin-Obukhov Length [m]	Surface Roughness Length [m]	Bowen Ratio	Albedo
Min.	2014	Jan	1	1	1	-999.0	-9.000	-9.000	-9.000	-999.0	-999.0	-99999.0	0.000	0.45	0.14
Max.	2016	Dec	31	366	24	347.6	3.045	2.689	0.015	2490.0	4000.0	8888.0	1.000	1.50	1.00
Graph															
1	2014	Jan	1	1	1	-12.4	0.155	-9.000	-9.000	-999.0	147.0	27.1	0.000	0.45	1.00
2	2014	Jan	1	1	2	-12.4	0.155	-9.000	-9.000	-999.0	147.0	27.1	0.000	0.45	1.00
3	2014	Jan	1	1	3	-13.0	0.180	-9.000	-9.000	-999.0	183.0	40.5	0.000	0.45	1.00
4	2014	Jan	1	1	4	-15.7	0.196	-9.000	-9.000	-999.0	209.0	43.4	0.000	0.45	1.00
5	2014	Jan	1	1	5	-16.8	0.193	-9.000	-9.000	-999.0	204.0	38.7	0.000	0.45	1.00
6	2014	Jan	1	1	6	-17.7	0.191	-9.000	-9.000	-999.0	200.0	35.4	0.000	0.45	1.00
7	2014	Jan	1	1	7	-16.2	0.195	-9.000	-9.000	-999.0	207.0	41.4	0.000	0.45	0.66
8	2014	Jan	1	1	8	25.2	0.221	-9.000	-9.000	-999.0	249.0	-38.5	0.000	0.45	0.28
9	2014	Jan	1	1	9	69.8	0.213	-9.000	-9.000	-999.0	236.0	-12.5	0.000	0.45	0.18
10	2014	Jan	1	1	10	105.8	0.181	-9.000	-9.000	-999.0	185.0	-5.0	0.000	0.45	0.15
11	2014	Jan	1	1	11	130.5	0.166	-9.000	-9.000	-999.0	162.0	-3.1	0.000	0.45	0.15
12	2014	Jan	1	1	12	142.9	0.167	-9.000	-9.000	-999.0	163.0	-2.9	0.000	0.45	0.14
13	2014	Jan	1	1	13	142.8	0.184	-9.000	-9.000	-999.0	189.0	-3.9	0.000	0.45	0.14
14	2014	Jan	1	1	14	130.4	0.199	-9.000	-9.000	-999.0	214.0	-5.5	0.000	0.45	0.15
15	2014	Jan	1	1	15	106.0	0.197	-9.000	-9.000	-999.0	210.0	-6.5	0.000	0.45	0.15

Wind Speed - Ws [m/s]	Wind Direction - Wd [degrees]	Reference Height for Ws and Wd [m]	Temperature - temp [K]	Reference Height for temp [m]	Precipitation Code	Precipitation Rate [mm/hr]	Relative Humidity [%]	Surface Pressure [mb]	Cloud Cover [tenths]
0.00	0.0	15.0	296.2	2.0	0	0.00	49.0	997.0	2
20.60	360.0	15.0	304.9	2.0	0	24.89	100.0	1014.0	10
5.70	71.0	15.0	299.8	2.0	0	0.00	80.0	1009.0	7
5.70	68.0	15.0	299.8	2.0	0	0.00	80.0	1009.0	7
6.20	74.0	15.0	299.8	2.0	0	0.25	80.0	1009.0	8
6.70	63.0	15.0	299.8	2.0	0	0.25	80.0	1009.0	7
6.70	63.0	15.0	299.8	2.0	0	0.51	80.0	1010.0	6
6.70	62.0	15.0	299.8	2.0	0	0.51	80.0	1010.0	5
6.70	65.0	15.0	299.8	2.0	0	0.76	80.0	1010.0	6
6.20	73.0	15.0	299.4	2.0	0	0.00	83.0	1010.0	5
5.70	67.0	15.0	299.8	2.0	0	0.00	80.0	1010.0	4
4.60	81.0	15.0	300.2	2.0	0	0.00	77.0	1010.0	4
4.10	114.0	15.0	300.6	2.0	0	0.00	75.0	1009.0	4
4.10	126.0	15.0	300.8	2.0	0	0.00	75.0	1009.0	4
4.60	133.0	15.0	300.8	2.0	0	0.00	75.0	1009.0	4
5.10	129.0	15.0	300.8	2.0	0	0.00	75.0	1008.0	4
5.10	132.0	15.0	300.9	2.0	0	0.00	75.0	1008.0	4

Table 45 - Screenshot of the profile data file used in the dispersion modelling

Met View [Profile Met Data File]

Profile File Name: HOLCIM.PFL

Filter

Year: All Month: All Day: All

Table Graph

Jan 1, 2014 to Dec 31, 2016

	Year	Month	Day	Hour	Measurement Height [m]	1, if this is the last (highest) level for this hour, or 0 otherwise	Direction the wind is blowing from for the current level [degrees]	Wind Speed for the current level [m/s]	Temperature at the current level [C]	Standard deviation of the wind direction fluctuations [degrees]	Standard deviation of the vertical wind speed fluctuations [m/s]
Min.	2014	Jan	1	1	15.0	1	0.0	0.00	23.1	99.0	99.00
Max.	2016	Dec	31	24	15.0	1	360.0	20.60	31.8	99.0	99.00
Graph					☐	☐	☐	☐	☑	☐	☐
1	2014	Jan	1	1	15.0	1	71.0	5.70	26.6	99.0	99.00
2	2014	Jan	1	2	15.0	1	68.0	5.70	26.6	99.0	99.00
3	2014	Jan	1	3	15.0	1	74.0	6.20	26.6	99.0	99.00
4	2014	Jan	1	4	15.0	1	63.0	6.70	26.6	99.0	99.00
5	2014	Jan	1	5	15.0	1	63.0	6.70	26.6	99.0	99.00
6	2014	Jan	1	6	15.0	1	62.0	6.70	26.6	99.0	99.00
7	2014	Jan	1	7	15.0	1	65.0	6.70	26.6	99.0	99.00
8	2014	Jan	1	8	15.0	1	73.0	6.20	26.2	99.0	99.00
9	2014	Jan	1	9	15.0	1	67.0	5.70	26.6	99.0	99.00
10	2014	Jan	1	10	15.0	1	81.0	4.60	27.1	99.0	99.00
11	2014	Jan	1	11	15.0	1	114.0	4.10	27.5	99.0	99.00
12	2014	Jan	1	12	15.0	1	126.0	4.10	27.6	99.0	99.00
13	2014	Jan	1	13	15.0	1	133.0	4.60	27.6	99.0	99.00
14	2014	Jan	1	14	15.0	1	129.0	5.10	27.6	99.0	99.00
15	2014	Jan	1	15	15.0	1	132.0	5.10	27.8	99.0	99.00
16	2014	Jan	1	16	15.0	1	134.0	5.70	27.8	99.0	99.00
17	2014	Jan	1	17	15.0	1	131.0	5.70	27.6	99.0	99.00
18	2014	Jan	1	18	15.0	1	117.0	5.70	27.5	99.0	99.00

2.3.3.1.4.5 Dispersion Option and Modelling Scenarios

The regulatory "Default" option in AERMOD was selected in the simulations. The regulatory options, included among others, simulations using the following inputs and dispersion process.

- Elevated terrain and hill heights;
- Stack-tip downwash effect for point sources;
- Plume dispersion caused by ambient turbulence; and
- Option to use missing data.

Table 46 presents the modelling scenarios considered in the study. Modelling was generally subdivided into two (2) main components, namely: without project upgrade and with project upgrade or project modification. Dispersions of TSP and PM_{10} were modelled for each component (with and without project upgrade).

For $PM_{2.5}$, the predicted concentrations were estimated by multiplying applicable ratios or factors of $PM_{2.5}$ to those of PM_{10} and TSP.

In addition, modelling also included simulations of predicted ambient SO_2 and NO_2 with the project upgrade due to addition of two (2) units of generator sets with capacity of 440 KVA each.

Table 46 - Modelling scenarios

Simulation No.	***Pollutant***	***Scenario***
		Without project upgrade
1	TSP	Without project upgrade and unmitigated fugitive emissions
2	TSP	Without project upgrade and mitigated fugitive emissions
3	PM_{10}	Without project upgrade and unmitigated fugitive emissions
4	PM_{10}	Without project upgrade and mitigated fugitive emissions
		With project upgrade
5	TSP	With project upgrade and unmitigated fugitive emissions
6	TSP	With project upgrade and mitigated fugitive emissions
7	PM_{10}	With project upgrade and unmitigated fugitive emissions
8	PM_{10}	With project upgrade and mitigated fugitive emissions

Simulation No.	Pollutant	Scenario
9	SO_2	With project upgrade
10	NO_2	With project upgrade
Note: $PM_{2.5}$ – estimated using applicable ratios and factors with PM_{10} and TSP		

2.3.3.2 Environmental Performance/Existing condition

As discussed in Environmental Performance/Existing Condition Methodology, the environmental performances of the project in terms of compliance with applicable air quality standards were assessed using the following available data:

a) Results of ambient monitoring of TSP, PM_{10}, SO_2 and NO_2, as reported in the SMR from 2014 to 2016; and
b) Results of ambient air monitoring of TSP, PM_{10}, $PM_{2.5}$, SO_2, and NO_2 and metals in ambient air by CRL (2017).

In addition, issues and concerns related to air quality during Focus Group Discussion (FGD) in Barangay Talaga East and Brgy. Balibaguhan are also discussed in this section.
The following presents the results and plots of measured ambient air concentrations including issues and concerns on air quality.

2.3.3.2.1 Results of Air Monitoring as Reported in the SMR/CMR

Table 47 presents the measured one-hour average concentrations of TSP, PM_{10}, SO_2 and NO_2 as reported in the SMR from 1st quarter of 2014 to 4th quarter of 2016. The plots of the measured TSP and PM_{10} concentrations are shown in ***Figure 88*** and ***Figure 89***, respectively. Note that SO_2 and NO_2 concentrations are not shown in figures as the measured concentrations were generally not detected (or ND).

Measured TSP concentrations ranged from 6.6 to 285. 1 µg/Nm^3 with an average concentration of 142 µg/Nm^3 while those of PM_{10} from 10.5 to 164 µg/Nm^3 with an average of 58.1 µg/Nm^3. These concentrations were within the NAAQS set for TSP and PM_{10} of 300 and 200 µg/Nm^3, respectively.

SO_2 levels based on total of 37 measurements or sampling were not-detected, except in one (1) monitoring wherein the measured SO_2 was 22.21 µg/Nm^3 in the community area in Brgy. Talaga East in Mabini, Batangas. The significant air emissions of the project are those related to fugitive emissions (i.e., vehicle transport and materials handling). SO_2 emissions at the baghouse stack of the project were generally lower (not detected) as reflected in the SMR. Measured NO_2 concentrations were also generally not-detected, although about 7 of the 35 reported concentrations ranged from 0.58 to 26.7 µg/Nm^3

In all, the measured one-hour average concentrations of TSP, PM_{10}, SO_2 and NO_2 as reflected in the SMR were all within the NAAQS for the foregoing pollutants.

Table 47 - Measured TSP, PM_{10}, SO_2 and NO_2 concentrations (in µg/Nm^3) for the project (Data Source: SMR 204 to 2016)

Parameter	Location	2014				2015				2016				Min	Max	Average/Value of Single Observation
		1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q			
TSP														**6.6**	**285.1**	**142.0**
	Guesthouse		157.39	36.38		116.8	96.75	107.1	31.55	92.72	237.7	18.3	6.6	6.6	237.7	90.1
	Main gate/Holcim		160.77	46.43		226.2		108.7	41.36	17.55	244.10	104.5	11.80	11.8	244.1	106.8
	Community area-Brgy. Talaga East						106.3	75.14	51.23	127.9	281.2	41.6		41.6	281.2	113.9
	Community area-Outside main gate										285.1			285.1	285.1	285.1
	Community area - Brgy Talaga East (P.Balibaguhan Boundary)						85.84	55.39	8.61	84.68				8.6	85.8	58.6
	Community phase				126.05						285.1			126.1	285.1	205.6
	Vacant lot near entrance gate		154.00													154.0
	A. Sandoval Memorial National High School		137.96													138.0
	Talaga Elementary School		110.45													110.5
	Sitio Silangan Montessori, Brgy. Chapel	157.55														157.6
PM_{10}														10.5	164.0	58.1
	Guesthouse					88.32			51.33	18.08		30.6		18.1	88.3	47.1
	Main gate/Holcim					62.66			66.37	10.5		30.6		10.5	66.4	42.5
	Community area-Brgy. Talaga East								164	19.55		12.9		12.9	164.0	65.5
	Community area-Outside main gate															
	Community area - Brgy Talaga East (P.Balibaguhan Boundary)								12.83	82.73				12.8	82.7	47.8
	Community phase															
	Vacant lot near entrance gate	61.73														61.7
	A. Sandoval Memorial National High School	100.13														100.1
	Talaga Elementary School	79.95														80.0
	Sitio Silangan Montessori, Brgy. Chapel	20.21														20.2
SO_2																
	Guesthouse		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND			ND
	Main gate/Holcim		ND	ND	ND	ND		ND	ND	ND	ND	ND	ND			ND
	Community area-Brgy. Talaga East						ND	ND	ND	ND	ND	22.2		ND	22.2	ND to 22.2
	Community area-Outside main gate										ND					ND
	Community area - Brgy Talaga East (P.Balibaguhan Boundary)						ND	ND	ND	ND				ND	ND	ND
	Community phase		ND								ND			ND	ND	ND

Parameter	Location	2014				2015				2016				Min	Max	Average/Value of Single Observation
		1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q			
	Vacant lot near entrance gate	ND														ND
	A. Sandoval Memorial National High School	ND														ND
	Talaga Elementary School	ND														ND
	Sitio Silangan Montessori, Brgy. Chapel	ND														ND
NO_2																
	Guesthouse			ND	ND	ND	ND	ND	ND	ND	ND	ND	16.7	ND	16.17	ND to 16.7
	Main gate/Holcim			ND	ND	ND	ND	ND	ND	ND		ND	26.7	ND	26.7	ND to 26.7
	Community area-Brgy. Talaga East						ND	ND	28.23	ND	ND	ND		ND	28.3	ND to 28.23
	Community area-Outside main gate										ND					ND
	Community area - Brgy Talaga East (P.Balibaguhan Boundary)						ND	ND	ND	ND				ND	ND	ND
	Community phase		ND													ND
	Vacant lot near entrance gate		7.5													7.5
	A. Sandoval Memorial National High School	9.3														9.3
	Talaga Elementary School	7.3														7.3
	Sitio Silangan Montessori, Brgy. Chapel	0.58														0.58

*ND – not detected

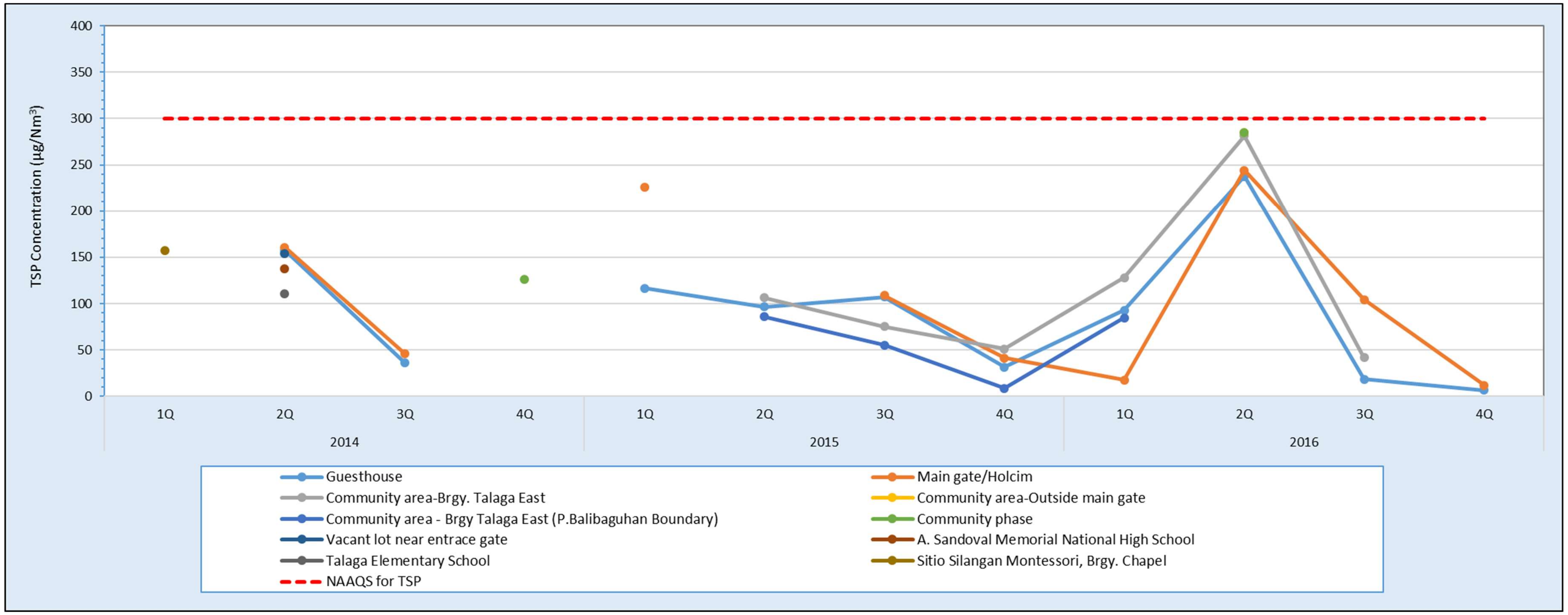


Figure 88 - Plot of measured TSP concentrations (as reported in the SMR/CMR)

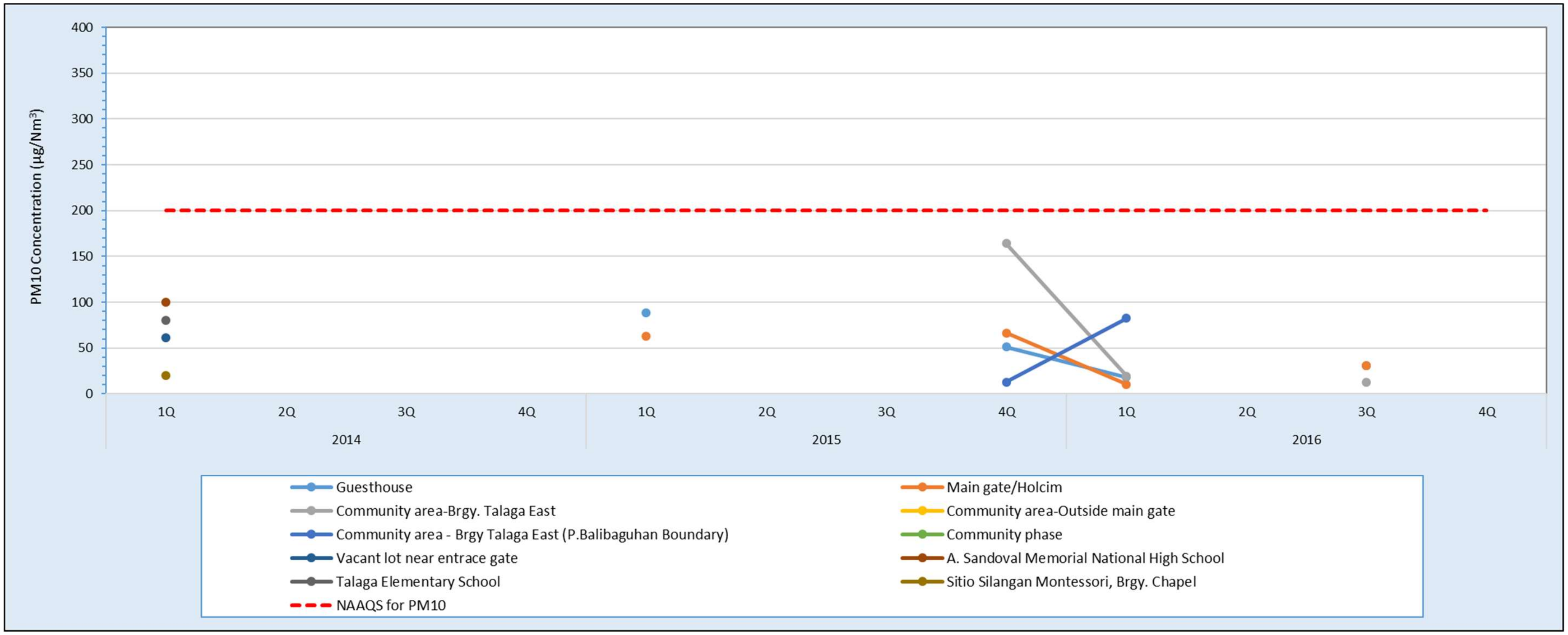


Figure 89 - Plot of measured PM_{10} concentrations (as reported in the SMR/CMR)

2.3.3.2.2 Results of Air Monitoring by CRL in 2017

Table 49 and **Table 50** show the results of the ambient air monitoring conducted by CRL in April 2017. As discussed in Environmental Performance/Existing Condition Methodology, monitoring by CRL involved sampling of TSP, PM_{10}, $PM_{2.5}$, NO_2, SO_2, and metals in ambient air (Sd, As, Cd, Cr, Cu, Pb, Hg, Ni, and Zn). For TSP, PM_{10}, NO_2, and SO_2, sampling was conducted in 24 hours and 1 hour to obtain samples comparable with the ambient guideline values and standards.

Monitoring results show that particulate pollutants (TSP and PM_{10}) were relatively lower as compared to the ambient guideline values and standards (

Table 49 and **Table 50**). The highest measured 24-hour average concentrations of TSP and PM_{10} were 39.4 and 30.7 µg/Nm^3, which were about 7 and 5 times lower than ambient guideline values of 230 and 150 µg/Nm^3, respectively.

For the 1-hour average TSP and PM_{10} concentrations, highest measured concentrations were 36.8 and 103.4 µg/Nm^3, in which the highest was observed at the parking area of the project site Relatively higher measured PM_{10} concentration was likely due to fugitive emissions arising from vehicular traffic. Result of 1-hour sampling for PM_{10}, was higher than TSP, though the mass diameter of the latter is greater than PM_{10}.

Results in ***Table 47*** indicates that the air quality in the area at the time of sampling (April 18 to 26, 2017) was in good condition in terms of the measured TSP, PM_{10}, and SO_2 concentrations.

Table 48 - Equivalent air quality indices of the measured air quality pollutants

Pollutant	***Concentration (µg/Nm^3)***	***Equivalent Air Quality Indices***	***Air Quality Indices***
TSP	28 to 39.4	Good condition	Good (0 to 80 µg/m^3)
PM_{10}	21.7 to 25.5	Good condition	Good (0 to 54 µg/m^3)
SO_2	Not detected	Good condition	0 to 0.034 ppm

Ambient metals in air indicated undetected levels of Sb, As, Cd, Cr, Pb, and Ni and traces of Cu, Hg, and Zn. There is no local ambient standard or guideline value for Cu, Hg, and Zn.

Table 49 - Measured 24-hour average ambient air concentrations (in μg/Nm³) from April 18 to April 26, 2017

Station No.	*Location*	*Date and Time of Sampling*	*TSP*	*PM_{10}*	*$PM_{2.5}$*	*NO_2*	*SO_2*
A1	Guest house of Holcim	April 18-19, 2017/ 1340H-1340H	32.4	22.2	16.5	4.3	ND
A2	Brgy. Pungo Talaga	April 19-20, 2017/ 1650H-1650H	32.6	25.5	5.1	2.3	ND
A3	Pulong Balibaguhan	April 20-21, 2017/ 1900H-1900H	28.0	21.7	7.2	3.2	ND
A4	Parking area	April 25-26,2017/ 1315H-1315H	39.4	30.7	13.2	9.1	ND
NAAQV		**24-hr average**	**230**	**150**	**50**	**150**	**180**

Table 50 - Measured 1-hour average ambient air concentrations (in μg/Nm³) from April 18 to April 26, 2017

Station No.	**Location**	**Date and Time of Sampling**	**TSP**	**PM_{10}**	**NO_2**	**SO_2**
A1	Guest house of Holcim	April 19, 2017/ 1345H-1445H	36.8	20.6	ND	ND
A2	Brgy. Pungo Talaga	April 20, 2017/ 1655H-1755H	8.7	41.7	ND	ND
A3	Pulong Balibaguhan	April 21, 2017/ 1905H-2005H	10.9	51.3	ND	ND
A4	Parking area	April 26, 2017/ 1330H-1430H	5.6	103.4	ND	ND
NAAQS		**1-hr average**	**300**	**200**	**260**	**340**

Table 51 - Measured 30-minute average ambient air concentrations (in μg/Nm³) from April 18 to April 26, 2017

Station No.	***Location***	***Date and Time of Sampling***	***Sb***	***As***	***Cd***	***Cr***	***Cu***	***Pb***	***Hg***	***Ni***	***Zn***
A1	Guest house of Holcim	April 19, 2017/ 1448H-1518H	ND	ND	ND	ND	0.552	ND	0.004	ND	0.229
A2	Brgy. Pungo Talaga	April 20, 2017/ 1800H-1830H	ND	ND	ND	ND	0.301	ND	0.006	ND	0.164
A3	Pulong Balibaguhan	April 21, 2017/ 2010H-2040H	ND	ND	ND	ND	ND	ND	0.005	ND	0.248
A4	Parking area	April 26, 2017/ 1435H-1505H	ND	ND	ND	ND	0.239	ND	0.006	ND	0.430
NAAQS		**30-min average**	**20**	**20**	**10**	**N/A**	**N/A**	**20**	**N/A**	**N/A**	**N/A**

Notes:

1) ND – not detected or below the method detection/reporting limit for Sb=0.10 µg, As =1.0 µg, Cd = 0.60 µg, Cr = 2.0 µg, Cu = 1.0 µg, Pb = 5.0 µg, and Ni = 3.0 µg
2) N/A – no applicable DENR standard

2.3.3.3 Key Impact Assessment

2.3.3.3.1 Estimated Emissions Rates

Table 52 and ***Table 53*** show the estimated total emission rates (in g/s) of TSP and PM_{10} per type for non-point sources, respectively, with and without the proposed project upgrade or modification.

The highest estimated emission rates of TSP (controlled and uncontrolled) were due to emissions arising from transport of haul trucks within the project site (main gate to the packing house and vice versa and main gate to the stockpiles and vice versa). PM_{10} emissions were also expected higher due to vehicular traffic.

There is significant increase in fugitive emissions with the proposed project upgrade. This is due to increase on the volume of trucks needed to haul the finished product at the packing building and on transporting materials to the stockpile or storage area when source locally.
Substantial increase on the volume of materials to be used for the proposed project upgrade attributed to increase of fugitive dust emissions, particularly on materials handling or hauling of materials from barges or ships to the conveyor system.

There is also expected increase of PM emissions in the stack of the grinding facility, as depicted in **Table 35** and **Table 36**. Note that about 80% of the generated hot gases are recirculated in the process (or 20% are dispersed to the atmosphere), as these are utilized in the grinding process.

Table 52 - Estimated emission rates of TSP for non-point sources (area and volume sources)

No.	Type of Activity	Location/Specifics	No. of Assumed Sources	Total Emissions (uncontrolled (g/s)	Control Efficiency (%)	Total Emissions (controlled) (g/s)
Without Project Upgrade/No Modification						
1	Materials handling	• Unloading of limestone at pier • Unloading of slag at pier • Handling of limestone stockpile • Handling of gypsum stockpile	6	0.094173	90	0.009417
2	Wind erosion at stockpiles	• Limestone stockpile • Gypsum stockpile	2	0.020783	90	0.002078
3	Paved road	• Main gate to packhouse to main gate • Main gate to limestone stockpile • Main gate to gypsum stockpile	41 (line volumes sources)	2.059483	75	0.514871
4	Transfer points	• Transfer point 1 • Transfer point 2 • Transfer point 3 • Transfer point 4	4	0.273611	95	0.012769
5	Conveyor	• Conveyor 1 • Conveyor 2 • Conveyor 3 • Conveyor 4	4	0.007362	90	0.000736
6	Motor vehicle emissions	• Main gate to packhouse to main gate	41 (line volume sources)	0.000469	90	0.000047

No.	***Type of Activity***	***Location/Specifics***	***No. of Assumed Sources***	***Total Emissions (uncontrolled (g/s)***	***Control Efficiency (%)***	***Total Emissions (controlled) (g/s)***
		• Main gate to limestone stockpile • Main gate to gypsum stockpile				
With Project Upgrade/Modification						
1	Materials handling	• Unloading of limestone at pier • Unloading of slag at pier • Handling of limestone stockpile • Handling of gypsum stockpile	6	0.282120	90	0.028212
2	Wind erosion at stockpiles	• Limestone stockpile • Gypsum stockpile	2	0.029341	90	0.002934
3	Paved road	• Main gate to packhouse to main gate • Main gate to limestone stockpile • Main gate to gypsum stockpile	41 (line volume sources)	2.745977	75	0.686494
4	Transfer points	• Transfer point 1 • Transfer point 2 • Transfer point 3 • Transfer point 4	4	0.669066	95	0.031223
5	Conveyor	• Conveyor 1 • Conveyor 2 • Conveyor 3 • Conveyor 4	4	0.018001	90	0.001800

No.	Type of Activity	Location/Specifics	No. of Assumed Sources	Total Emissions (uncontrolled (g/s)	Control Efficiency (%)	Total Emissions (controlled) (g/s)
6	Motor vehicle emissions	• Main gate to packhouse to main gate • Main gate to limestone stockpile • Main gate to gypsum stockpile	41 (line volume sources)	0.000625	90	0.000063

Table 53. Estimated emission rates of PM10 for non-point sources (area and volume sources)

No.	Type of Activity	Location/Specifics	No. of Assumed Sources	Total Emissions (uncontrolled (g/s)	Control Efficiency (%)	Total Emissions (controlled (g/s)
Without Project Upgrade/No Modification						
1	Materials handling	• Unloading of limestone at pier • Unloading of slag at pier • Handling of limestone stockpile • Handling of gypsum stockpile	6	0.0445412	90	0.0044541
2	Wind erosion at stockpiles	• Limestone stockpile • Gypsum stockpile	2	0.0111593	90	0.0011159
3	Paved road	• Main gate to packhouse to main gate • Main gate to limestone stockpile • Main gate to gypsum stockpile	41(line volumes sources)	0.3953187	75	0.0988297

No.	Type of Activity	Location/Specifics	No. of Assumed Sources	Total Emissions (uncontrolled (g/s)	Control Efficiency (%)	Total Emissions (controlled (g/s)
4	Transfer points	• Transfer point 1 • Transfer point 2 • Transfer point 3 • Transfer point 4	4	0.1003241	95	0.0046818
5	Conveyor	• Conveyor 1 • Conveyor 2 • Conveyor 3 • Conveyor 4	4	0.0026502	90	0.0002650
6	Motor vehicle emissions	• Main gate to packhouse to main gate • Main gate to limestone stockpile • Main gate to gypsum stockpile	41 (line volume sources)	0.0003750	90	0.0000375
With Project Upgrade/Modification						
1	Materials handling	• Unloading of limestone at pier • Unloading of slag at pier • Handling of limestone stockpile • Handling of gypsum stockpile	6	0.1334352	90	0.0133435
2	Wind erosion at stockpiles	• Limestone stockpile • Gypsum stockpile	2	0.0146703	90	0.0014670
3	Paved road	• Main gate to packhouse to main gate • Main gate to limestone stockpile • Main gate to gypsum stockpile	41 (line volume sources)	0.5270915	75	0.1317729

No.	Type of Activity	Location/Specifics	No. of Assumed Sources	Total Emissions (uncontrolled (g/s)	Control Efficiency (%)	Total Emissions (controlled (g/s)
4	Transfer points	• Transfer point 1 • Transfer point 2 • Transfer point 3 • Transfer point 4	4	0.2453241	95	0.0114485
5	Conveyor	• Conveyor 1 • Conveyor 2 • Conveyor 3 • Conveyor 4	4	0.0064805	90	0.0006481
6	Motor vehicle emissions	• Main gate to packhouse to main gate • Main gate to limestone stockpile • Main gate to gypsum stockpile	41 (line volume sources)	0.0005000	90	0.0000500

2.3.3.3.2 Predicted highest concentrations at all gridded receptors and using three (3) years of sequential hourly meteorological data

Table 54 shows the highest predicted 24-hour (at 98th percentile value) and annual average concentrations using three (3) years of sequential hourly data and all receptors described in previous section. **Figure 90** to **Figure 97** show the plots of the predicted concentrations (uncontrolled and controlled) at various averaging periods.

The highest predicted concentrations arising from the operation of the project (with and without project upgrade/modification and without mitigation measures or uncontrolled emissions) exceeded the ambient guideline value set for TSP at 230 µg/Nm^3. With the mitigation or control measures to lessen release of fugitive emissions, the predicted highest concentrations (with and without project upgrade/modification) appeared to comply the ambient guideline values set at 230 and 90 µg/Nm^3 for the 24-hour and annual averaging times, respectively.

For PM_{10}, the predicted concentrations (controlled and uncontrolled emissions) were within the ambient guideline values set at 150 and 60 µg/Nm^3 for the 24-hour (at 98th percentile) and annual averaging periods, respectively. PM_{10} concentrations are generally lower than those of TSP as depicted in the emission factors and in **Table 52** and **Table 53**.

The location of the highest predicted concentration (24-hour average at 98th percentile values) was at one of the fence line receptors located at the main gate of the project site (with coordinates, UTM(x)= 277,082.2 m E and UTM(y) =1,519,892.11 m N), as shown in **Figure 90** to **Figure 97**. The locations of highest concentrations are similar with other simulations (PM_{10}, TSP) whether controlled or uncontrolled emissions at other averaging periods (annual).

Highest predicted concentrations occurred at the fence line east of the project site (with coordinates, UTM(x)= 277,082.2 m E and UTM(y) =1,519,892.11 m N) as the area is downwind of the project facility when the prevailing winds blow from the east and east-southeast. This resulted to high predicted levels within the east side and adjacent areas, as depicted in the contour lines oriented from ESE towards ENE (**Figure 90** to **Figure 97).**

Table 54. Predicted highest 24-hour average (at 98th percentile values) and annual average concentrations of TSP and PM10 within the modelling domain

Pollutant/ Averaging Time	No Modification		With Modification		NAAQS/ NAAQG
	Uncontrolled	Controlled	Uncontrolled	Controlled	
Total Suspended Particulates (TSP)					
24-hour (98th percentile)	**480.5**	119.6	**645.7**	160.5	**230**
Annual (Average)	**173.3**	44.2	**236.6**	61.0	**90**
PM10					
24-hour (98th percentile)	94.5	23.6	129.0	32.8	**150**
Annual (Average)	35.3	9.7	49.9	14.6	**60**

Notes:
Please refer to **Figure 90** to **Figure 97** for locations of the highest concentrations and the isopleths of the above-predicted concentrations and the

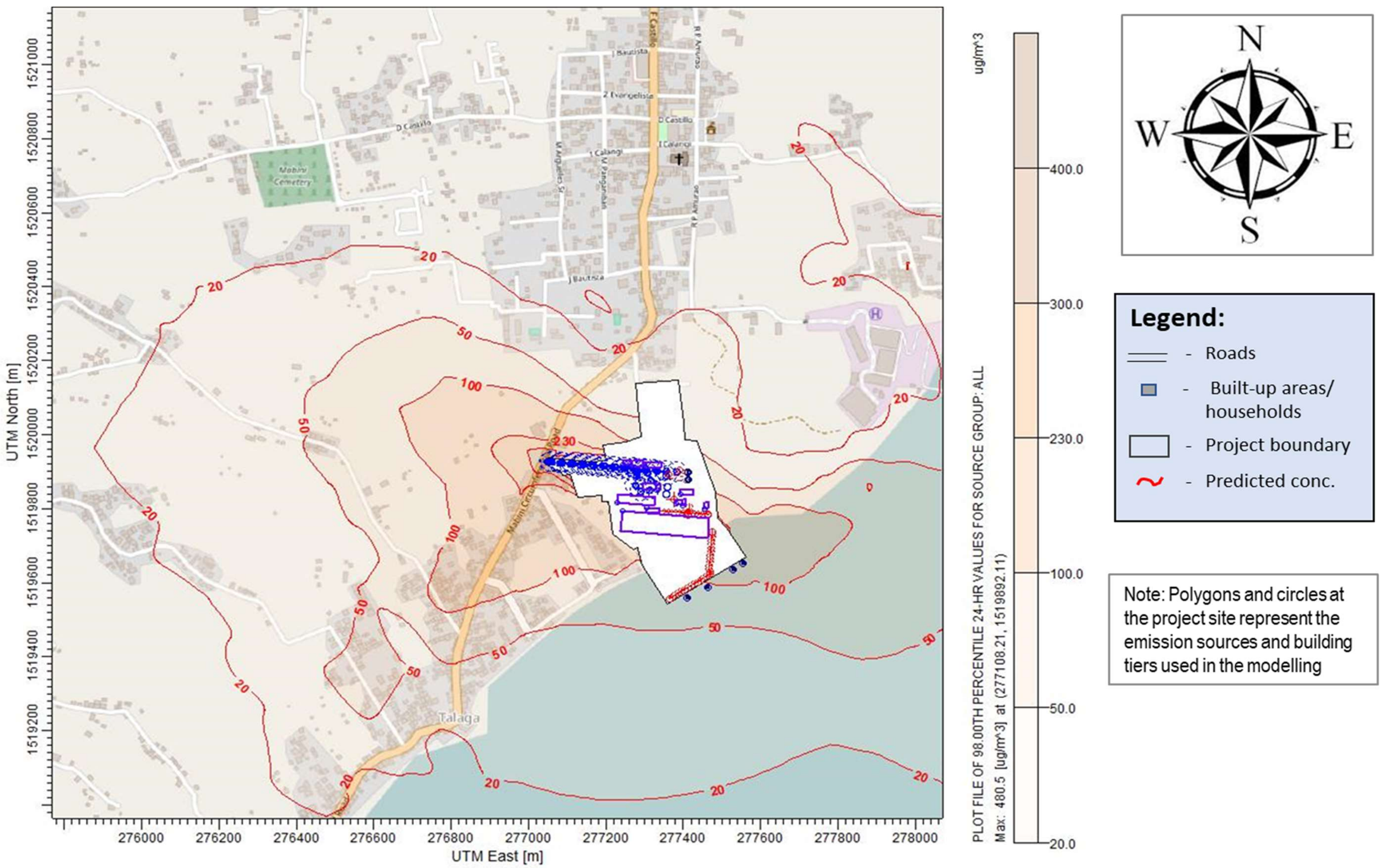


Figure 90 - Predicted 24-hour concentrations at 98th percentile of TSP (unmitigated) without the proposed modification (or in existing condition)

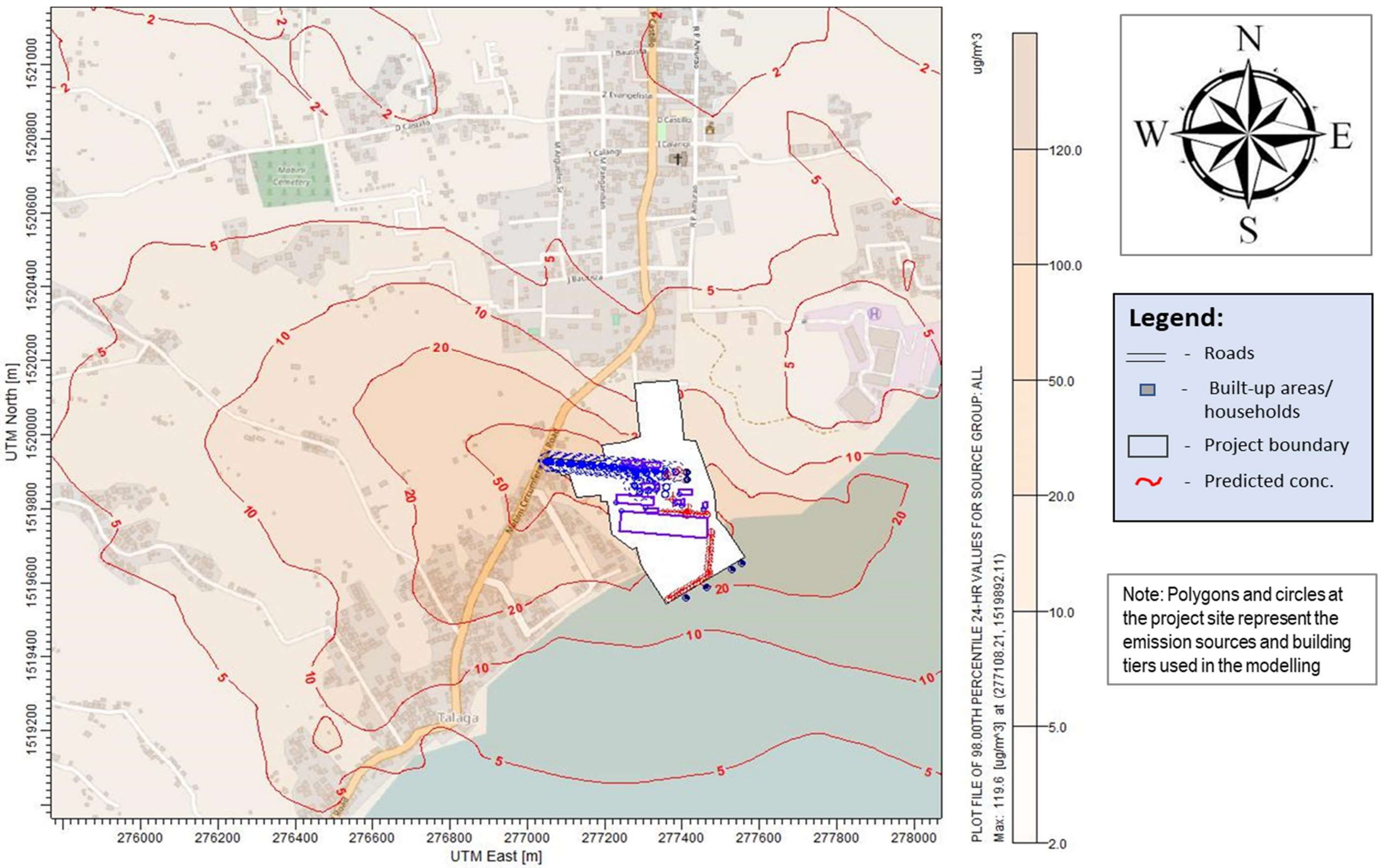


Figure 91 - Predicted 24-hour concentrations at 98th percentile of TSP (mitigated) without the proposed modification (or in existing condition)

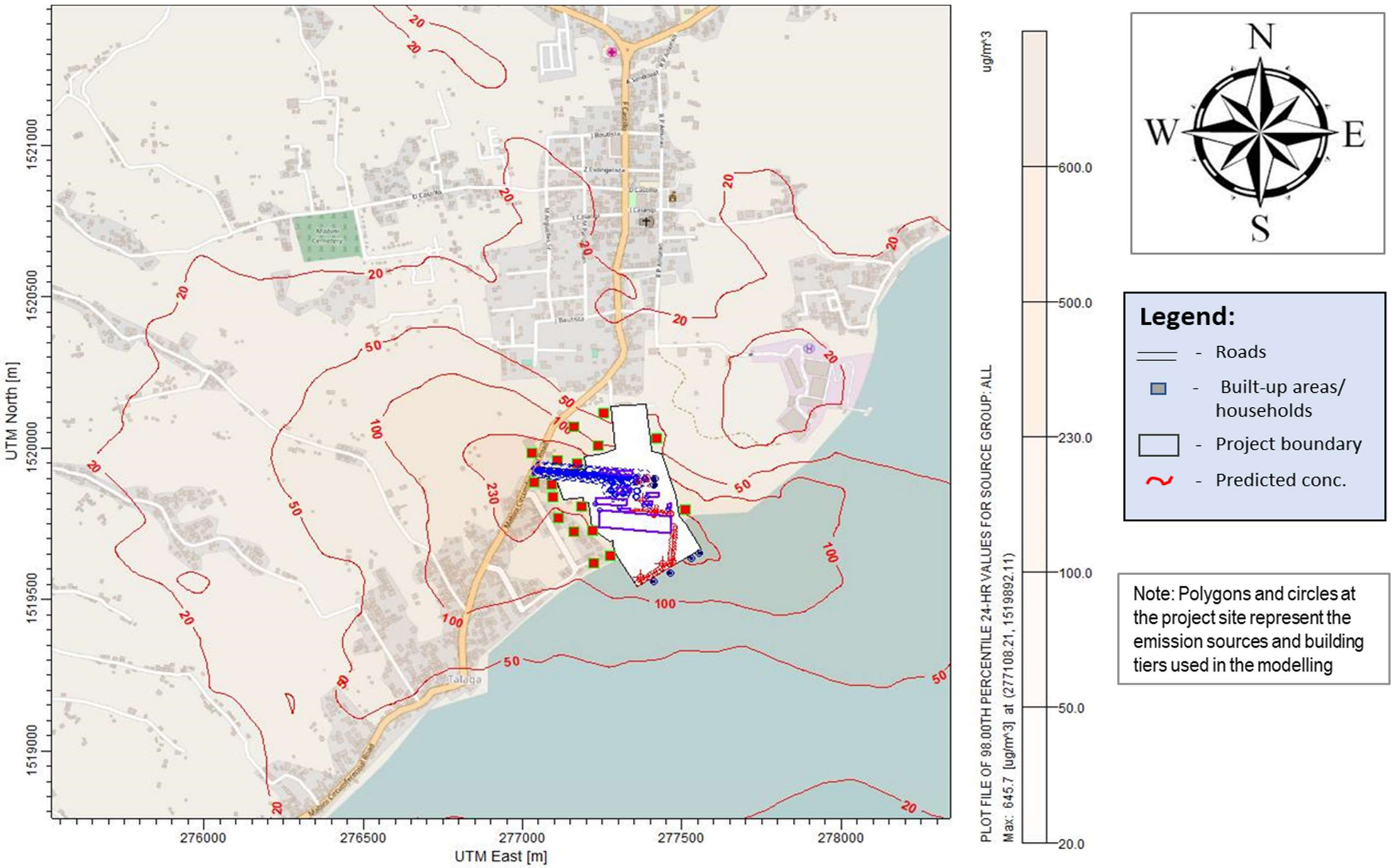


Figure 92 - Predicted 24-hour concentrations at 98th percentile of TSP (unmitigated) with the proposed modification

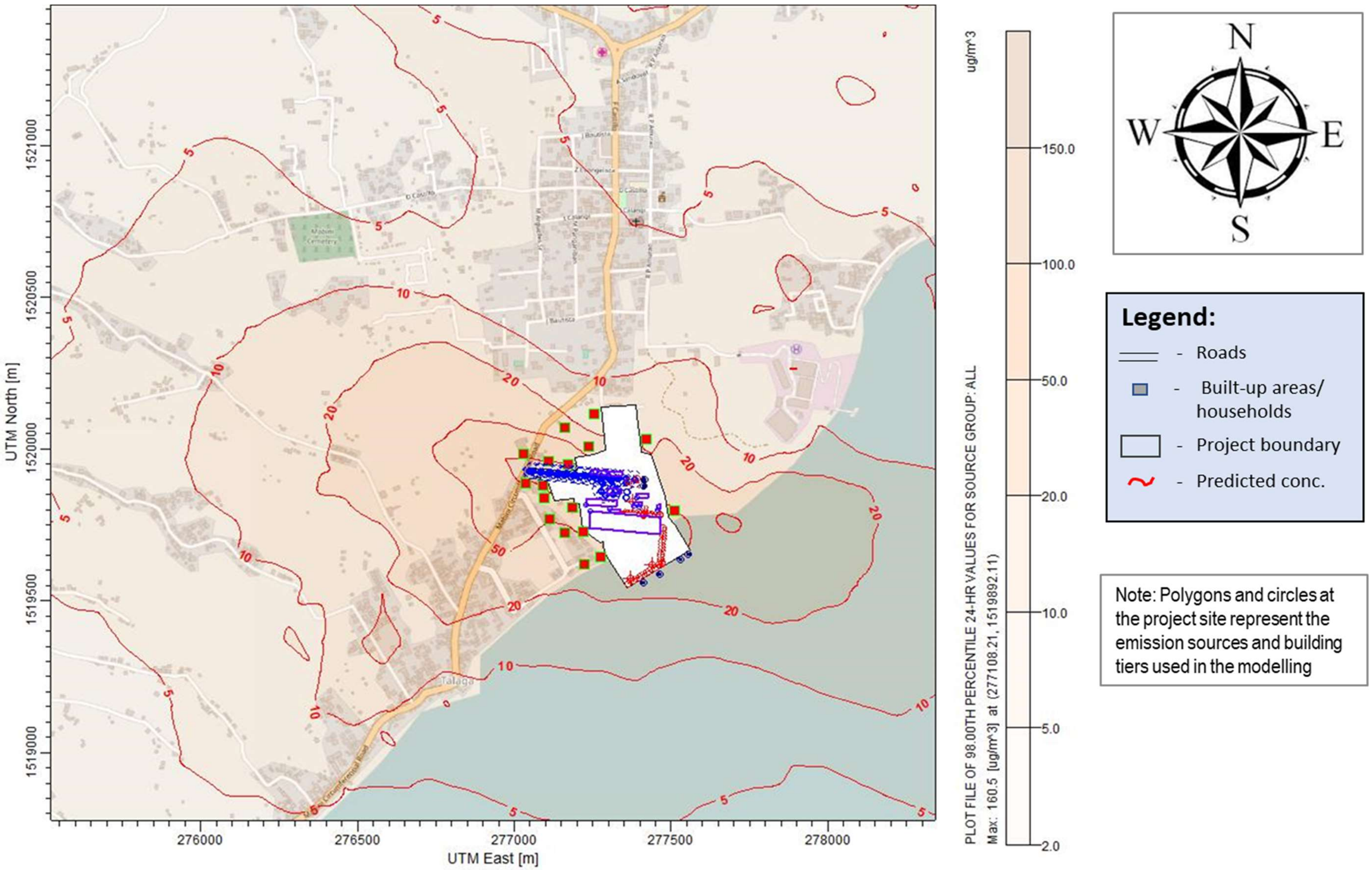


Figure 93 - Predicted 24-hour concentrations at 98th percentile of TSP (mitigated) with the proposed modification

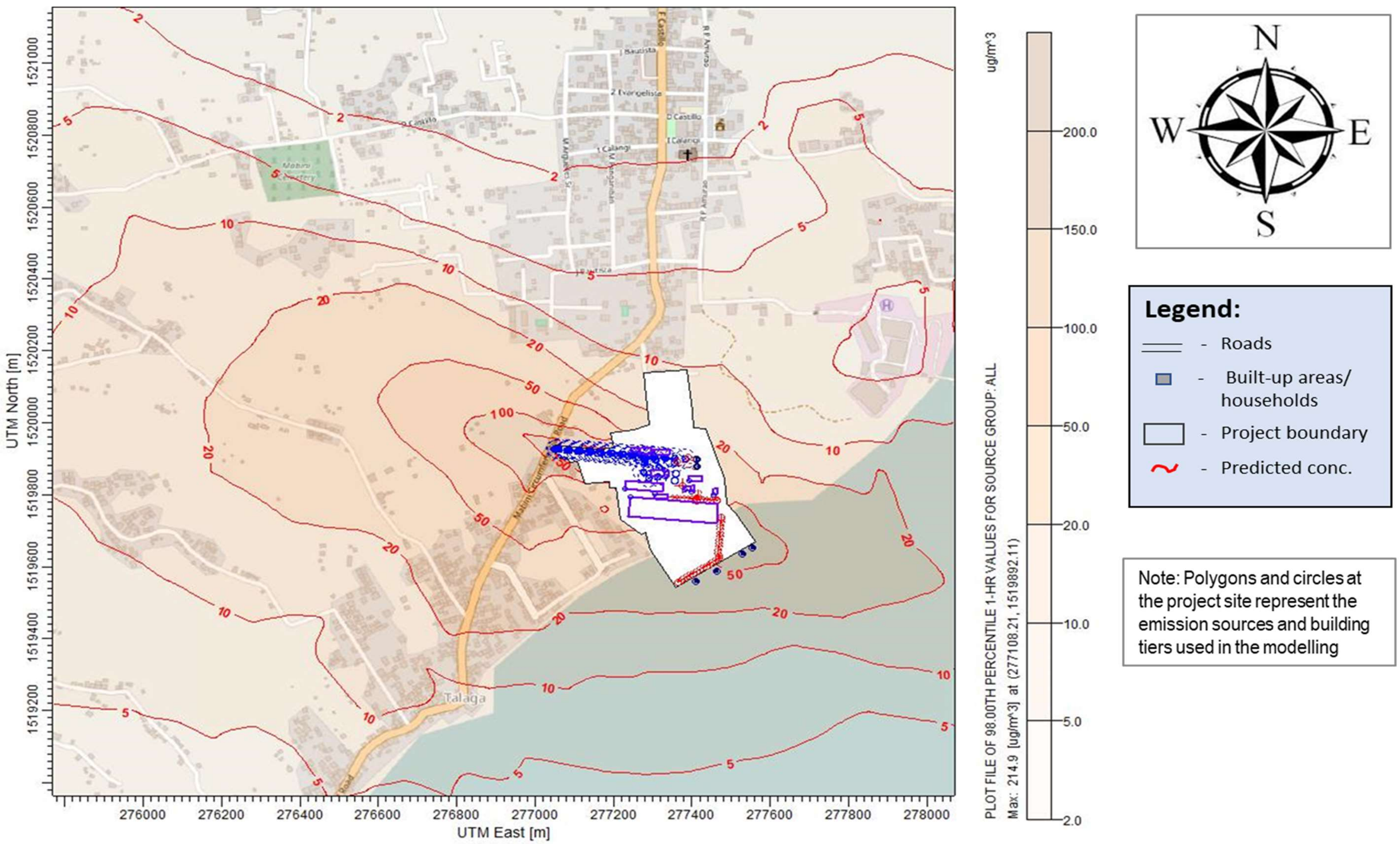


Figure 94 - Predicted 24-hour concentrations at 98th percentile of PM10 (unmitigated) without the proposed modification (or in existing condition)

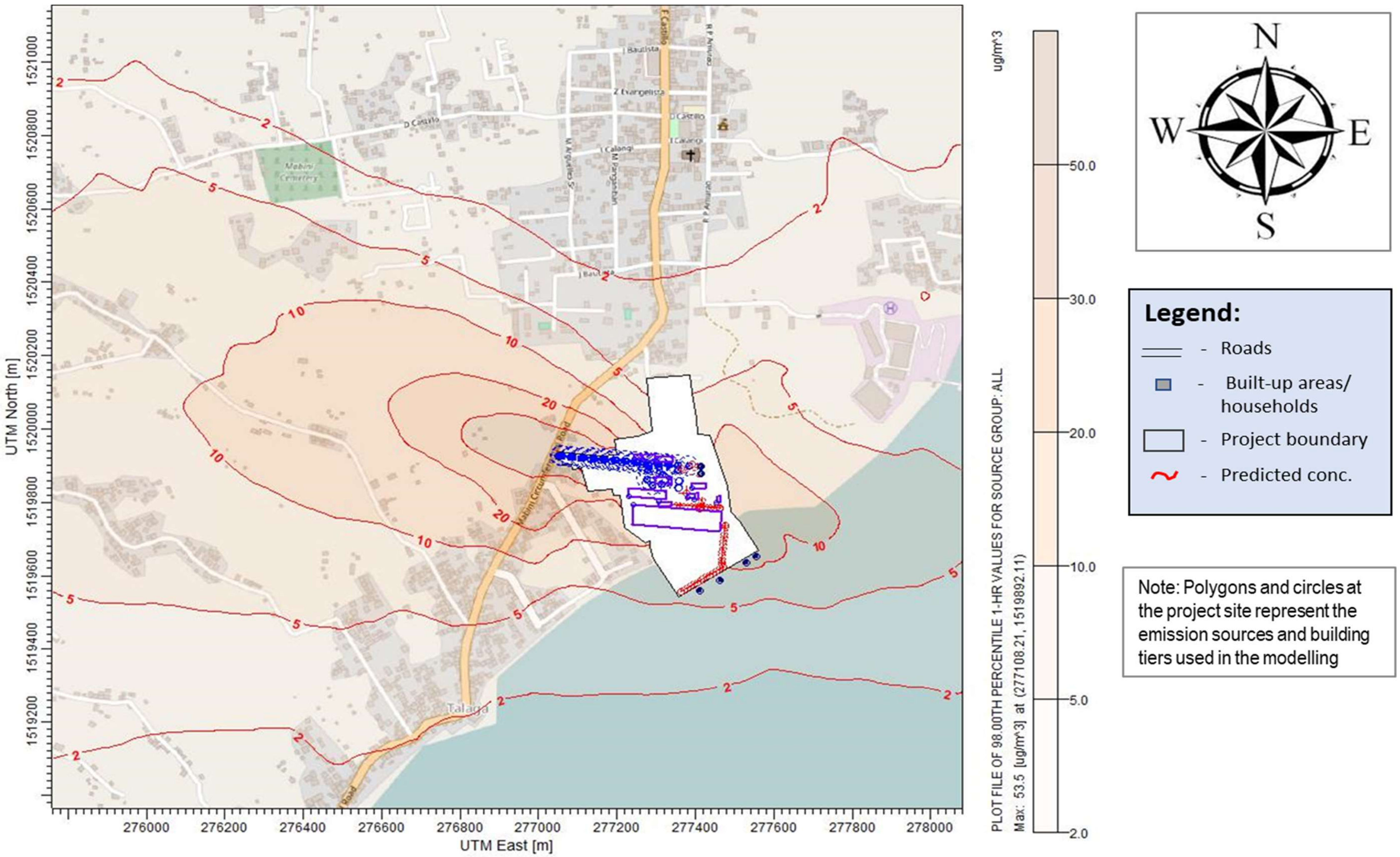


Figure 95 - Predicted 24-hour concentrations at 98th percentile of PM_{10} (mitigated) without the proposed modification (or in existing condition)

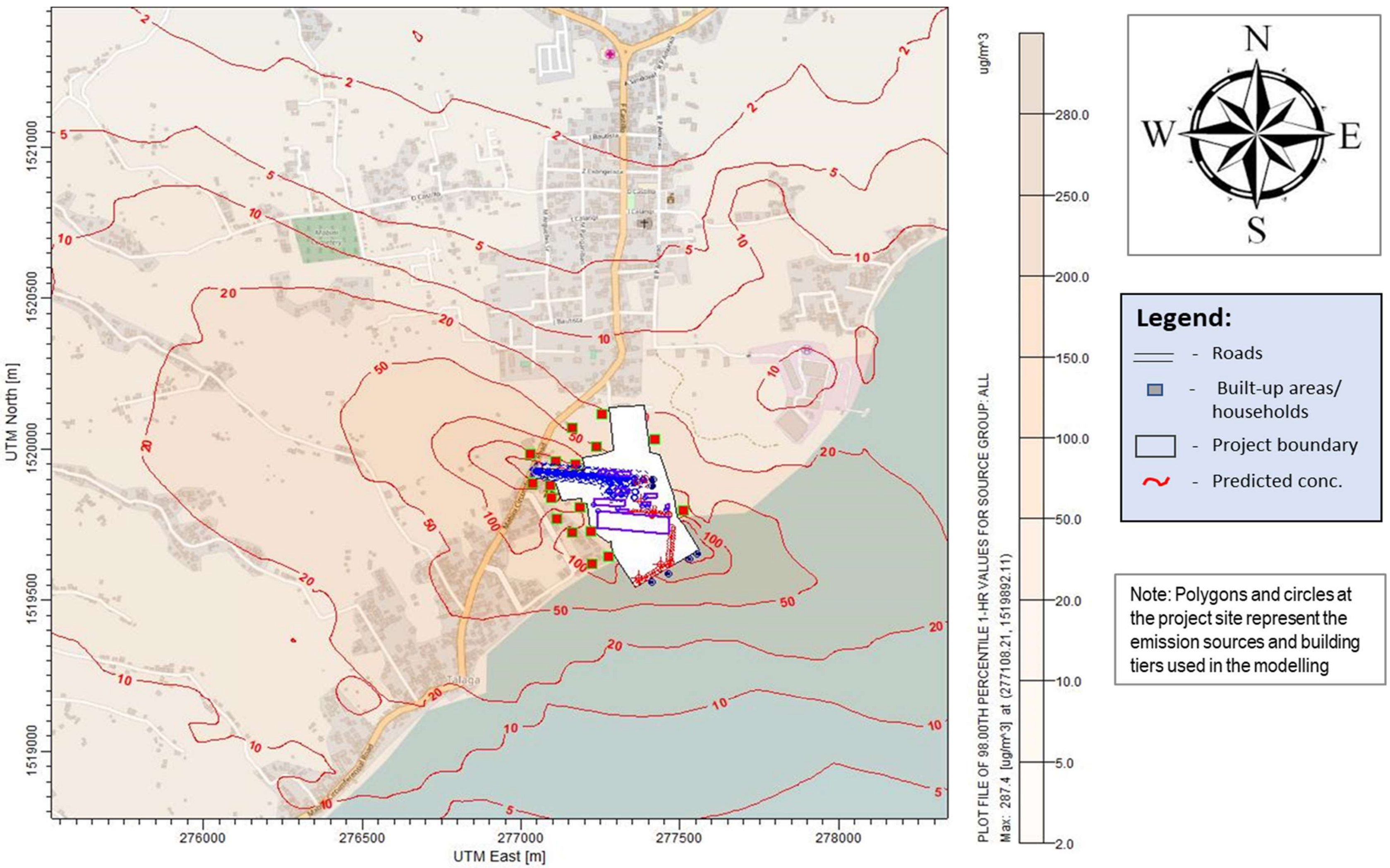


Figure 96 - Predicted 24-hour concentrations at 98th percentile of PM10 (unmitigated) with the proposed modification

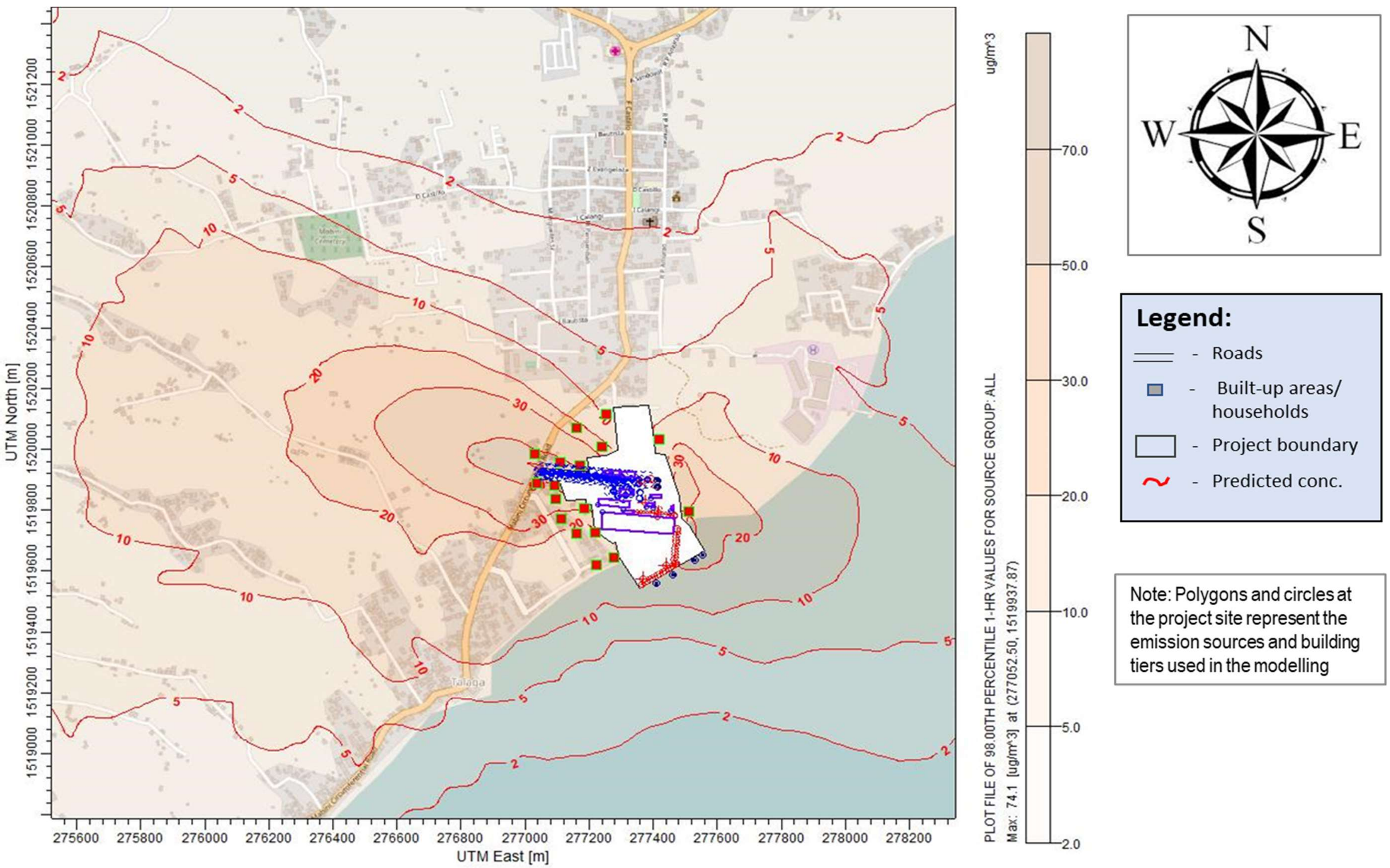


Figure 97 - Predicted 24-hour concentrations at 98th percentile of PM10(mitigated) with the proposed modification

2.3.3.3.3 Predicted highest concentrations using three (3) years of sequential hourly meteorological data at the discrete receptors

Figure 99 to ***Figure 102*** and ***Figure 103*** to ***Figure 106*** show the plot of the highest predicted concentrations of TSP and PM_{10}, respectively, at the discrete receptors with and without the project upgrade (or modification).

Although the highest predicted concentrations were already identified in Item b) above, the highest predicted concentrations at discrete receptors (total of 17) or residences located outside and surrounding the project site were also simulated. This was to determine the exact predicted concentrations at specific receptors (residences or households) that are likely affected by the project operation due to its proximity to the project site.

Without the project upgrade and with no control measures to control dust emissions, predicted concentrations (24-hour average at 98^{th} percentile) were higher than the ambient guideline values set for TSP at Receptor Nos. 6, 8, 9, 10, and 11.

With the project upgrade, additional two (2) receptors (Receptors Nos. 3 and 7) were found to have predicted levels greater than the ambient guideline values set for TSP. Predicted highest annual average concentrations of TSP were also exceeded at receptors 6, 10 and 11 without the project upgrade, and one (1) additional receptor (Receptor No. 8) with the proposed project upgrade. This was due to the corresponding increase of fugitive emissions with the volume of raw and finished materials to be processed and transported within the project site.

Receptors (Receptor Nos. 3, 6, 7, 8, 9, 10, and 11) with predicted levels exceeding ambient guideline values without control or mitigation measures are located east of the project site, particularly at residences or households north and south of the main gate. These receptors were highly exposed to dispersion of fugitive emissions from the project site (without control measures) when prevailing winds blow from the east and east-southeast (or from the sea).
With the assumed proposed mitigation measures at the project (i.e., continuous watering of dry and exposed surfaces, use of barriers to confine emissions), predicted concentrations were lower than the ambient guideline value set for TSP. This assumed continuous implementation of control measures to lessen fugitive dust emission, such as reduction of dust by maximum of 90% at stockpiles and materials handling, at the emission sources.

Thus, it is necessary to conscientiously implement mitigation measures as ambient guideline values and standards are likely exceeded at nearby receptors (or households/residences) without the required control measures. The recommended mitigation measures are discussed in Section 3 (Environmental Management Plan).

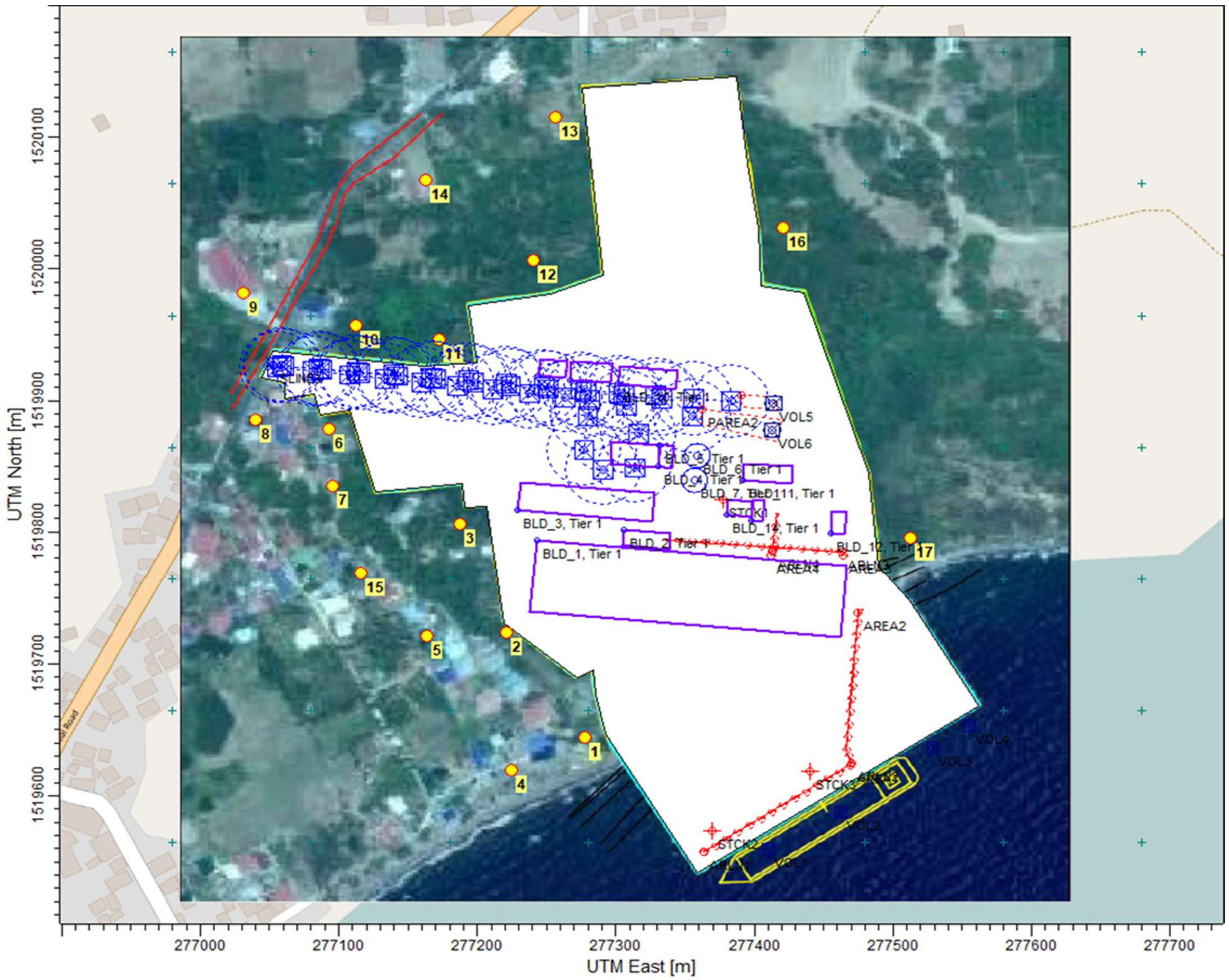


Figure 98 - Locations of selected discrete receptors (represented as circles outside project boundaries)

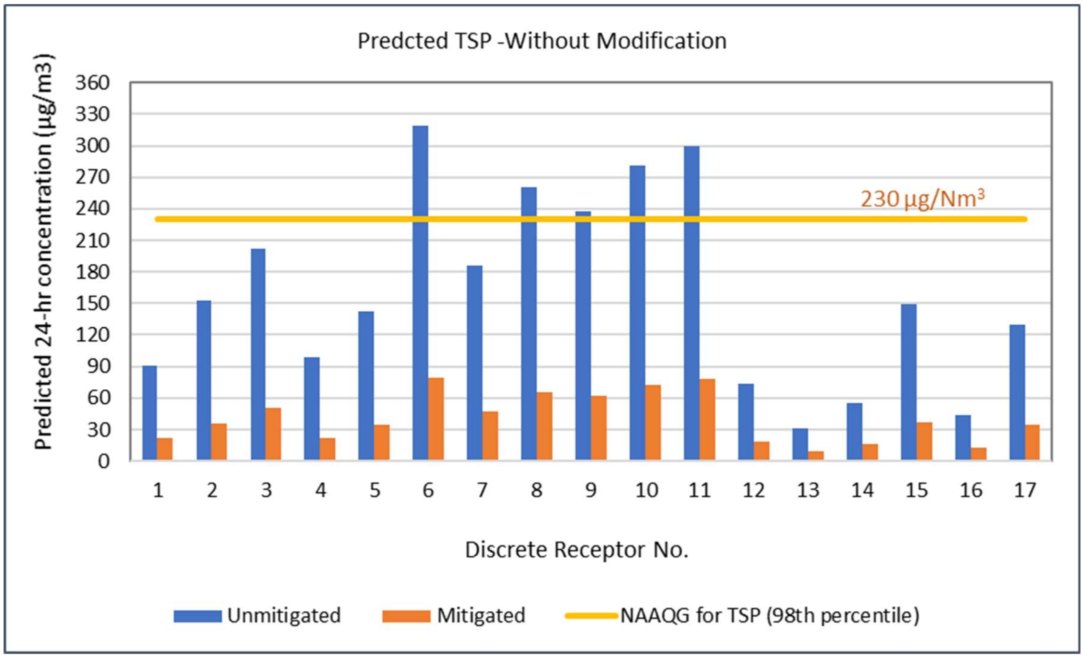


Figure 99 - Highest predicted 24-hour average concentrations of TSP (98th percentile) at the discrete receptors arising from the existing operation of the project (w/out modification)

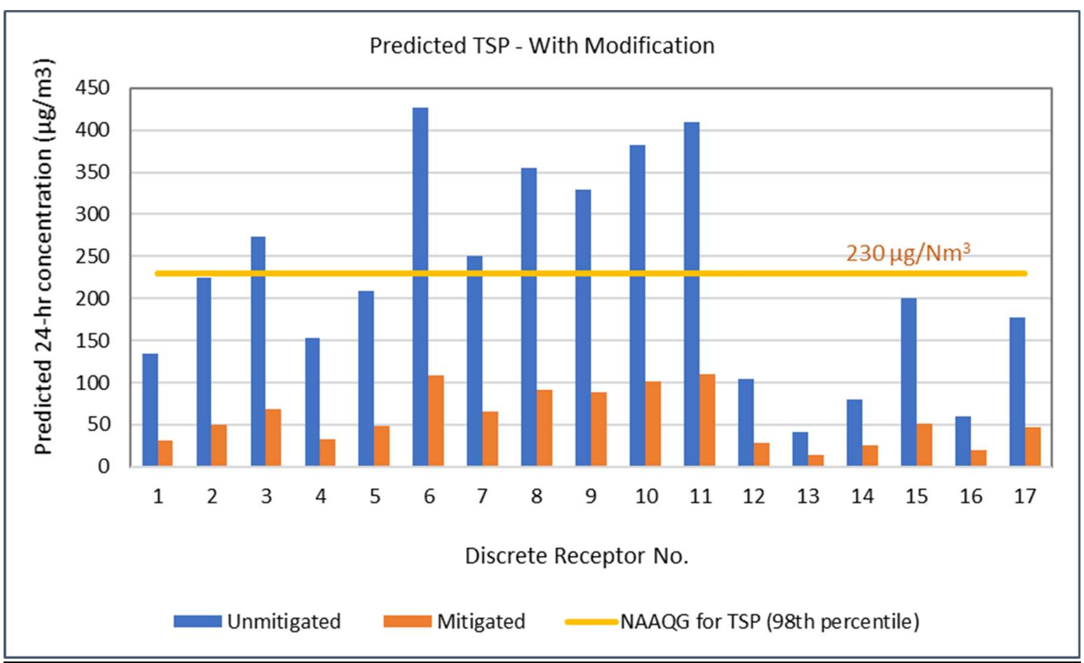


Figure 100 - Highest predicted 24-hour average concentrations of TSP (98th percentile) at the discrete receptors arising from the existing operation of the project (with proposed modification)

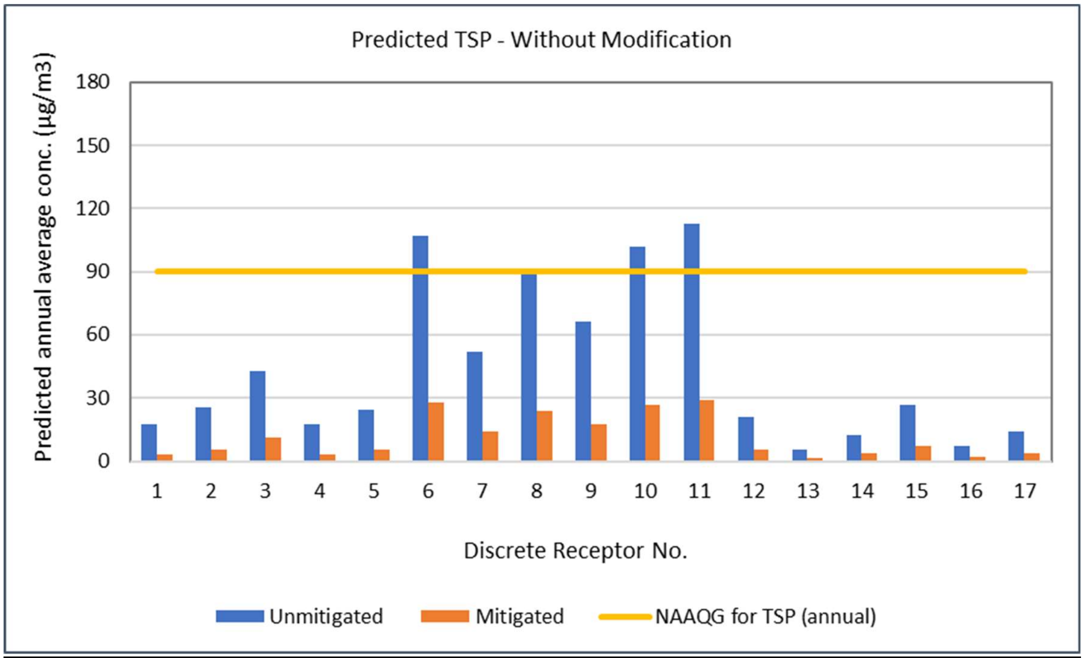


Figure 101 - Highest annual average concentrations of TSP (98th percentile) at the discrete receptors arising from the existing operation of the project (without modification)

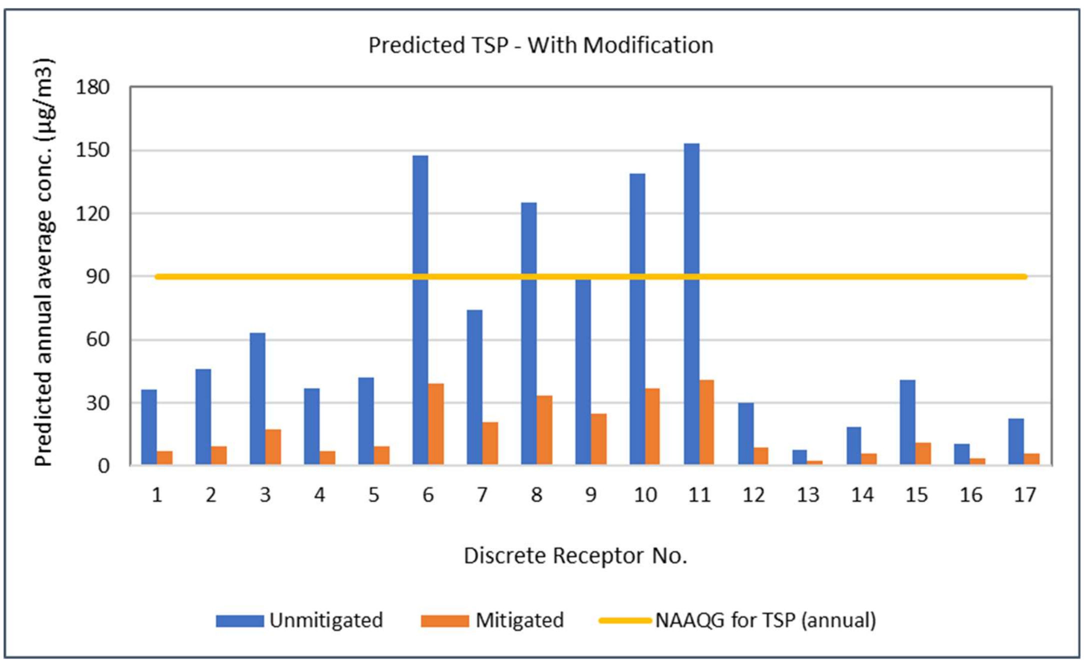


Figure 102 - Highest annual average concentrations of TSP (98th percentile) at the discrete receptors arising from the existing operation of the project (with proposed modification)

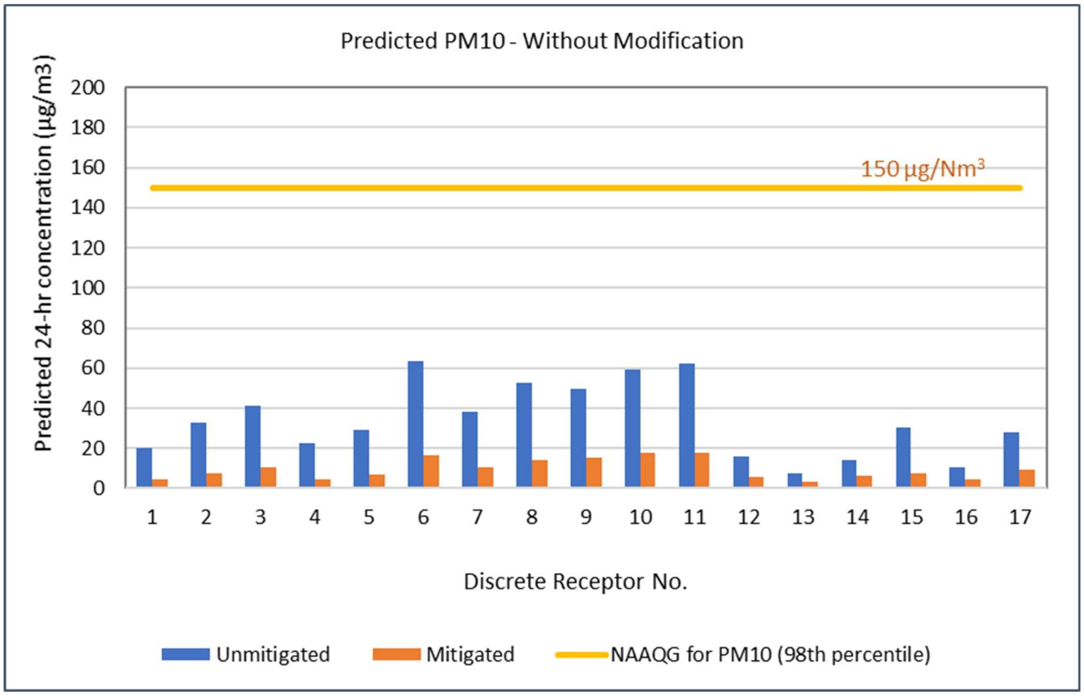


Figure 103 - Highest predicted 24-hour average concentrations of PM10 (98th percentile) at the discrete receptors arising from the existing operation of the project (w/out modification)

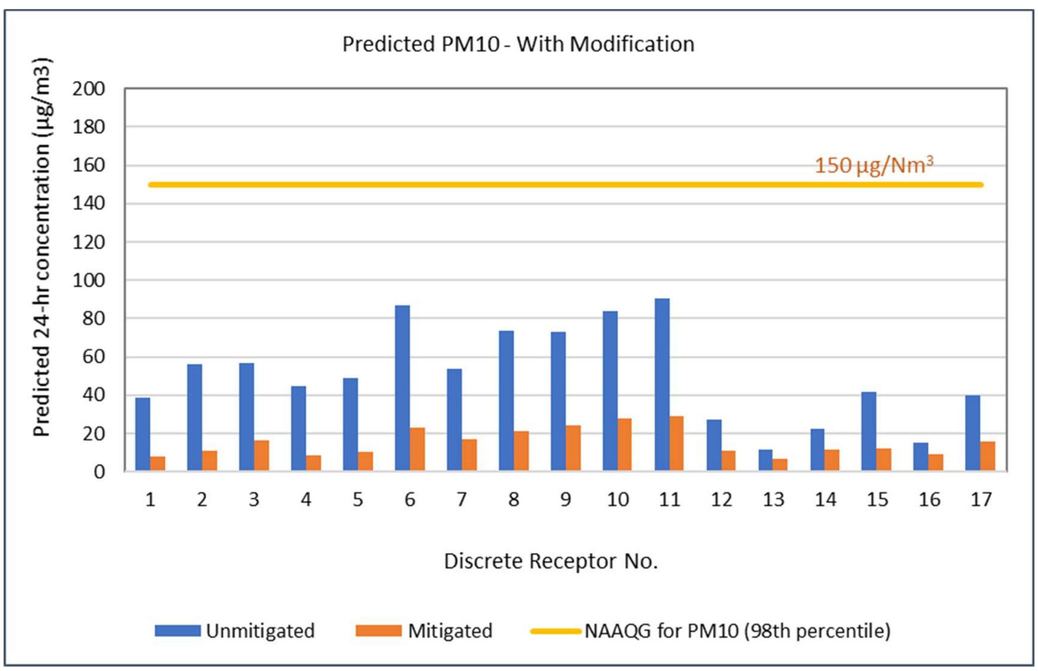


Figure 104 - Highest predicted 24-hour average concentrations of PM10 (98th percentile) at the discrete receptors arising from the existing operation of the project (with proposed modification)

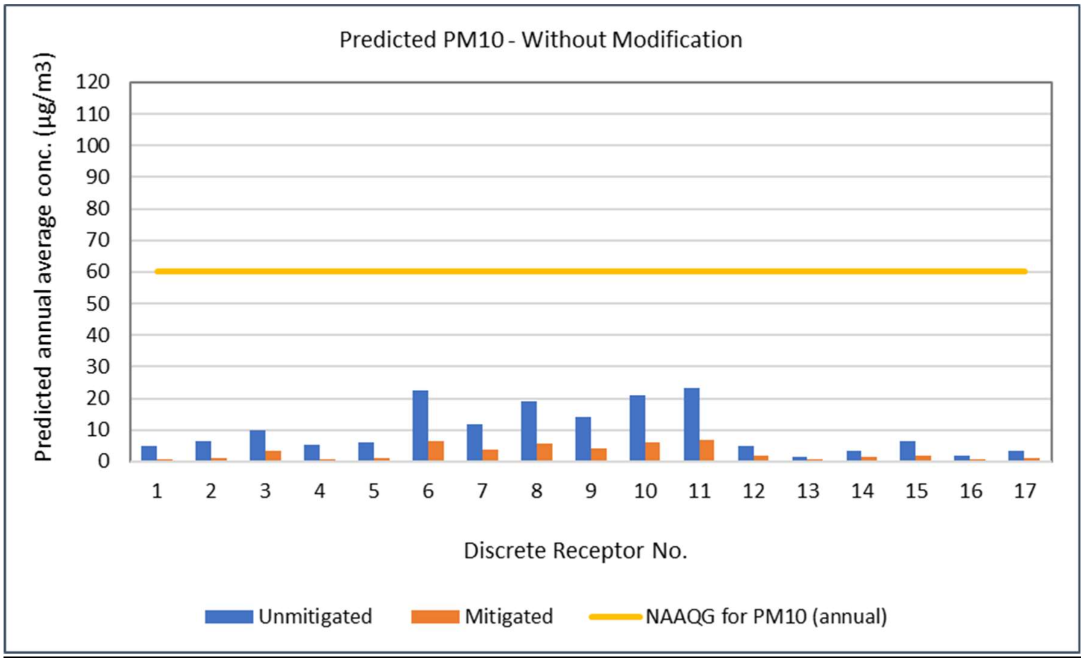


Figure 105 - Highest annual average concentrations of PM10 (98th percentile) at the discrete receptors arising from the existing operation of the project (without modification)

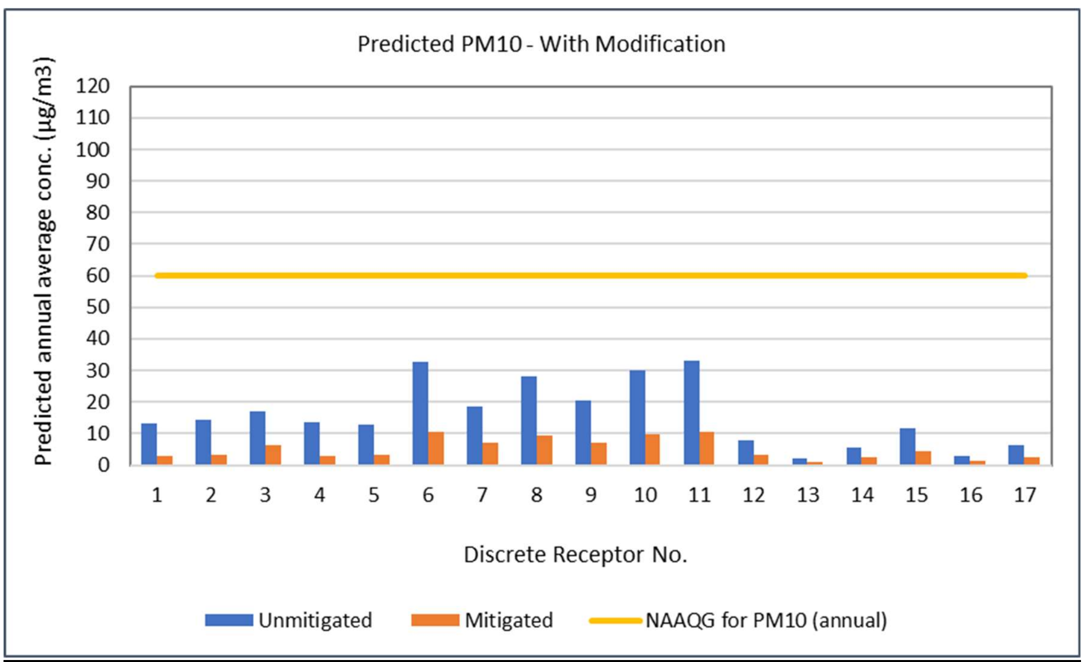


Figure 106 - Highest annual average concentrations of PM10 (98th percentile) at the discrete receptors arising from the existing operation of the project (with proposed modification)

2.3.3.3.4 Predicted plus background ambient air concentrations

Section 6 (Background ambient air data) in MC 2008-003 requires assessing the cumulative impact of a proposed new or modified source. Cumulative air impact assessment requires use of existing air quality data. In the absence of air quality data, cumulative impact assessment could use dispersion modelling techniques to determine dispersed air pollutants from existing sources.

While there are available air quality data for the project as reported in the SMR, which could be used as background data, the main constraint is that meteorological conditions at the time of monitoring were not reported or indicated in the report. Secondly, information on the sources of air emissions at the time of monitoring were also not available. Thus, it would be difficult to assess or compare background concentrations as peak modelled concentrations may not be in the same condition as what was reported or monitored.

With the above-mentioned limitations on the use of available air quality data, this study utilized air modelling to determine the dispersed emissions arising from the operation of the existing project facilities. To determine cumulative impact, the dispersed emissions from the proposed project upgrade (or proposed project modification) were then modelled with the existing emission sources (or without project upgrade).

Further, an attempt was made to compare the measured or background air quality data with those of the predicted concentrations (uncontrolled and controlled). Note that only air quality stations or locations that were frequently sampled (please refer **Table 55** and **Table 56** on the locations) or with four (4) or more measured concentrations were included as background data.

Results show that the one-hour average measured levels (at 98th percentile) fall within the range of predicted concentrations (controlled to uncontrolled) without project upgrade (or existing project facilities), although measured levels at 2 of the 5 locations, namely: community area in Brgy. Talaga East, and guesthouse, appear greater than the results of the modelled concentrations. The differences could be attributed to emissions from other nearby sources (i.e., fugitive emissions from nearby mill facility or emissions along the national highway).

Furthermore, results in **Table 55** and **Table 56** suggest considerable increase on the background levels arising from the operation of the proposed project upgrade. This is largely attributed to increase in project related activities (i.e., increase on truck hauling) and significant increase on the processing of materials.

Thus, it is important to include in the environmental management plan and project design the mitigation measures to ensure that any additional discharge of fugitive emissions will not further contribute to high levels of TSP and PM_{10} concentrations in the vicinities of the project site. Proposed mitigation measures are in Section 3 (Environmental Management Plan).

Annex P shows the post plot of predicted air concentrations at selected air stations.

Table 55 - Measured and predicted 1-hour average concentrations of TSP

Rec. No.	***Location***	***Measured conc. (98th percentile) (µg/Nm³)***	***Predicted concentrations (µg/m³)***	
			Without project upgrade (controlled to uncontrolled)	***With project upgrade (controlled to uncontrolled)***
1	Community phase	281.92	68.7 to 280.8	92.3 to 396.7
2	Brgy. Talaga East	265.9	34.0 to 146.3	48.5 to 336.4
3	Main gate*	241.2	147.5 to 562.4	205.0 to 758.4
4	Guesthouse*	223.2	30.0 to 118.4	43.9 to 163.6
5	Brgy Talaga-P Palibaguhan boundary	85.8	27.6 to 98.8	41.3 to 138.3

*Locations represent point along or close to the sampling station as option to disable onsite receptors was used

Table 56 - Measured and predicted 1-hour average concentrations of PM10

Rec. No.	***Location***	***Measured conc. (98th percentile) (µg/Nm³)***	***Predicted concentrations (µg/m³)***	
			Without project upgrade (controlled to uncontrolled)	***With project upgrade (controlled to uncontrolled)***
2	Brgy. Talaga East	158.2	7.0 to 45.6	15.0 to 119.7
3	Main gate	66.1	34.7 to 117.6	52.7 to 164.9
4	Guesthouse	86.1	9.1 to 24.8	19.4 to 38.3
5	Brgy Talaga-P Palibaguhan boundary	81.3	11.3 to 23.3	22.3 to 37.9

2.3.3.3.5 Predicted ambient air concentration of SO_2 and NO_2

The proposed project upgrade (or project modification) is expected to emit gaseous air pollutants (SO_X and NO_X) due to operation of two (2) units of ecohopper generator sets with capacity of 440 KVA each. As the detailed design of the generator sets (i.e., stack heights and diameter) is yet to be provided by the proponent, source input parameters used in the modelling were estimated or computed using the technical specifications of a Caterpillar generator set with rated capacity of 440 KVA.

Using the AP-42 emission factors and the exhaust gas flow and exhaust gas temperature of a 440 KVA Caterpilliar genset, the emission rates of SO_X (as SO_2) and NO_X (as NO_2) were computed as 0.121 and 1.8302 g/s, respectively. For PM emission of the genset, this was already included in the simulations with the non-point and point sources (please refer **Table 37**).

The predicted SO_2 and NO_2 concentrations (24-hour at 98th percentile and annual average) arising from operation of the generator sets were all within the ambient guideline values set for the said air pollutants (**Table 57**). Compliance to ambient SO_2 could be attributed to use of diesel fuel with low sulfur content. Lower concentrations of SO_2 and NO_2 were also predicted due to high temperature and high exit velocity of the exhaust gas of the generator sets, which resulted to increase in plume rise, and subsequently, decrease in ambient or ground level concentrations.

Note that the predicted levels of TSP arising from the operation of the two (2) sets of generator set were already included in the previous simulations.

Table 57 - Predicted ambient air concentrations of SO_2 and NO_2

Pollutant	*Averaging Period*	*Predicted concentration (μg/m^3)*	*NAAQG (μg/m^3)*	*Remarks*
SO_2	24-hour (98th)	8.8	180	Within NAAQG
SO_2	Annual		80	Within NAAQG
NO_2	24-hour (98th)	106.7	150	Within NAAQG
NO_2	Annual	1.0	-	Within NAAQG

Notes:
1) SO_X emission factor = 0.00205 lb/(hp-hr) (Source: AP-42)
2) NO_X emission factor = 0.031 lb/(hp-hr) (Source: AP-42)

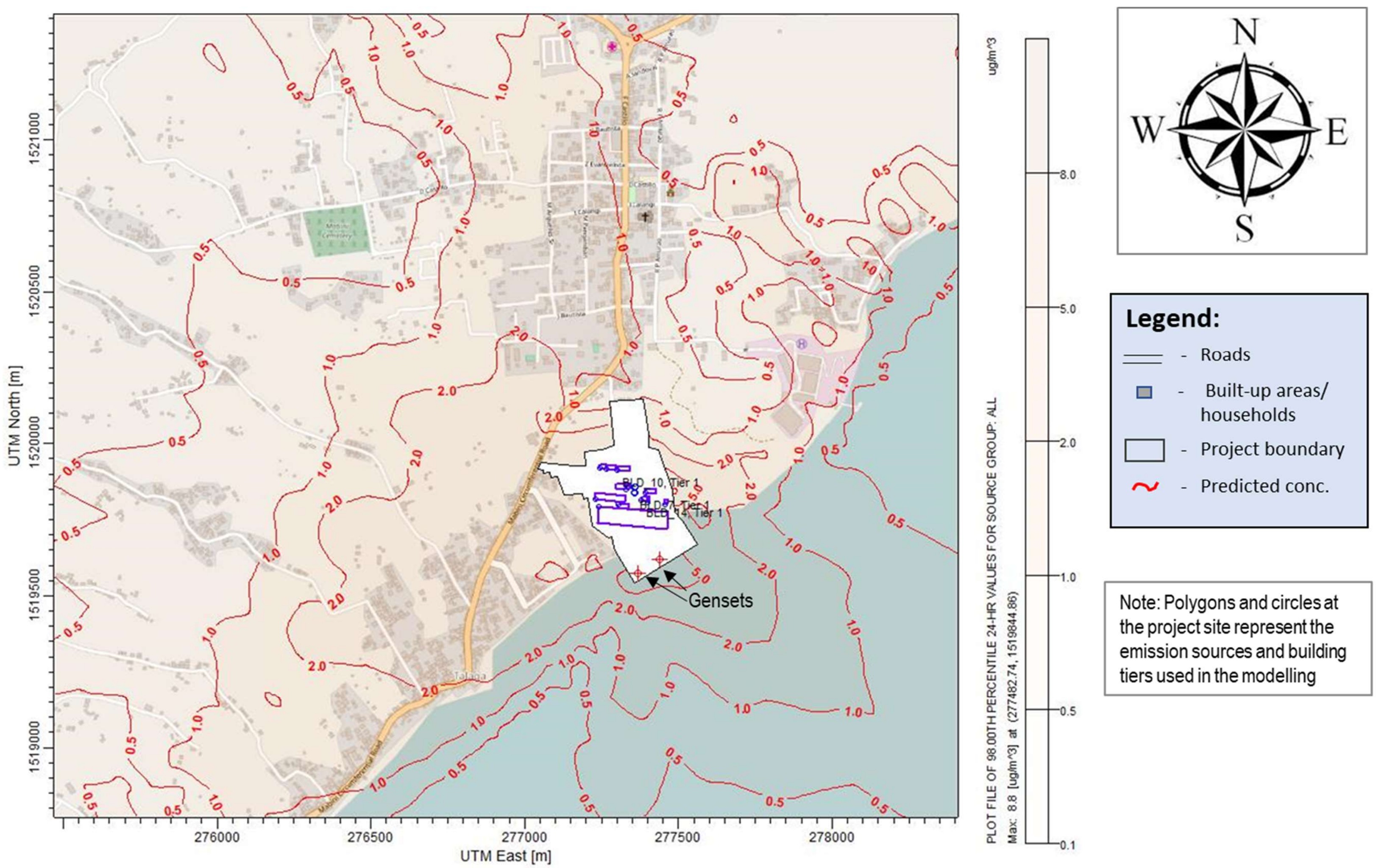


Figure 107 - Predicted concentrations (24-hour average at 98th percentile) of SO_2 arising from the operation of the two (2) ecohopper gensets

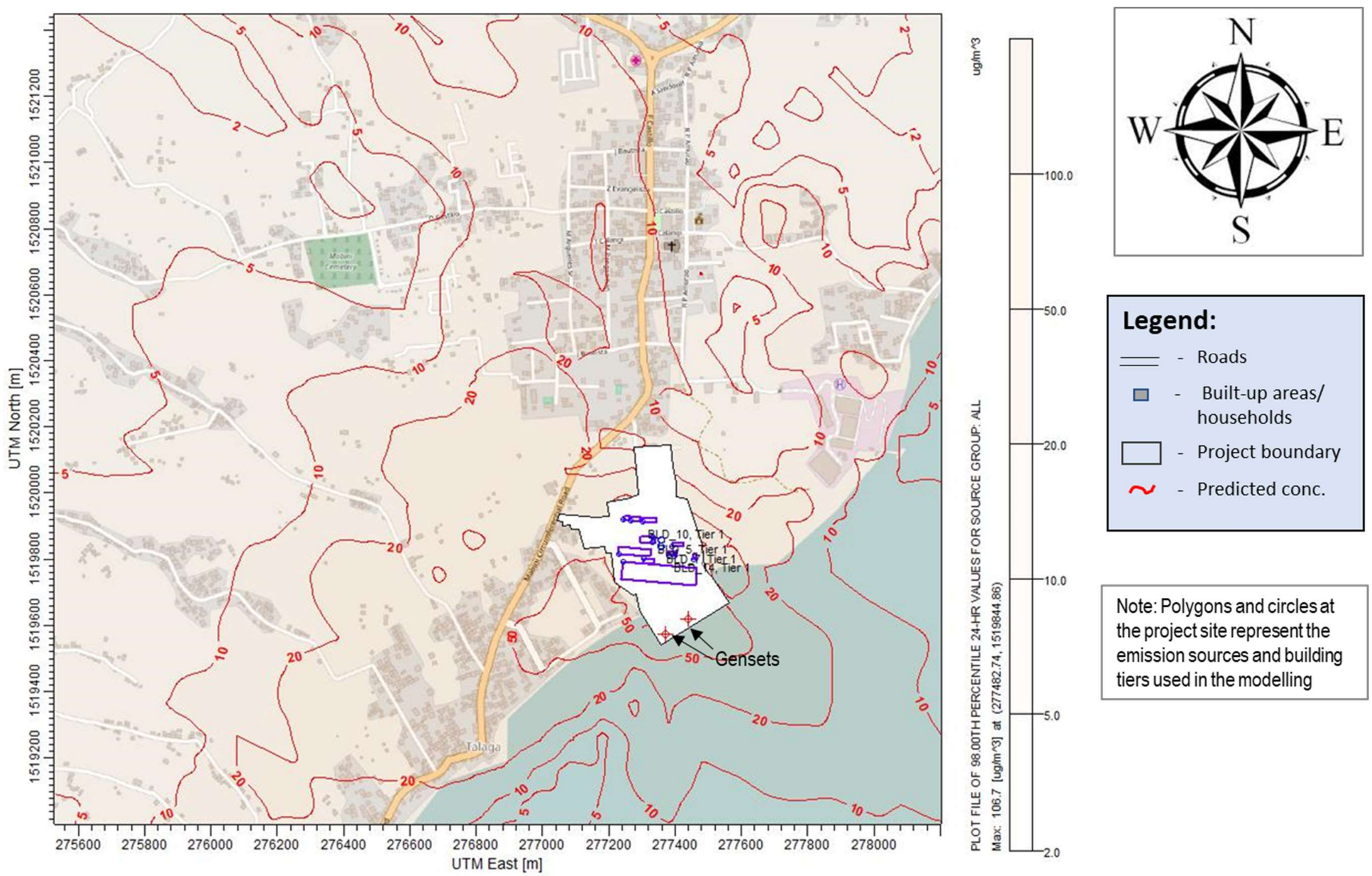


Figure 108 - Predicted concentrations (24-hour average at 98th percentile) of NO_2 arising from the operation of the two (2) ecohopper gensets

2.4 The People

The proposed project is located in Barangay Pulong Balibaguhan, Municipality of Mabini, Province of Batangas. Because of this, Barangay Pulong Balibaguhan is identified as direct impact barangay. Barangay Talaga East is considered as indirect impact barangay. The secondary impact is the entirety of the Municipality of Mabini.

The Municipality of Mabini is a First-Class Municipality located in the southern tip of Batangas Province. It has a total land area of 4,296 hectares comprised on 1 urban barangay and 33 rural barangays.

The primary impact barangay, Pulong Balibaguhan is located just a kilometer away from the center of the municipality and 15 kilometers from the provincial capital. It has a total land area of 45.3295 hectares. The barangay has five (5) sitios namely, Sitios Pungo, Ilaya, Ibaba, Bijia, and Nayon.

The second primary impact area is Barangay Talaga East. This is situated adjacent to Barangay Pulong Balibaguhan. Barangay Talaga East has a total land area of 54.58 hectares. It comprises of six sitios namely: Bukana; Kabulusan; Silangan; Payapa; Pungo; and Kanto.

2.4.1 Methodology

Various methods were used in gathering information on the demographic and socio-economic conditions of the impact areas. These methods include review of secondary information sources, and conduct of perception survey and focus group discussions.

Secondary data sources were from the from the most current available published survey and census reports of the Philippine Statistics Authority as well as the latest Local Development Plans of the Municipality of Mabini. These include the following:

- 2003-2012 Comprehensive Land-Use Plan of Mabini;
- 2016-2025 Comprehensive Development Plan of Mabini;
- 2010 Census of Population and Household, PSA;
- 2015 Census of Population, PSA; and
- 2012 Full Year Official Poverty Statistics, PSA.

2.4.2 Demographic Baseline Information of Impact Areas

2.4.2.1 Population Size and Growth Rate

Based on the 2015 Census of Population of the Philippine Statistics Authority, the population of Mabini is 46,211. It is 1.72% of the total population of the Province of Batangas[3]. From its 2010 population, which is 44,349, it has a population growth rate of 0.82%. With the given growth rate, the population size of Mabini will double in 84 years.

The population of Barangay Pulong Balibaguhan in 2015 is 940. Comparing it with the 2010 population, 887, the barangay has a population growth rate of 1.16%. The growth rate of Pulong Balibaguhan is almost the same as the municipality and is also expected to double its population in 60 years.

Barangay Talaga East has a population of 1,716 in 2015. Within five (5) years, its population grew by 0.38% considering its population in 2010 is 1,684. Its growth rate is lower than of the municipality, if this growth rate will remain constant its population will double after 184 years.

Table 58 - Population and Growth Rate of Impact Areas, 2010 and 2015

Area	2010 Population	2015 Population	Population Growth Rate (%)	Doubling Time
Municipality of Mabini	44,349	46,211	0.82	84
Barangay Pulong Balibaguhan	887	940	1.16	60
Barangay Talaga East	1,684	1,716	0.38	184

2.4.2.2 Population Composition

The sex and age-group disaggregated data of the municipality of Mabini reveals that the highest percentage among age-group is within 5-9 years old (9.84%) in 2010. The data also showed that the working age group of 15-64 comprised 28,924 individuals or 65 percent of the population. There were equal number of males and females in the entire municipality. It was observed however, that females have higher life expectancy than males.

[3] 2015 Population of the Province of Batangas is 2,694,335 (Philippine Statistics Authority)

Comparing the 2015 data, the ages 5-9 years old still has the highest number in the age group (9.16%). The working age group of 15-64 increased to 30,177 but still comprising 65% of the population. There are an almost equal number of males compared to females, with the male population slightly higher than the females.

Table 59 - Household Population by Age Group and Sex, and Age Composition, and Sex Ratio: Mabini, 2010 and 2015

Age Group	2010 Population			Age Composition (%)	Sex Ratio	2015 Population			Age Composition %	Sex Ratio
	Both Sexes	Males	Females			Both Sexes	Males	Females		
Under 1	836	414	422	1.89	0.98:1	880	437	443	1.90	0.99:1
1 – 4	3,440	1,769	1,671	7.76	1.06:1	3,684	1,889	1,795	7.97	1.05:1
5 – 9	4,362	2,213	2,149	9.84	1.03:1	4,232	2,183	2,049	9.16	1.07:1
10 – 14	4,152	2,160	1,992	9.36	1.08:1	4,203	2,154	2,049	9.10	1.05:1
15 – 19	4,011	1,990	2,021	9.04	0.98:1	4,138	2,156	1,982	8.95	1.09:1
20 – 24	4,052	2,063	1,989	9.14	1.04:1	4,043	2,093	1,950	8.74	1.07:1
25 – 29	4,299	2,139	2,162	9.69	0.99:1	3,893	1,952	1,941	8.42	1.001:1
30 – 34	3,823	1,955	1,868	8.62	1.05:1	3,930	1,968	1,962	8.50	1.003:1
35 – 3 9	3,236	1,633	1,603	7.30	1.02:1	3,531	1,821	1,710	7.64	1.06:1
40 – 44	2,668	1,355	1,313	6.02	1.03:1	2,927	1,483	1,444	6.33	1.03:1
45 – 49	2,220	1,142	1,078	5.01	1.06:1	2,509	1,303	1,206	5.43	1.08:1
50 – 54	1,854	886	968	4.18	0.92:1	2,007	1,028	979	4.34	1.05:1
55 – 59	1,534	733	801	3.46	0.92:1	1,770	847	923	3.83	0.918:1
60 – 64	1,227	556	671	2.77	0.83:1	1,429	666	763	3.09	0.873:1
65 – 69	903	395	508	2.04	0.78:1	1,117	477	640	2.42	0.745:1
70 – 74	697	281	416	1.57	0.68:1	735	304	431	1.59	0.705:1
75 – 79	467	175	292	1.05	0.60:1	566	210	356	1.22	0.589:1
80 years old & over	568	190	378	1.28	0.50:1	617	185	432	1.34	0.428:1
Total	**44,349**	**22,047**	**22,302**	**100.00**	**0.99:1**	**46,211**	**23,156**	**23,055**	**100.00**	**1.004:1**

Source: 2010 Census of Population and Housing (Philippine Statistics Authority, 2011)
2015 Census of Population and Housing (Philippine Statistics Authority, 2011)

Table 60 presents the available 2010 data of the sex and age-group disaggregated household population of Pulong Balibaguhan. Age group 25-29 comprised the majority (10.82%) of the population of the barangays in 2010, followed by those in the age groups 10-14 (10.17%) and 5-9 years (9.24%). There was an equal number of males and females. The ratio of males and females still remains true in Pulong Balibaguhan from the 2015 data, with males slightly higher the the females.

Table 60 - Household Population by Age Group and Sex, and Age Composition, and Sex Ratio: Pulong Balibaguhan, 2010

Age Group	2010 Population			Age Composition (%)	Sex Ratio
	Both Sexes	Males	Females		
Under 1	5	3	2	0.56	1.50:1
1 – 4	69	36	33	7.78	1.09:1
5 – 9	82	37	45	9.24	0.82:1
10 – 14	95	46	49	10.71	0.94:1
15 – 19	88	50	38	9.92	1.32:1
20 – 24	75	44	31	8.46	1.42:1
25 – 29	96	46	50	10.82	0.92:1
30 – 34	68	31	37	7.67	0.84:1
35 – 3 9	50	27	23	5.64	1.17:1
40 – 44	58	27	31	6.54	0.87:1
45 – 49	56	28	28	6.31	1:1
50 – 54	44	20	24	4.96	0.83:1
55 – 59	36	21	15	4.06	1.40:1
60 – 64	15	8	7	1.69	1.14:1
65 – 69	17	4	13	1.92	0.31:1
70 – 74	13	8	5	1.47	1.60:1
75 – 79	10	4	6	1.13	0.67:1
80 years old & over	10	3	7	1.13	0.43:1
Total	**887**	**443**	**444**	**100.00**	**1:1**

Source: 2010 Census of Population and Housing (Philippine Statistics Authority, 2011)

Table 61 - Population of impact barangay and by sex 2015

Name of Barangay	Population	Males	Females	Sex Ratio
Pulong Balibaguhan	973	496	477	1.04:1
Talaga East	1721	860	861	0.998:1

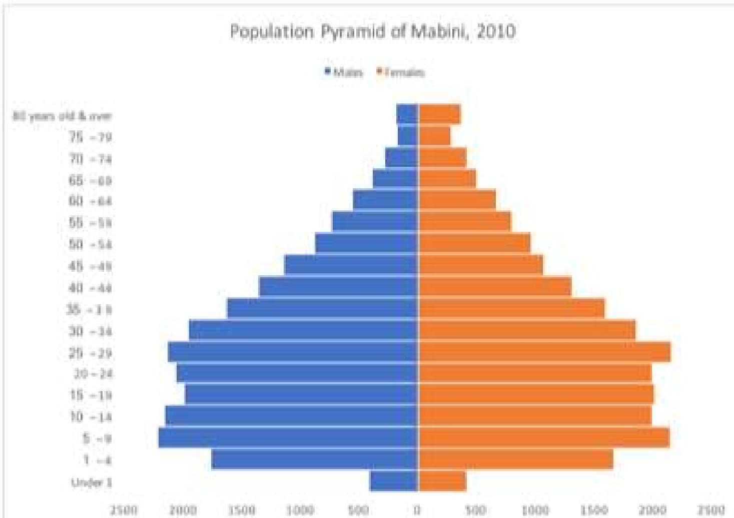
In Talaga East, the 2010 sex and age-group disaggregated household population shows that large number of population belongs to the age groups 25-29 years old (9.98%) and 30-34 years old (9.50%) It is also observed that females outnumbered males. Also, it is observed that females had higher life expectancy than men. Comparing with the available 2015 data, there are more males added to the population than the females, (from 830 to 860 males compared to 854 to 861 females by 2015) with the females still slightly outnumbering the males by 1 individual.

Table 62 - Household Population by Age Group and Sex, and Age Composition, and Sex Ratio: Talaga East, 2010

Age Group	2010 Population			Age Composition (%)	Sex Ratio
	Both Sexes	Males	Females		
Under 1	26	12	14	1.54	0.86:1
1 – 4	125	60	65	7.42	0.92:1
5 – 9	157	91	66	9.32	1.38:1
10 – 14	129	70	59	7.66	1.19:1
15 – 19	113	66	47	6.71	1.40:1
20 – 24	150	60	90	8.91	0.67:1
25 – 29	168	81	87	9.98	0.93:1
30 – 34	160	76	84	9.50	0.90:1
35 – 3 9	130	70	60	7.72	1.17:1
40 – 44	98	51	47	5.82	1.09:1
45 – 49	70	32	38	4.16	0.84:1
50 – 54	79	43	36	4.69	1.19:1
55 – 59	86	40	46	5.11	0.87:1
60 – 64	61	32	29	3.62	1.10:1
65 – 69	46	17	29	2.73	0.59:1
70 – 74	39	17	22	2.32	0.77:1
75 – 79	22	8	14	1.31	0.57:1
80 years old & over	25	4	21	1.48	0.19:1
Total	**1,684**	**830**	**854**	**100.00**	**0.97:1**

Source: 2010 Census of Population and Housing (Philippine Statistics Authority, 2011)

The population pyramid shows at a glance the distribution of the population in the impact areas. The shape of the pyramid generally reflects the pattern of fertility, mortality, and migration in the past. The population pyramid of Mabini presented in ***Figure 109*** is expansive wherein a very large portion of the population belongs to the younger age groups and the population of age 65 and above constitute a very small proportion of the total population. The Population Pyramid of the two (20 impact barangays, Pulong Balibaguhan and Talaga East, shares the form of the population pyramid of the municipality.



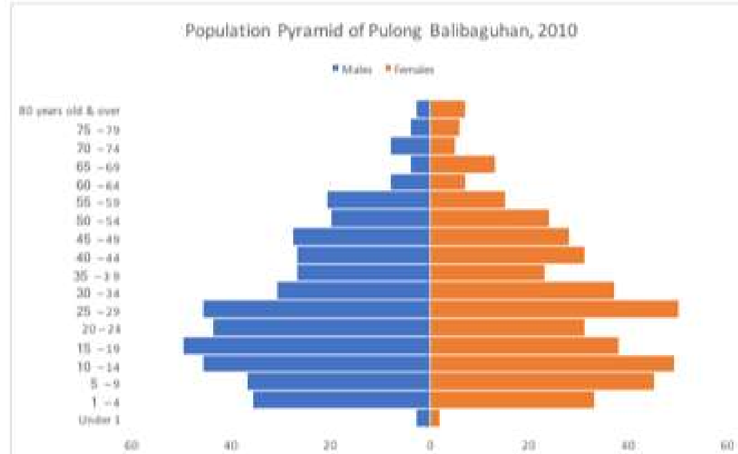


Figure 1. Population Pyramid of the Impact Areas, 2010

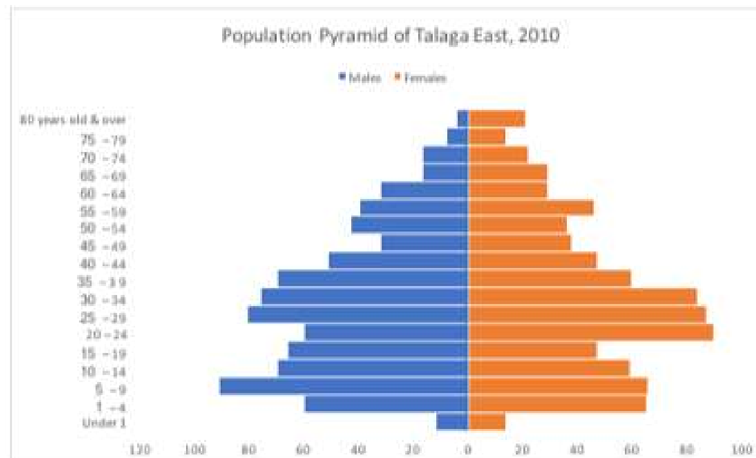


Figure 109 - Population Pyramid of the Impact Areas, 2010

In 2010, the young dependents (0 to 14 years) in the Municipality of Mabini comprised 28.8% of the household population while the old dependents (65 years and over) posted a share of 5.9%. The working-age population (15 to 64 years) accounted for the remaining 65.3%. The overall dependency ratio was 53, which indicates that for every 100 working-age population, there were about 53 dependents (44 young dependents and nine old dependents).

The dependency ratio for the impact barangays is presented in ***Table 63***. The two barangays had the same dependency ratio in 2010, which means that there were 51 dependents for every 100 working-age population.

Comparing with the available 2015 data in Mabini, there are more dependents in 2015 compared to 2010. There are 58 dependents for every 100 working age population in Mabini by 2015. This was due to the slight decrease in the population of ages 0-14, and a much bigger increase of the old dependent population (from 0.09 to 0.15).

Table 63 - Age Dependency Ratio of Impact Areas, 2010

Age Group	Mabini (2010)		Mabini (2015)		Pulong Balibaguhan (2010)		Talaga East (2010)	
	No.	Dependency Ratio	No.	Dependency Ratio	No.	Dependency Ratio	No.	Dependency Ratio
Working Age (15 and 64)	28,924		30,177		586		569	
Dependent Population	15,425	0.53:1	17,463	0.58:1	301	0.5 1:1	1,115	0.51:1
Young (0 - 14)	12,790	0.44:1	12,999	0.43:1	251	0.42:1	437	0.39:1
Old (65 and above)	2,635	0.09:1	4,464	0.15:1	50	0.09:1	132	0.12:1

Source: Computed based on 2010 Census of Population and Housing (Philippine Statistics Authority, 2011)

2.4.2.3 Population Distribution

The total population density in Mabini, considering the 46,211 inhabitants and the land area of 4,296 hectares, is almost eleven (11) persons per hectare of land. The two impact barangays are more densely populated than the municipality in the average. Barangay Talaga East has a population density of 31 persons per hectare of land while in Barangay Pulong Balibaguhan is 21 persons per hectare of land.

Table 64 - Population Density of Impact Areas, 2015

Area	2015 Population	Land Area (Hectares)	Population Density (No. of Persons per Hectare)
Municipality of Mabini	46,211	4,296	10.75
Barangay Pulong Balibaguhan	940	45.3295	20.73
Barangay Talaga East	1,716	54.5875	31.43

Sources: 2015 Census of Population (Philippine Statistics Authority, 2016)
2016-2025 Comprehensive Development Plan (Municipality of Mabini, 2016)

Table 65 presents that the average household size in the municipality of Mabini is 4.90, with the 48,628-total population and 9,924 number of households. The household size in Barangay Talaga is slightly lower than the municipal average while Barangay Pulong Balibaguhan is slightly higher.

Compared with the 2015 data, there are observed increase in both population and household number in all of the areas. However, the average member per household decreased from 4.9 to 4.6 in Mabini while it remains the same in the 2 impact barangays.

Table 65 - Number of Households and Average Household Size of Impact Areas

Area	2010 Population	2010 No. of Household	Average Household Member	2015 Population	2015 no. of Household	Average Household No.
Municipality of Mabini	44,349	9,097	4.9	46,211	9,924	4.6
Barangay Pulong Balibaguhan	887	177	5.0	973	194	5.01
Barangay Talaga East	1,684	363	4.6	1,843	400	4.6

2.4.2.4 Other Demographic Information

2.4.2.4.1 Ethnicity

The ethnic origins of the residents within the impact areas is presented in ***Table 66***. There were at least 26 ethnicities within the Municipality of Mabini. Majority (92.20%) of the residents in the municipality were Tagalogs. In the Barangay Pulong Balibaguhan, there were only four (4) ethnicities present and almost all (99.32%) are tagalogs. In Barangay Talaga East, 98.04% were tagalogs and there were other five (5) ethnicities present.

Table 66 - Ethnicity in the Impact Areas, 2010

Ethnicity	Municipality of Mabini		Barangay Pulong Balibaguhan		Barangay Talaga East	
	No.	%	No.	%	No.	%
Batangan	1,083	2.44	-	-	-	-
Bikol/Bicol	510	1.15	-	-	-	-
Bisaya/Binisaya	735	1.66	-	-	-	-
Boholano	11	0.02	-	-	-	-
Caviteño	21	0.05	-	-	-	-
Cebuano	167	0.38	-	-	1	0.06
Davaweño	13	0.03	-	-	-	-
Hiligaynon Ilonggo	113	0.25	2	0.23	-	-
Ifugao	14	0.03	2	0.23	-	-
Ilocano	133	0.30	-	-	-	-
Kapampangan	39	0.09	-	-	-	-
Masbateño/ Masbatenon	32	0.07	-	-	-	-
Pangasinan/ Panggalato	22	0.05	-	-	-	-
Romblomanon	51	0.11	-	-	-	-
Surigaonon	18	0.04	-	-	-	-
Tagabawa	27	0.06	-	-	3	0.18
Tagalog	40,888	92.20	881	99.32	1,651	98.04
Tagbanua	36	0.08	-	-	6	0.36
Tagbanua/ Calamian	48	0.11	-	-	22	1.13
Talaandig	28	0.06	-	-	1	0.06
Tausug	11	0.02	-	-	-	-
Waray	131	0.30	2		-	-
Zambageño-Chavacano	14	0.03	-	-	-	-

Ethnicity	Municipality of Mabini		Barangay Pulong Balibaguhan		Barangay Talaga East	
	No.	%	No.	%	No.	%
Other Local Ethnicity	174	0.39	-	-	-	-
American/ English	2	0.00	-	-	-	-
Other Foreign Ethnicity	28	0.06	-	-	-	-
Total	**44,349**	**100.00**	**887**	**100.00**	**1,684**	**100.00**

Source: 2010 Census of Population and Housing (Philippine Statistics Authority, 2011)

2.4.2.4.2 Marital Status

In 2010, of the household population 10 years old and over in the Municipality of Mabini, 50.47% were married while 40.14% were never married. The rest of the population were categorized as follows: widowed, 4.72%; common-law/live-in marital arrangement, 3.35%; divorced/separated, 1.23%.

Table 67 - Household Population 10 Years Old and Over by Marital Status and Sex: Mabini, 2010

Marital Status	*Both Sexes*		*Male*		*Female*	
	No.	*%*	*No.*	*%*	*No.*	*%*
Single	14,334	40.14	7,592	43.01	6,742	37.33
Married	18,025	50.47	8,999	50.98	9,026	49.98
Widowed	1,685	4.72	296	1.68	1,389	7.69
Divorced/Separated	440	1.23	160	0.91	280	1.55
Common-law/ Live in	1,195	3.35	593	3.36	602	3.33
Unknown	32	0.09	11	0.06	21	0.12
Total	**35,711**	**100.00**	**17,651**	**100.00**	**18,060**	**100.00**

Source: 2010 Census of Population and Housing (Philippine Statistics Authority, 2011)

Comparing the data from 2010 to 2015 (***Table 68***), the marital status have no dramatic change. The highest percentage of the household population 10 years and older are married (46%) while 41 percent of the age group are single. There are 4.95 percent that are widowed, 1.53% divorced and 6.39% are common-law or living in. There are more females that are widowed and divorced while there are more single and married males compared to females in 2015.

Table 68 - Household Population 10 Years Old and Over by Marital Status and Sex: Mabini, 2015

Marital Status	Both Sexes		Male		Female	
	No.	%	No.	%	No.	%
Single	15,499	41	8,303	44.5	7,196	38.3
Married	17,093	46	8,561	45.91	8,532	45.5
Widowed	1,854	4.95	356	1.90	1,498	7.98
Divorced/Separated	575	1.53	231	1.24	344	1.83
Common-law/ Live in	2,394	6.39	1,196	6.41	1,198	6.38
Total	37,415	**100.00**	18,647	**100.00**	18,768	**100.00**

Source: 2015 Census of Population and Housing (Philippine Statistics Authority, 2011)

In Barangay Talaga East married residents (54%) outnumbered the residents that were considered single (39.17%). Among the married persons, 55.17% were males while 52.89% were females. For the single marital status, the males outnumbered the females.

Table 69 - Household Population 10 Years Old and Over by Marital Status and Sex: Talaga East, 2010

Marital Status	*Both Sexes*		*Male*		*Female*	
	No.	*%*	*No.*	*%*	*No.*	*%*
Single	539	39.17	276	41.38	263	37.09
Married	743	54.00	368	55.17	375	52.89
Widowed	76	5.52	16	2.40	60	8.46
Divorced/Separated	11	0.80	4	0.60	7	0.99
Common-law/ Live in	7	0.51	3	0.45	4	0.56
Total	**1,376**	**100.00**	**667**	**100.00**	**709**	**100.00**

Source: 2010 Census of Population and Housing (Philippine Statistics Authority, 2011)

2.4.2.4.3 Highest Educational Attainment

The 2010 data from the entire municipality of Mabini showed that of the household population aged five (5) years and over, 32.25% had attended or completed elementary education, 36.09% had reached or finished high school, 8.9 percent were college undergraduates, and 13.67% were academic degree holders. Among those with an academic degree, the females (2,986) outnumbered the males (2,492). Similarly, more females (17) than males (10) had pursued post baccalaureate courses.

Table 70 - Household Population 5 Years Old and Over by Highest Educational Attainment and Sex: Mabini, 2010

Highest Educational Attainment	***Both Sexes***		***Male***		***Female***	
	No.	***%***	***No.***	***%***	***No.***	***%***
No Grade Completed	803	2.00	399	2.01	404	2.00
Preschool	1,344	3.35	690	3.47	654	3.24
Elementary	12,924	32.25	6,393	32.18	6,531	32.32
High School	14,462	36.09	7,347	36.99	7,115	35.21
Post-Secondary	1,318	3.29	717	3.61	601	2.97
College Undergraduate	3,549	8.86	1,734	8.73	1,815	8.98
Academic Degree Holder	5,478	13.67	2,492	12.55	2,986	14.78
Post Baccalaureate	27	0.07	10	0.05	17	0.08
Not Stated	168	0.42	82	0.41	86	0.43
Total	**40,073**	**100.00**	**19,864**	**100.00**	**20,209**	**100.00**

Source: 2010 Census of Population and Housing (Philippine Statistics Authority, 2011)

The 2015 data likewise showed that in terms of educational attainment of 5 years and older in Mabini, majority of the age group are studying in Highschool (41.04%) followed by those in elementary (29.45%). However, 1.8 % have no grade completed, 2.7% are in preschool, 2.56 are in post-secondary level, 9.66 are college undergraduate, and 12.6% are academic degree holders. Access to education for both males and females are equal with more females attaining post-secondary, college undergraduate and even academic degrees. Compared to males.

Table 71 - Household Population 5 Years Old and Over by Highest Educational Attainment and Sex: Mabini, 2015

Highest Educational Attainment	**Both Sexes**		**Male**		**Female**	
	No.	**%**	**No.**	**%**	**No.**	**%**
No Grade Completed	752	1.8	390	1.87	362	1.74
Preschool	1,143	2.7	556	2.67	587	2.82
Special Education	17	0.00	13	0.000	4	0.000
Elementary	12,268	29.45	6,211	29.82	6,057	29.10
High School	17,092	41.04	8,954	42.99	8,138	39.09
Post-Secondary	1,068	2.56	509	2.44	559	2.69
College Undergraduate	4,022	9.66	1,896	9.10	2,126	10.21
Academic Degree Holder	5,247	12.6	2,287	10.98	2,960	14.22
Post Baccalaureate	38	0.000	14	0.000	24	0.001
Not Stated	-	-	-	-	-	-

Highest Educational Attainment	Both Sexes		Male		Female	
	No.	%	No.	%	No.	%
Total	**41,647**	**100**	**20,830**	**100**	**20,817**	**100**

Source: 2010 Census of Population and Housing (Philippine Statistics Authority, 2011)

In 2010 in Barangay Pulong Balibaguhan, majority of the residents (29.89%) five (5) years and older has reached or completed high school education. This was followed by the number of elementary level or graduates (26.69%). It is observed that there were more males (51%) who are college undergraduates than females (45), but more females (96) were academic degree holders than males (87).

Table 14 - Household Population 5 Years Old and Over by Highest Educational Attainment and Sex: Pulong Balibaguhan, 2010

Highest Educational Attainment	Both Sexes		Male		Female	
	No.	%	No.	%	No.	%
No Grade Completed	15	1.85	3	0.74	12	2.93
Preschool	27	3.32	13	3.22	14	3.42
Elementary	217	26.69	105	25.99	112	27.38
High School	243	29.89	128	31.68	115	28.12
Post-Secondary	32	3.94	17	4.21	15	3.67
College Undergraduate	96	11.81	51	12.62	45	11.00
Academic Degree Holder	183	22.51	87	21.53	96	23.47
Total	**813**	**100.00**	**404**	**100.00**	**409**	**100.00**

Source: 2010 Census of Population and Housing (Philippine Statistics Authority, 2011)

The same with Barangay Talaga East, most of the residents (37.31) ages five (5) years old and above attended or graduated high school. There was an equal number of population (286) among males and females who reached or completed high school education. A lone female resident was recorded to have attained post baccalaureate studies.

Table 72 - Household Population 5 Years Old and Over by Highest Educational Attainment and Sex: Talaga East, 2010

Highest Educational Attainment	Both Sexes		Male		Female	
	No.	%	No.	%	No.	%
No Grade Completed	25	1.63	13	1.72	12	1.55
Preschool	36	2.35	18	2.37	18	2.32
Elementary	422	27.53	216	28.50	206	26.58

Highest Educational Attainment	Both Sexes		Male		Female	
	No.	%	No.	%	No.	%
High School	572	37.31	286	37.73	286	36.90
Post-Secondary	43	2.80	24	3.17	19	2.45
College Undergraduate	97	6.33	45	5.94	52	6.71
Academic Degree Holder	337	21.98	156	20.58	181	23.35
Post Baccalaureate	1	0.07	0	0.00	1	0.13
Total	**1,533**	**100.00**	**758**	**100.00**	**775**	**100.00**

Source: 2010 Census of Population and Housing (Philippine Statistics Authority, 2011)

2.4.2.4.4 Disability

According to the Philippine Statistics Authority, disabilities may be physical, mental, or sensory motor impairment such as partial or total blindness, low vision, partial or total deafness, oral defect, having only one hand or no hands, one leg or no leg, mild or severe cerebral palsy, retarded, mentally ill, mental retardation, and multiple impairment.

In 2010, around 1.4% (or 639 persons) of the 44,349 - household population of the municipality of Mabini had disability, the biggest proportion came from the working-age population of 15-64 years age group (62.91). This number was not considered in computing for the dependency ratio.

Table 73 - Household Population with Disability by Age Group and Sex: Mabini, 2010

Age Group	Both Sexes		Male		Female	
	No.	%	No.	%	No.	%
Below 15	120	18.78	65	20.83	55	16.82
15 -64	402	62.91	197	63.14	205	62.69
64 and Above	117	18.31	50	16.03	67	20.49
Total	**639**	**100.00**	**312**	**100.00**	**327**	**100.00**

2010 Census of Population and Housing (Philippine Statistics Authority, 2011)

In the case of Pulong Balibaguhan, 1.8% of the 2010 household population had disability. Large number of household population with disability belong to the working-age group (10). The same number of persons with disability (3) were registered for the young and old dependent household population.

Table 74 - Household Population with Disability by Age Group and Sex: Pulong Balibaguhan, 2010

Age Group	Both Sexes		Male		Female	
	No.	%	No.	%	No.	%
Below 15	3	18.75	2	25.00	1	12.50
15 -64	10	62.50	5	62.50	5	62.50
64 and Above	3	18.75	1	12.50	2	25.00
Total	**16**	**100.00**	**8**	**100.00**	**8**	**100.00**

Source:2010 Census of Population and Housing (Philippine Statistics Authority, 2011)

For Talaga East, a very minimal percentage was considered with disability, which is 0.47% of the 2010 household population or only five (5) residents. Most belong to the working-age population followed by the old dependent population with ages 64 and above.

Table 75 - Household Population with Disability by Age Group and Sex: Talaga East, 2010

Age Group	*Both Sexes*		*Male*		*Female*	
	No.	*%*	*No.*	*%*	*No.*	*%*
Below 15	1	12.50	0	12.50	1	0.00
15 -64	5	62.50	4	62.50	1	80.00
64 and Above	2	25.00	1	25.00	1	20.00
Total	**8**	**100.00**	**5**	**100.00**	**3**	**100.00**

Source: 2010 Census of Population and Housing (Philippine Statistics Authority, 2011)

2.4.2.4.5 Housing

In the municipality of Mabini last 2010, almost three-fourths (73.04%) of the housing units were built on their own lots or being amortized. Moreover, 13.23% of the households occupied lots which were rent-free but with consent of the owner, 6.24% rented the lots that they occupied while 0.13% occupied lots which were rent-free but without consent of the owner.

The 2015 data showed no significant change from 2010. 71.42 percent of the household owned or amortized their houses, about 2 percent less than in 2010 while 6.24 percent rents their homes which is almost the same in 2010. There is an increase of rent free with consent of owner to 19.16 percent from 13.23 percent in 2010. There is also a slight increase in the number of informal settlers

Table 76 - Number of Households by Tenure Status of the Lot: Mabini, 2010 and 2015

Tenure Status of Lot	***2010***		***2015***	
	Number of Housing Units	***%***	***Number of Housing Units***	***%***
Owned/being amortized/owner-like	6,943	73.04	7,109	71.42
Rented	593	6.24	617	6.20
Rent-free with consent of owner	1,258	13.23	1,907	19.16
Rent-free without consent of owner	12	0.13	50	0.50
Not reported	56	0.59	271	2.72
Not applicable	644	6.77	-	-
Total	**9,506**	**100.00**	9,954	**100.00**

Source: 2010 Census of Population and Housing (Philippine Statistics Authority, 2011)
2015 Census of Population and Housing (PSA 2018)

In 2010, majority of the households (80.87%) in Barangay Pulong Balibaguhan lived in housing units built on lots that they owned or amortized. Also, 12.57% rented the lots that they occupied and 3.28% rented for free with consent of the owner.

Table 77 - Number of Households by Tenure Status of the Lot: Pulong Balibaguhan, 2010

Tenure Status of Lot	***Number of Housing Units***	***%***
Owned/being amortized/owner-like	148	80.87
Rented	23	12.57
Rent-free with consent of owner	6	3.28
Rent-free without consent of owner	0	0.00
Not reported	0	0.00
Not applicable	6	3.28
Total	**183**	**100.00**

Source: 2010 Census of Population and Housing (Philippine Statistics Authority, 2011)

The same case was observed in Barangay Talaga East. Most of the housing units (82.51%) were built within the lots owned or being amortized by the households. Only about 3% rented the lot and about 10% rented for free with consent of the owner.

Table 78 - Number of Households by Tenure Status of the Lot: Talaga East, 2010

Tenure Status of Lot	*Number of Housing Units*	*%*
Owned/being amortized/owner-like	316	82.51
Rented	11	2.87
Rent-free with consent of owner	36	9.40
Rent-free without consent of owner	0	0.00
Not reported	0	0.00
Not applicable	20	5.22
Total	**383**	**100.00**

Source: 2010 Census of Population and Housing (Philippine Statistics Authority, 2011)

The data from 2010 showed that the occupied housing units in the municipality of Mabini have outer walls and roofs made of strong materials. Majority or 6,316 housing units had outer walls made of concrete/brick/stone. Also, greater majority or 8,353 had roofs made of galvanized iron/ aluminum. There was still quite a number of housing units with outer walls made from bamboo/sawali/cogon/nipa (1,023), while there were houses that used cogon/nipa/anahaw as roofing materials (603).

Comparing with the 2015 data on occupied housing units in Mabini, there is an increase in outer walls and roofs made by durable and strong materials. There is an increase of concrete walls from 6,316 in 2010 to 6,732 in 2015 while there are decrease of wood, half concrete/half wood, galvaized iron and bamboo or sawali as materials of outer walls in their homes. The same is true in terms of roofing materials. There are significant increase in galvanized iron/aluminum, tile concrete/clay tile, half galvanized iron and asbestos while there is decrease in cogon/nipa/anahaw as roofing materials of their homes.

Table 79 - Occupied Housing Units by Construction Materials of the Road and Outer Walls: Mabini, 2010

Construction Materials of the Outer Walls	**Total Occupied Housing Units (2010)**	**Total Occupied Housing Units (2015)**
Concrete/ Brick/ Stone	6,316	6,732

Construction Materials of the Roof	**Total Occupied Housing Units(2010)**	**Total Occupied Housing Units(2015)**
Galvanized Iron/ Aluminum	8,353	8,532

Construction Materials of the Outer Walls	Total Occupied Housing Units (2010)	Total Occupied Housing Units (2015)
Wood	745	640
Half Concrete/ Brick/ Stone/ Half Wood	1,482	1,407
Galvanized Iron/ Aluminum	37	19
Bamboo/ Sawali/ Cogon/ Nipa	1,023	890
Asbestos	0	-
Glass	5	-
Makeshift/ Salvaged/ Improvised Materials	93	42
Trapal		15
Others	9	1
No Walls	1	
Not Reported	30	11
Total	**9,741**	9,757

Construction Materials of the Roof	Total Occupied Housing Units(2010)	Total Occupied Housing Units(2015)
Tile Concrete/ Clay Tile	83	99
Half Galvanized Iron and Half Concrete	349	586
Wood	274	-
Cogon/ Nipa/ Anahaw	603	444
Asbestos	1	2
Makeshift/ Salvaged/ Improvised Materials	78	43
Trapal	-	45
others	-	1
Not reported	-	5
Total	**9,741**	**9,757**

Source: 2010 Census of Population and Housing (Philippine Statistics Authority, 2011)
2015 Housing tables by city and municipalities (Philippine Statistics Authority, 2011)

Large number of housing units in Barangay Pulong Balibaguhan were also constructed using durable materials. The 149 occupied housing units had concrete/ brick/ stone materials for outer walls. While, galvanized iron/ aluminum roofs were installed in 152 housing units.

Table 80 - Occupied Housing Units by Construction Materials of the Road and Outer Walls: Pulong Balibaguhan, 2010

Construction Materials of the Outer Walls	Total Occupied Housing Units	Construction Materials of the Roof	Total Occupied Housing Units
Concrete/ Brick/ Stone	149	Galvanized Iron/ Aluminum	152
Wood	3	Tile Concrete/ Clay Tile	11
Half Concrete/ Brick/ Stone/ Half Wood	18	Half Galvanized Iron and Half Concrete	9
Galvanized Iron/ Aluminum	4	Wood	3
Bamboo/ Sawali/ Cogon/ Nipa	7	Cogon/ Nipa/ Anahaw	6
Asbestos	0	Asbestos	0
Glass	0	Makeshift/ Salvaged/ Improvised Materials	2
Makeshift/ Salvaged/ Improvised Materials	2	**Total**	**183**
Total	**183**		

Source: 2010 Census of Population and Housing (Philippine Statistics Authority, 2011)

In Talaga East, most of the housing units also had outer walls made from concrete/brick/stone (226). There were 119 housing units with half concrete/brick/stone or half wood as outer walls materials. It was observed however, that 31 housing units still used bamboo/sawali/cogon/nipa as their outer walls. In terms of roofing materials, most housing units were made from galvanized iron/aluminum (232).

Table 81 - Occupied Housing Units by Construction Materials of the Road and Outer Walls: Talaga East, 2010

Construction Materials of the Outer Walls	Total Occupied Housing Units	Construction Materials of the Roof	Total Occupied Housing Units
Concrete/ Brick/ Stone	226	Galvanized Iron/ Aluminum	232
Wood	1	Tile Concrete/ Clay Tile	1
Half Concrete/ Brick/ Stone/ Half Wood	119	Half Galvanized Iron and Half Concrete	114
Galvanized Iron/ Aluminum	1	Wood	12

Construction Materials of the Outer Walls	Total Occupied Housing Units
Bamboo/ Sawali/ Cogon/ Nipa	31
Asbestos	0
Glass	0
Makeshift/ Salvaged/ Improvised Materials	0
Others	0
No Walls	0
Not Reported	5
Total	**383**

Construction Materials of the Roof	Total Occupied Housing Units
Cogon/ Nipa/ Anahaw	24
Total	**383**

Source: 2010 Census of Population and Housing (Philippine Statistics Authority, 2011)

2.4.2.5 Migration Pattern

2.4.2.5.1 Out-Migration

Out-migrants from the municipality of Mabini were mostly Overseas Filipino Workers (OFW). In the 2010 Census of Population and Housing, out of 35,711 household population 10 years and over 16.88% or 6,029 were overseas workers. Male overseas workers (3,108) outnumbered their female counterparts (2,921). Overseas workers aged 45 years and over made up the largest age group, comprising 24.33% of the total overseas workers from this municipality in 2010, followed by the age groups 30 to 34 years (16.64%), 35 to 39 years (16.25%), and 25 to 29 years (15.48%).

Table 82 - Overseas Workers 10 Years Old and Over by Age Group and Sex: Mabini, 2010

Age Group	Both Sexes		Male		Female	
	No.	%	No.	%	No.	%
Below 20	357	5.92	180	5.79	177	6.06
20-24	537	8.91	278	8.94	259	8.87
25-29	933	15.48	471	15.15	462	15.82
30-34	1,003	16.64	538	17.31	465	15.92
35-39	980	16.25	540	17.37	440	15.06
40-44	752	12.47	392	12.61	360	12.32
45 and over	1,467	24.33	709	22.81	758	25.95
Total	**6,029**	**100.00**	**3,108**	**100.00**	**2,921**	**100.00**

Source: 2010 Census of Population and Housing (Philippine Statistics Authority, 2011)

Highest Grade/Year Completed and Sex	Total Overseas Workers	Age Group						
		Below 20	20 - 24	25 - 29	30 - 34	35 - 39	40 - 44	45 and over

Overseas workers in Barangay Pulong Balibaguhan was comprised of 64 persons from the 2010 household population. This was 8.76% of the total population of 10 years and over. Statistics of male (33) overseas workers was slightly higher that females (31). Similar to the data from the municipality the 45 and above age-group occupied the highest number of OFWs in the barangay.

Table 83 - Overseas Workers 10 Years Old and Over by Age Group and Sex: Pulong Balibaguhan, 2010

Age Group	Both Sexes		Male		Female	
	No.	%	No.	%	No.	%
Below 20	0	0.00	0	0.00	0	0.00
20-24	1	1.56	1	3.03	0	0.00
25-29	16	25.00	8	24.24	8	25.81
30-34	3	4.69	1	3.03	2	6.45
35-39	10	15.63	6	18.18	4	12.90
40-44	7	10.94	4	12.12	3	9.68
45 and over	27	42.19	13	39.39	14	45.16
Total	**64**	**100.00**	**33**	**100.00**	**31**	**100.00**

Source: 2010 Census of Population and Housing (Philippine Statistics Authority, 2011)

Most of the out-migrants from Barangay Talaga East were OFWs. In 2010, there were 273 OFWs which is almost 20% of the household population of 10 years old and over in 2010. Of these number 140 persons were males and 133 were females. The most number of OFWs were ages 45 years old and above (24.91%).

Table 84 - Overseas Workers 10 Years Old and Over by Age Group and Sex: Talaga East, 2010

Age Group	Both Sexes		Male		Female	
	No.	%	No.	%	No.	%
Below 20	5	1.83	5	3.57	0	0.00
20-24	17	6.23	7	5.00	10	7.52
25-29	39	14.29	18	12.86	21	15.79

Age Group	Both Sexes		Male		Female	
	No.	%	No.	%	No.	%
30-34	51	18.68	26	18.57	25	18.80
35-39	53	19.41	32	22.86	21	15.79
40-44	40	14.65	25	17.86	15	11.28
45 and over	68	24.91	27	19.29	41	30.83
Total	**273**	**100.00**	**140**	**100.00**	**133**	**100.00**

Source: 2010 Census of Population and Housing (Philippine Statistics Authority, 2011)

The municipality of Mabini, through the Community-Based Monitoring System (CBMS) survey, determined the highest educational attainment of the recorded OFWs in 2009. Data from the entire municipality shows that most of the OFWs (46.51) were college graduates or had attended college education. In Barangay Pulong Balibaguhan, most of the OFWs (41.94) had graduated or attended Secondary Education while in Talaga East majority were college level or academic degree holders.

Table 85 - Highest Educational Attainment of OFWs from the Impact Areas

Highest Educational Attainment	Municipality of Mabini		Barangay Pulong Balibaguhan		Barangay Talaga East	
	No.	%	No.	%	No.	%
Elementary Level	576	9.07	0	0.00	17	5.54
Secondary Level	2,288	36.01	65	41.94	123	40.07
Tertiary Level	2,955	46.51	50	32.26	167	54.40
Total	**6,353**	**100.00**	**155**	**100.00**	**307**	**100.00**

Source: 2016-2025 Comprehensive Development Plan (Municipality of Mabini, 2016)

Included in the 2009 CBMS survey was the country of destination of the OFWs. The most common overseas workplaces or migration destination were Middle East, European Countries, Asian Countries, United States of America (USA) and others. It was recorded that majority of the residents sought overseas work or migrated in European Countries. The most common destination in Europe were Rome and Italy (Municipality of Mabini, 2016).

Table 86 - Place of Work or Migration of OFWs within the Impact Areas

Country	Municipality of Mabini	Barangay Pulong Balibaguhan	Barangay Talaga East
Middle East	645	18	27
European Countries	2,584	64	217

Country	Municipality of Mabini	Barangay Pulong Balibaguhan	Barangay Talaga East
Asian Countries	276	7	17
U.S.A	251	15	2
Other Countries	597	11	44
Total	**6,353**	**115**	**307**

Source: 2016-2025 Comprehensive Development Plan (Municipality of Mabini, 2016)

There were also known out-migrants that chose to work in other municipality, provinces, or regions within the country to find work, livelihood, or additional income (Municipality of Mabini, 2016).

2.4.2.5.2 In-Migration

As discussed in the 2016-2025 Comprehensive Development Plan (CDP) of the municipality, records of in-migration were obtained through the CBMS survey conducted in 2009. The results showed that 8 % of the total population are in-migrants for the last five (5) years. These include those population who migrated into a barangay of the municipality in the last five years. These are the population whose original residences are from the barangays within the municipality; from municipalities within the province; and from provinces in different regions of the country who transferred from there and settle permanently in the municipality. National Capital Region or Metro Manila Areas, being the transition area for in- migration in the country, is also a major original residence of in-migrants in the municipality. Most of the in-migrants come from the Luzon Areas or provinces of Regions I-V. In- migrants from Luzon constitute about 41 % of the total in-migrant population.

In Barangay Talaga East, Luzon was also recorded high as origin of in-migrants. About 30% of the in-migrants came from Cordillera Administrative Region and/or Regions I to V. The next most number of in-migrants came from other barangays of Mabini (27.52%).

There were no recorded in-migration in Barangay Pulong Balibaguhan from 2004-2009.

Table 87 - No. of In-Migrants and Original Place of Residence for the last Five Years, 2009

Place of Origin	Municipality of Mabini		Barangay Talaga East	
	No.	%	No.	%
From other Barangays of Mabini	397	14.60	30	27.52
From other Town of Batangas	657	24.15	17	15.60

Place of Origin	*Municipality of Mabini*		*Barangay Talaga East*	
	No.	*%*	*No.*	*%*
National Capital Region (Metro-Manila)	294	10.81	5	4.59
Luzon Provinces (CAR, Regions I-V)	1,120	41.18	32	29.36
Visayas Provinces (Regions VI-VIII)	221	8.13	3	2.75
Mindanao Provinces (Regions XI-XIII	31	1.14	2	1.83
Total	**2,720**	**100.00**	**109**	**100.00**

Source: 2016-2025 Comprehensive Development Plan (Municipality of Mabini, 2016)

2.4.3 Availability of Public Services

2.4.3.1 Health and Sanitation

There are thirteen (13) medical facilities/establishments offering medical health services in the municipality. These consist of the Municipal Health Office (MHO) or the Rural Health Unit (RHU), two (2) Barangay Health Stations; three (3) Medical Clinics; two (2) Private General Hospitals; four (4) Private Dental Clinics; and one (1) Private Optical Clinic.

The MHO is manned by the Municipal Health Officer, a licensed doctor and surgeon; a Dentist, licensed dentist and assigned to the MHO by the Provincial Health Office; three (3) nurses; one (1) medical technologist; one (1) administrative assistant; six (6) midwives including one (1) detailed from the Provincial Health Office; one (1) Sanitary Inspector; one (1) dental aide; and one (1) day care worker. There are currently two (2) personnel whose nature of appointment are casual and job order. There are also four (4) registered nurses assigned to the MHO under the Nurses Deployment Program of the Department of Health.

Practitioners in the different private medical health clinics and hospitals offering medical services to the population augments and provides the medical services required by the population. These private practitioners consist of the following: ten (10) doctors/physicians; four (4) dentists; and one (1) ophthalmologist.

The leading causes of morbidity and mortality in the Municipality of Mabini for the year 2012 as gathered from the Municipal Health Office are presented in the following tables.

Table 88 - Ten Leading Causes of Morbidity, 2012

Causes of Morbidity	*No. of Cases*	*%*
1. Acute Upper Respiratory Infection	810	36.00

Causes of Morbidity	No. of Cases	%
2. Pneumonia	683	30.00
3. Dermatitis	131	5.80
4. Hypertension	130	5.70
5. Acute Tonsillitis	122	5.00
6. Diarrhea	95	4.00
7. Wound	85	3.70
8.PTB	75	3.30
9. Asthma	68	3.00
10. Vertigo	66	2.90

Source: 2016-2025 Comprehensive Development Plan (Municipality of Mabini, 2016)

Table 89 - Ten Leading Causes of Mortality, 2012

Causes of Mortality	No. of Cases	%
1. Cancer of All Kinds	22	32.00
2. Pneumonia	20	28.00
3. Stroke	7	9.80
4. Renal Failure	6	8.40
5. Cerebrovascular Disease	5	7.00
6. Hypertension	5	7.00
7. Respiratory Tuberculosis	2	2.80
8. Asthma	2	2.80
9. Enteric Fever	1	1.40
10. Septicemia	1	1.40

Source: 2016-2025 Comprehensive Development Plan (Municipality of Mabini, 2016)

Programs and projects being implemented by the MHO are as follows:

- Obstetrical Services;
- Maternal and Child Care
- Control of Diarrheal Diseases;
- Control of Acute Respiratory Infection;
- Family Planning
- Nutrition Program: Supplemental Feeding to 2nd and 3rd Degree Malnourished Children;
- Control of Communicable and Non-Communicable Diseases;
- Control of Cardio Vascular Diseases;
- Cancer Program Awareness and Prevention;

- Diabetic Program;
- Dental Health Services;
- Environmental Health and Sanitation;
- Primary Health Care;
- Health Education; and
- Medico-Legal Services.

The 2013 report on toilet facilities of the households within the municipality showed that there are 231 out of 7,798 households inspected in all barangays are without toilets. This constitutes about 3 % of the total households inspected.

In terms of Solid Waste Management, the municipality has an open dumpsite located at the back of the municipal hall at Barangay Poblacion. Currently, the dumpsite is inadequate to accommodate the wastes generated by the whole municipality. A Materials Recovery Facility is established in Barangay Pulong Niogan where waste segregation, recycling, and composting are being undertaken. In 2014, the wastes estimated to be generated by the total population are 9,092,902 kilograms. These require a sanitary landfill with an area of 41,331 square meters or 4.1331 hectares including the additional 50 % of areas for landfill for daily cover, roads, receiving areas, fencing and other facilities. The municipality is looking for a possible site to be acquired to develop as sanitary landfill.

2.4.3.2 Education

School-age population ages 5-22 years old comprising of kindergarten (5); elementary level (6–12); secondary level or high school (13–16) and tertiary level or college (17-22) total to 16,394 constituting about 34 % of the total population. Kindergarten pupils constitute 6 % of the total school age population. Elementary level pupils are about 40 % of the total school-age population and secondary level or high school students are 33 % of the total. Tertiary level or college students constitute 21 % of the total school-age population. Of the total school-age population, 50.01 % are males and 49.99 % are females. The sex ratio is 1:1.

Table 90 - School-Going Age Population Composition by School-Age, 2014

Age Group	Both Sexes	Male		Female		Sex Ratio
		No.	%	No.	%	
Kindergarten (5)	957	487	50.00	479	50.00	.99:1
Elementary (6-12)	6,556	3,278	50.00	3,278	50.00	1:1
Secondary (13-16)	5,335	2,667	49.99	2,668	50.01	.99:1

Age Group	Both Sexes	Male		Female		Sex Ratio
		No.	%	No.	%	
Tertiary (17-21)	3,545	1,773	50.01	1,772	49.99	1:1
Total	**16,394**	**8,199**	**50.01**	**8,195**	**49.99**	**1:1**

Source: 2016-2025 Comprehensive Development Plan (Municipality of Mabini, 2016)

There is a total of 27 schools in the municipality. These schools include: 4 private elementary schools offering nursery, kindergarten and elementary grades I to VI studies; 18 public elementary schools offering kindergarten and grades I to VI; 3 public national/municipal high schools and 1 private high school offering secondary level courses; and 1 private tertiary level school offering both secondary level studies and collegiate level courses of studies.

One (1) Public National High School is situated within Pulong Balibaguhan, the Anselmo A. Sandoval Memorial National High School (AASMNHS). The facilities present in this school are HE/TLE Room, Library, Clinic, Computer Corner/Room, Recreation Areas/Audiovisual Room, Administrative Office/s, and Canteen. Based on the minimum standards of Department of Education, the AASMNHS will still need to establish the following facilities: Workshop Room; Science Laboratory; Playground/ Basketball Court; and Guidance Office.

According to the 2016-2025 Comprehensive Development Plan of the Municipality of Mabini, all the school buildings of private pre-elementary and elementary schools are made of concrete construction materials and all are in good condition. In public elementary schools, existing school buildings generally need repair and improvement. Some are already dilapidated and are for condemnation and/or demolition.

There are a total of 8,463 enrolled pupils and students in all schools in the municipality. Of this number, 5,339 or 63 % are enrolled in elementary level; 2,956 or 35 % are in secondary level or high school; and 168 or 2 % are in tertiary level or collegiate level.

The elementary level is comprised of 44 pupils in the nursery level; 755 pupils in kindergarten and 4,540 pupils in grades I to VI. Sex ratio is 1.08:1

For the secondary level, there are 2,956 students enrolled in the secondary level or junior and senior high school students constituting about 35 % of the total number of enrolled pupils and students. Male / female ratio is 1.04:1 meaning for every 104 males there are 100 females.

A total of 168 students are enrolled in the tertiary collegiate level courses at the Mabini College of Batangas (MCB) the lone tertiary level institution of learning in the municipality. Male students are 29 while females are 139 with a ratio of .20:1. This means that there are 20 males for every 100 females or for every 1 male there 5 females. College students constitute about 2 % of the total number of enrolled pupils and student within the municipality.

Table 91 - Enrollment by Level, By Sex, 2013-2014

Level	**Enrollment**			
	Both Sexes (percent)	**Male**	**Female**	**Sex Ratio**
Nursery	44	19	25	.76:1
Kindergarten	755	394	361	1;1.09
Elementary	4,540	2,359	2,142	1:1.08
Elementary Level Sub-Total	5,339 (63%)	2,772	2,567	1.08:1
Secondary Level	2,956 (35%)	1,510	1,446	1.04:1
Tertiary Level	168 (2%)	29	139	.20:1
GRAND TOTAL	**8,463 (100%)**	**4,311**	**4,152**	**1.03:1**

Source: 2016-2025 Comprehensive Development Plan (Municipality of Mabini, 2016)

Referring to the information presented in Table 90, there is a total school-age population of 16,394 or 34 % of the total population. This population group is consisting of 957 children aged 5 years old intended for kindergarten level; 6,556 children aged 6-12 years old intended for elementary level; 5,335 teen-agers aged 13-16 years old intended for secondary level; and 3,545 young adults aged 17-21 years intended for tertiary level.

Over-all enrollment participation rate is about 52 % of the total school-age population. For each of the educational levels, the enrollment participation rate is as follows: 79 % for kindergarten level, 81 % for elementary level; 55 % for secondary or high school level and 5 % for tertiary or collegiate level.

It was assumed that about 5 % of the school-age population are enrolled in schools outside of the municipality particularly in Bauan, Batangas City and Lipa City within the province and even as far as Metro Manila. Elementary and secondary level pupils and students are mostly enrolled in schools within the province. Tertiary level or college students are mostly enrolled in both provincial and Metro Manila colleges and universities.

Two major private elementary schools: Lady Fatima Montessori School (LFMS) and Sta. Fe Integrated School (SFIS) offer nursery courses for children aged below 5 years old. Four (4) teachers and 3 classrooms are assigned in the said level of which, there are 2 teachers in each school and 2 classrooms in LFS and 1 classroom in SFIS. For the nursery level teacher-pupil ratio is 1:11 and classroom-pupil ratio is 1:15. The existing ratios in both schools are well within the standard of 40 pupils under 1 teacher in a classroom.

Kindergarten level of study or course is offered in both private and public schools. Over-all respective ratios are: teacher-pupil ratio, 1:29 and classroom-pupil ratio is 1:126. The existing Teacher-Pupil ratio is within the standard. However, there is a need to augment the Classroom-Pupil ratio. The backlog is traced from the public schools offering kindergarten classes. There are no specific classrooms assigned for the Public School's kindergarten classes. The classes are being held in any spare or available classroom of the schools. There is a need for the provision of separate and specific rooms for the kindergarten levels in all public schools.

Elementary grades I to VI are also being offered in both private and public elementary schools. Teachers and classrooms for the use of the elementary pupils are 199 and 192 respectively which gives the teacher-pupil ratio of 1:23 and classroom-pupil ratio of 1:24 which is compliance with the set standards.

Private and Public Secondary Schools are present in the Municipality. The total number of teacher at the secondary level is 100. Over-all teacher-student ratio is 1:30 and classroom-student ratio is 1:38. The data is also within the set standards od Department of Education.

Table 92 - School Level, By No. of Teachers, No. of Classrooms and Existing Ratios, 2013-2014

Level	*No. of Teachers*	*Teacher-Pupil Ratio*	*No. of Classrooms*	*Classroom-Pupil Ratio*
Nursery	4	1:11	3	1:15
Kindergarten	26	1:29	6	1:126
Elementary (Grades I-VI)	199	1:23	192	1:24
Elementary Level Sub-Total	229	1:23	201	1:26
Secondary Level	100	1:26	78	1:38

Source: 2016-2025 Comprehensive Development Plan (Municipality of Mabini, 2016)

Based on the assessment of the Municipality of Mabini (Municipality of Mabini, 2016), the current over-all enrollment participation rate is low at only 53 % of the total school-age population. In order to address the gap, the municipality made projections on School-Age Population, set the target Enrollment Participation Rate (EPR) to get the Projected Enrollment and determined the future requirement of schools for ten (10) years covering the school years from 2015-2016 to 2024-2025. For the future requirements in terms of teachers and classrooms, the standard of 40 pupils or students under 1 teacher in 1 classroom was adopted.

For kindergarten level, the enrollment participation rate of 80 % will be increased up to 100 % within the ten (10) year period from school year 2014-2015 to 2024-2025. With the current EPR for kindergarten level of 80 %, the remaining 20 % will be programmed to increase for the next ten years with an annual increase of about 2 %. In terms of future requirements for the next ten years, there should be a total of 28 teachers and 28 classrooms for the kindergarten level of education. With the existing number of teachers for the kindergarten level of 26 for both private and public schools, additional number of teachers within the planning period is 2. In terms of classrooms, kindergarten classes of public schools share with the classrooms for the elementary pupils on an interval or schedule of classes' strategy. There are no permanent classrooms assigned for kindergarten classes only. Thus, the total required number of classrooms for the public school-kindergarten level is 22.

Table 93 - Projected Enrollment in Kindergarten (Pre-Elementary) Level and Future Requirements for School Years 2014-2015 to 2024-2025

School Year	Projected School-Age Population (5 Years Old)	Percent (%) Target for Enrollment	Projected Enrollment	Total Future Requirements	
				Teachers	Classrooms
2015-2016	972	82 %	797	19	19
2016-2017	990	84 %	832	20	20
2017-2018	1,009	86 %	868	21	21
2018-2019	1,027	88 %	904	22	22
2019-2020	1,046	90 %	941	23	23
2020-2021	1,065	92 %	980	24	24
2021-2022	1,085	94 %	1.020	25	25
2022-2023	1,105	96 %	1,061	26	26
2023-2024	1,125	98 %	1,102	27	27
2024-2025	1,146	100 %	1,146	28	28

Source: 2016-2025 Comprehensive Development Plan (Municipality of Mabini, 2016)

For the elementary level, with 71% EPR, the remaining 29 % of the school-age population aged 6-12 years old must be enrolled by school year 2024- 2025. Thus, an annual additional EPR of about 3 % of the total population of children of said age bracket will be targeted within the 10 school years. The total requirements are 191 teachers and same number of classrooms by the end of the planning period. With the existing number of 199 teachers and 192 classrooms for both private and public schools, there are no additional requirements for teachers and classrooms by the end of the planning period in schoolyear 2024-2025.

Table 94 - Projected Enrollment in Elementary Level and Future Requirements SY 2015-2025 to SY 2024-2025

School Year	Projected School Age Population 6 - 12 Years Old	% Target for Enrollment	Projected Enrollment	Total Future Requirements	
				Teachers	Classrooms
2015-2016	6,552	74.00	4,848	121	121
2016-2017	6,668	77.00	5,134	128	128
2017-2018	6,786	80.00	5,428	135	135
2018-2019	6,906	83.00	5,731	143	143
2019-2020	7,028	86.00	6,044	151	151
2020-2021	7,153	89.00	6,366	159	159
2021-2022	7,280	92.00	6,697	167	167
2022-2023	7,409	95.00	7,038	175	175
2023-2024	7,541	98.00	7,390	184	184
2024-2025	7,675	100.00	7,675	191	191

Source: 2016-2025 Comprehensive Development Plan (Municipality of Mabini, 2016)

Secondary or high school level enrollment has an EPR of 56 % during the current school year. An EPR of 85 % for these teen-agers will be targeted within the 10-year period. With the K-12 scheme being implemented by the Department of Education, the affected populations are those aged 13-16 for school year 2014- 2015 and 2015-2016; population aged 13-17 for school years 2016-2017 and population aged 13-18 from school year 2017-2018 up to the tenth year, school year 2024-2025. The target EPR of 85 % by the tenth year, school year 2024-2025 will mean annual additional EPR of about 3 % of the annual total population aged 13-18 for the next ten years.

For the secondary or high school level, projected enrollment is 5,418 by school year 2024-2025. These will require a total of 135 teachers and classrooms by the same period. With the present number of secondary level or high school teachers of 100 and 78 classrooms, additional requirements are 35 teachers and 57 classrooms within the planning period.

Table 95 - Projected Enrollment in Secondary Level and Future Requirements for SY 2014-2015 to 2023-2024

School Year	Projected School Age Population 13-18 Years Old	%	Projected Enrollment	Total Future Requirements	
				Teachers	Classrooms
2015-2016	5,425	60.00	3,255	81	81
2016-2017	5,523	63.00	3,479	87	87
2017-2018	5,623	66.00	3,711	92	92
2018-2019	5,725	69.00	3,950	98	98
2019-2020	5,829	72.00	4,196	105	105
2020-2021	5,935	75.00	4,451	111	111
2021-2022	6,042	78.00	4,712	117	117
2022-2023	6,151	81.00	4,982	124	124
2023-2024	6,262	83.00	5,197	130	130
2024-2025	6,375	85.00	5,418	135	135

Source: 2016-2025 Comprehensive Development Plan (Municipality of Mabini, 2016)

Other needs identified by the Municipality (Municipality of Mabini, 2016):

1. Knowledge and skills upgrading of existing teachers and non-teaching personnel of private and public schools. Self-help or self-initiated continuing education for individual teachers should be encouraged and assisted. Scholarships for teachers in these endeavors should be extended. Conduct of seminar-workshops/trainings for upgrading knowledge and teaching skills of teachers should be organized by the District Office with assistance from the Local School Board. Attendance to seminar-workshops/training organized by DepEd, National Office and other education oriented non-governmental organizations must also be encouraged by the District Office and the Local School Board.

2. Maintenance, Repair, Improvement of School Buildings, Classrooms and Provision of Complete School Facilities. there is a need for the provision and completion of all school facilities in the public elementary schools. Continuous repair and improvement of school buildings and classroom at the public elementary schools must also be considered.

2.4.4 Social Welfare

Delivery of social welfare services in the municipality is ensured through the Municipal Social Welfare and Development Office (MSWDO). The Office is manned by five (5) personnel consisting of two (2) social welfare officers, one (1) welfare aide and two (2) day care workers. Complementing the municipal government staff are the officers and members of volunteer groups supporting specific programs and officers and members of associations of beneficiaries of specific programs being implemented by the MSWDO. Volunteers and beneficiaries include Day Care Workers, Barangay Nutrition Scholars, Senior Citizens, Persons with Disability, Women's Organizations and other groups.

Below are the list of Social Welfare Programs and Projects being implemented in the municipality:

- Family Community Welfare Program
  - Community Assistance: Distribution/Renewal of PhilHealth ID Cards
  - NHTS-PR (Pantawid Pamilya Pilipino Program)
  - Livelihood Trainings
  - Family Case Work: Family members needing psychological, clinical and medical intervention to appropriate agencies.
  - Pre-Marriage Counselling Service (PMC)
  - Solo Parent Act: Provision of certificate to Single Parent to avail of the benefit cited in RA 8972
- Child and Youth Welfare Program
  - Day Care Service Program
  - Minor Applying for Clearances to Travel Abroad
  - Minors Special Case (Case Management Conference)
- Emergency Assistance Program
- Program for PWDs and Elderly Persons
- Women Welfare Program: Orientation on Anti-Violence Against Women to couples
- Nutrition Program

2.4.4.1 Peace and Order

The peace and order in the municipality is being maintained mainly by the Mabini PNP Force. The station is located adjacent to the Municipal Hall. It occupies and area of 256 square meters or .0256 hectares. The municipal jail occupies and area of about 20.25 square meters having a dimension 4.5 by 4.5 meters. The Mabini PNP has a police force of 27 policemen. Of these number of policeman, ten (10) are assigned to manage traffic at the municipal streets and portions of the national roads traversing the municipality. As to vehicles and equipment, the PNP station has three (3) patrol cars and two (2) MCs which are all in good condition.

The Barangay Tanods in all barangays and the private investigation and security agencies operating in the commercial and industrial establishments in the municipality also provide protective services to the municipality. These groups assist and support the PNP in the delivery of protective services assuring peace and order in the municipality. There are 296 barangay tanods in all barangays of the municipality averaging 8 per barangay. The three (3) barangays with the highest number of barangay tanods with 15 each are: Anilao Proper, Ligaya and Poblacion. The barangay with the lowest number of tanods is Sta. Ana with only 4 members.

The peace and order situation in the municipality is generally peaceful and orderly. However, crime incidence, still occur though minimal, in every barangay of the municipality. Of the 34 barangays, 27 barangays were reported with crime incidence in 2013. Barangays with no crime incidence reported were Laurel, Ligaya, Mainit, Malimatoc I, Nag-Iba, Pilahan and Sto. Niño.

Specific to the crime incidence within the impact barangays, seven (7) cases of RA No. 9165 otherwise known as The Dangerous Drugs Act were recorded in 2013 at Pulong Balibaguhan. While in Barangay Talaga East, three (3) cases of Alarm and Scandal were recorded.

2.4.4.2 Public Utilities and Infrastructure

2.4.4.2.1 Water Supply Services

The 2009 CBMS survey results showed that 87.53 % of the total households have access to safe drinking water.

Water supply services in the municipality are being provided by the Mabini Water District and the individual barangay waterworks systems. The Mabini Water District provides water supply services to 44 % of the total households in the municipality and 52 % of the total households in the 26 barangays being served. The capacity of the source of water being supplied by the Mabini Water District is 62,630 cubic liters per month. For those barangays not served by the Mabini Water District, other sources of water such as: individual deepwells, barangay spring development projects or small scale waterworks system provide for the water supply needs of the population.

In 2013, 229 households in Barangay Pulong Balibaguhan are being served by the Mabini Water District while 244 households in Talaga East received water services from the same provider (Municipality of Mabini, 2016).

2.4.4.2.2 Power Supply Services

Batangas Electric Cooperative II (BATELEC II) provides the power supply to all households in the municipality. All households or 100 % of the households availed the power supply services of the said electric cooperative. There are established Barangay Power Associations (BAPA) in some barangays of the municipality which serve as management group for the provision of electric power services in the barangays. The BAPAs are mini-electric cooperatives in the barangays. Power, however, are connected and provided by the BATELEC II facility in the municipality.

2.4.4.2.3 Communication Facilities

All forms of telecommunications media and facilities are available in the municipality. Electronic communication facilities such as cellsites are present in the municipality. These are owned, operated and maintained by the different telecommunication companies (telcos) such as Globe Telecom, Smart Communications, Inc. and Digitel. Thus, about 85 % of the total population are with landline telephone connections, cellphones, and computers: desktops, laptops and notebooks and others state-of the art telecommunications gadgets.

Mass media forms such as television channels can be monitored from the municipality. National television channels are clearly watched in the municipality. Other high frequency channels both local and international channels are made available through cable services also available in the municipality.

Newsprint media in the form of newspapers of both local and national circulation are available in the municipality. Local newspaper produced in the province at Batangas City and Lipa City are available. Newspapers of national circulation such as Inquirer, Manila Bulletin and Philippine Star are available. Tabloids and magazines are also being sold in newsstands.

Postal mail services are being provided by PhilPost.

2.4.4.2.4 Transport Facilities

The main mode of transportation within the municipality are tricycles. It is used to convey commuters to and from the urban barangays of Poblacion, Anilao Proper and Talaga East to all barangays of the municipality. Transportation need of the residents from the municipality to Batangas City and vice-versa is being provided by the Mabini Jeepney Operators and Drivers Association (MAJODA). Member jeepneys can also be hired for other routes on special arranged trips to any point of Batangas province, Metro Manila and to any point of Luzon. There are other jeepney transport organizations covering and operating in some barangays.

In the coastal areas of the municipality, boats are being used as transport facility. There are ninety-two (92) fishing vessels of three (3) tonnage and below registered in the municipality. A total of sixty-seven (67) dive boats catering to tourists/divers along the Balayan Bay dive sites are registered in the municipality. Three (3) motorized bancas/fishing boats are registered.

2.4.4.2.5 Port Facilities

The ports facilities in the municipality consist of one (1) passenger ports owned and managed by the municipal government; one (1) inter-island passenger port administered by the Philippine Ports Authority, a national government agency; one (1) port support facility for oil exploration of the Philippine National Oil Corporation (PNOC), a national government agency and four (4) industrial ports owned and managed by the existing private industrial establishments. There are also improvised jetties or landing spaces/planks improvised by boatmen from Tingloy ferrying passengers to and from Mabini to Tingloy and vice-versa.

One of the four (4) industrial ports is the Holcim-Mabini port facility situated within Barangay Pulong Balibaguhan.

In Barangay Talaga East, an improvised port or jetty is being assembled to accommodate passenger ferryboats from Municipality of Tingloy.

2.4.4.2.6 Road Network System

The whole municipality is traversed by 149.873 kilometers of road network providing access to the whole municipality and its barangays. The road network is composed of national roads with a total length of 34 kilometers; provincial road, 1 kilometer; municipal roads of 3.288 kilometers and barangay roads of 111.585 kilometers. With the current population of 47,749 total road density is 319 persons per one (1) kilometer. Considering the width of existing roads, the total land area occupied by these roads is 121.5814 hectares.

The Mabini Circumferential Road passing thru the western coastal tourism barangays to the southeastern and eastern barangays towards the Poblacion areas of the municipality is an extension of the national road. It is the circumferential backbone of the total road network of the municipality. This road is about fully completed, operational and serviceable. The following table shows breakdown of this network by administration, location, length, pavement, and condition of roads.

Table 96 - Road Network in the Municipality of Mabini

Type of Road by Administration	*Location*	*Length (in kilometers)*	*Pavement*	*Condition of Roads*
A. National Roads	23 barangays	34.000	Concrete	Very Good Condition
B. Provincial Road	Barangay Sampaguita	1.00	Concrete with Asphalt Overlay	Very Good Condition
C. Municipal Roads	Poblacion and Pulong Niogan	3.288	Concrete	Very Good Condition
D. Barangay Roads	All barangays	111.585	Concrete and Earthfill	Good Condition
Total		149.873		

Source: 2016-2025 Comprehensive Development Plan (Municipality of Mabini, 2016)

There are eleven (11) bridges in the municipality. These bridges connect national and barangay roads. The locations and numbers of bridges in the barangays are as follows: San Juan, (1); Mainaga, (2); Solo,(1); Malimatoc I, (2); Gasang (1); Talaga Proper (2); and Talaga East (2). These are mostly of boxed culvert type, about 3-5 meters long and are concrete.

2.4.5 Socioeconomic Information

2.4.5.1 Main Sources of Income and Sources of Livelihood

Referring to the results of the 2009 Community-Based Monitoring Survey of the municipality. Of the total household surveyed, 22.73% were engaged in wholesale/ retail trading. These economic activities include mainly sari-sari stores, small scale groceries that deals on household items as well as livestock and poultry needs.

The second (2nd) economic activity most households were engaged in was livestock/ poultry raising, with 21.22% of the total household surveyed.

Engaging in construction work activities was the third (3rd) economic activity in the municipality. Most male and some females who are members of the labor force and households work as foremen, skilled and unskilled laborers in construction projects. Construction projects include residential buildings; commercial establishments such as resorts, beach houses, stores, groceries and the like, and industrial firms such as warehouses, factories, plants and seaports: piers and wharves.

The fourth (4th) most common economic activity in the municipality is related to transportation, communication, & storage. Transportation is the main economic activity among the three activities mentioned that is engaged in by most households. This is due to the presence of trucks, vans, public utility jeepneys and tricycles providing transport services within the barangays, inter-barangays, within the municipality, inter-municipality, within the province and even up to Metro Manila. These are owned and operated by households engaged in said business. Courier and brokerage services are also available to facilitate transfer of funds, goods and materials from Overseas Filipino Workers (OFWs) to the members of the families/households left behind in the barangays.

Specifically, in Barangay Pulong Balibaguhan, surveyed households are mostly engaged in wholesale/ retail trading (22.22%) followed by construction work activities, then transportation, communication, & storage (18.52%).

While in Barangay Talaga East, almost half of the households that were surveyed are engaged also in wholesale/ retail trading (46.25%). This was followed by transportation, communication, & storage at 16.25%. Livestock/ Poultry farming and construction related activities were the third (3rd) most common economic activity in Barangay Talaga East with each having 8.75% of the total household surveyed.

Table 97 - Economic Activities Engaged in By Households

Economic Activity	***Municipality of Mabini***		***Barangay Pulong Balibaguhan***		***Barangay Talaga East***	
	No. of Households	***%***	***No. of Households***	***%***	***No. of Households***	***%***
Crop Farming	226	5.58	2	7.41	2	2.50
Livestock/ Poultry	860	21.22	1	3.70	7	8.75

Economic Activity	***Municipality of Mabini***		***Barangay Pulong Balibaguhan***		***Barangay Talaga East***	
	No. of Households	***%***	***No. of Households***	***%***	***No. of Households***	***%***
Fishing	266	6.56	0	0.00	1	1.25
Forestry	64	1.58	0	0.00	1	1.25
Wholesale/ Retail	921	22.73	6	22.22	37	46.25
Manufacturing	92	2.27	3	11.11	3	3.75
Community, Social & Personal Services	219	5.40	0	0.00	5	6.25
Transportation, Communication, & Storage	571	14.09	5	18.52	13	16.25
Construction	696	17.18	6	22.22	7	8.75
Mining	23	0.57	0	0.00	0	0.00
Other Activities	114	2.81	4	14.81	4	5.00
Total	**4,052**	**100.00**	**27**	**100.00**	**80**	**100.00**

Source: 2016-2025 Comprehensive Development Plan (Municipality of Mabini, 2016)

2.4.5.2 Employment Profile

The Service Sector (Tertiary) employed most in 2012-2013. Employment in tertiary or service industries constitutes 53.20 % of the total employment. Primary industries and tertiary industries have employment percentage of 23.34 % and 23.46 %, respectively. Employment wise, tertiary industries can be considered as the prime mover of the general economy of the municipality.

Table 98 - Number of Employment by Economic Activity, 2012-2013

Economic Activities	***Employment (No. of Warm Bodies)***	***%***
Primary (Extractive Industries)	***2,378***	***23.34***
A. Agriculture (Crop Farming and Livestock and Poultry Raising)	1,589	15.60
B. Fishing	766	7.52
C. Mining and Quarrying (including Forestry)	23	0.87
Secondary (Manufacturing Industry)	***2,390***	***23.46***
D. Manufacturing (Bakeries, Flour Milling, Smelting)	689	6.76
E. Electricity, Gas, Water Supply	167	1.64

Economic Activities	***Employment (No. of Warm Bodies)***	***%***
F. Construction: Building Construction	1,534	15.06
Tertiary (Services)	***5,418***	***53.20***
G. Wholesale and Retail Trade	1,121	11.00
H. Hotels and Restaurants (Eateries and Resorts)	522	5.12
I. Transport, Storage & Communication	1,129	11.08
J. Financial Intermediation	150	1.50
K. Real Estate, Leasing, Rental & Business Activities	157	1.54
L. Other Community, Social and Personal Service Activities including Public Administration and Defense (L); Education (M); and Health and Social Work (N)	2,339	22.96
TOTAL	**10,186**	**100.00**

Source: 2016-2025 Comprehensive Development Plan (Municipality of Mabini, 2016)

2.4.5.3 Poverty Incidence

Based on the 2012 Official Poverty Statistics published by PSA, poverty incidence in the province of Batangas increased from 2006, to 2009, and to 2012. The recorded poverty incidence in Batangas in 2012 was 14.7%, it is lower than the national average which was 19.7%. It was also observed that the magnitude of poor families and population continuously increased from the three survey periods. The Annual per Capita Poverty Threshold increased in 2012 with Php 19,437.00 compared to the value during 2006 (Php 13,360.00) and 2009 (Php 17,360.00). The value for the province of Batangas was higher than the Annual Per Capita Poverty Threshold for the whole country which is Php 18,935.00. Poverty threshold is the minimum income required for a family/individual to meet the basic food and non-food requirements (Philippine Statistics Authority, 2013).

Table 99 - Comparative Poverty Statistics of Batangas Province: 2006, 2009, 2012

Indicators	***Year***		
	2006	***2009***	***2012***
Poverty Incidence Among Population (%)	10.9	12.6	14.7
Magnitude of Poor Population	301,261	374,373	452,808
Magnitude of Poor Families	49,739	62,889	80,551
Annual per Capita Poverty Threshold (in Pesos)	13,735	17,360	19,437

Source: 2012 Full Year Official Poverty Statistics (Philippine Statistics Authority, 2013)

2.4.5.4 Business and Commercial Establishment

Table 100 presents the list of registered establishments with issued business permits and license to operate from the Office of the Mayor. The total number of establishments/industries in the municipality is 2,649. Of these numbers 1,449 or 54.70 % are classified Primary Industries; 46 or 1.74 & are Secondary Industries and 1,154 or 43.56 % are Tertiary Industries. In terms of number of establishments/industries primary industries has the highest number.

Table 100 - Number of Business Establishments in the Municipality of Mabini, 2014

Business Establishment and Economic Activities	*No. of Establishment*	*%*
Primary (Extractive Industries)	***1,449***	***54.70***
A. Agriculture (Crop Farming and Livestock and Poultry Raising)	888	33.52
B. Fishing	495	18.68
C. Mining and Quarrying (including Forestry)	66	2.5
Secondary (Manufacturing Industry)	***46***	***1.74***
D. Manufacturing (Bakeries, Flour Milling, Smelting)	22	0.83
E. Electricity, Gas, Water Supply	3	0.11
F. Construction: Building Construction	21	0.80
Tertiary (Services)	***1,154***	***43.56***
G. Wholesale and Retail Trade	728	27.48
H. Hotels and Restaurants (Eateries and Resorts)	147	5.55
I. Transport, Storage & Communication	38	1.43
J. Financial Intermediation	18	0.68
K. Real Estate, Leasing, Rental & Business Activities	17	0.64
L. Other Community, Social and Personal Service Activities including Public Administration and Defense (L); Education (M); and Health and Social Work (N)	206	7.78
TOTAL	**2,649**	**100.00**

Source: 2016-2025 Comprehensive Development Plan (Municipality of Mabini, 2016)

2.4.6 <u>Perception Survey</u>

A perception survey for the direct impact barangay was conducted on March 2017. The survey was focused on Barangay Pulong Balibaguhan, the host barangay of Holcim-Mabini. Purposive sampling technique was used in the perception survey. The respondents were identified as the most useful representatives of the community for the study: Sangguninang Barangay members and officers, Barangay Health Workers, Purok Leaders, and Sectoral/People Organizations and representatives. A total of 41 respondents/households were surveyed, almost achieving 90% level of confidence and 10% margin of error based on 177 total number of households. The survey form used is attached as ***Annex Q***

2.4.6.1 Profile of Survey Respondents

Gender. Majority of the respondents are females with 85.37% of the total 41 respondents. Males comprise 14.63% of the total respondents.

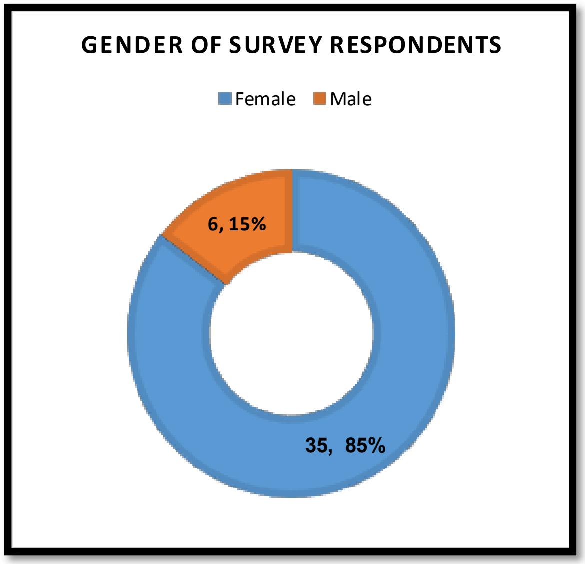


Figure 110 - Gender of Respondents

Age. shows the age distribution of the respondents. The most number of respondents belongs to the 51 – 60 age bracket with 31.71%. This was followed by age bracket 31 – 40 (24.39%) and 41 – 50 (21.95%). Older age groups 61 – 70 and 71 - above were 9.76% and 4.88% of the respondents, respectively.

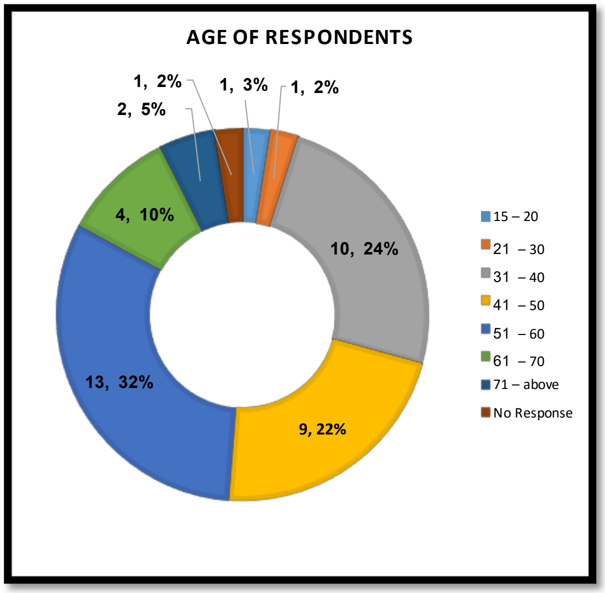


Figure 111 - Age of Respondents

Birthplace. Majority of the respondents were born in the impact barangay. There were 19% of them whom were born from other provinces and 12% from other municipalities in Batangas.

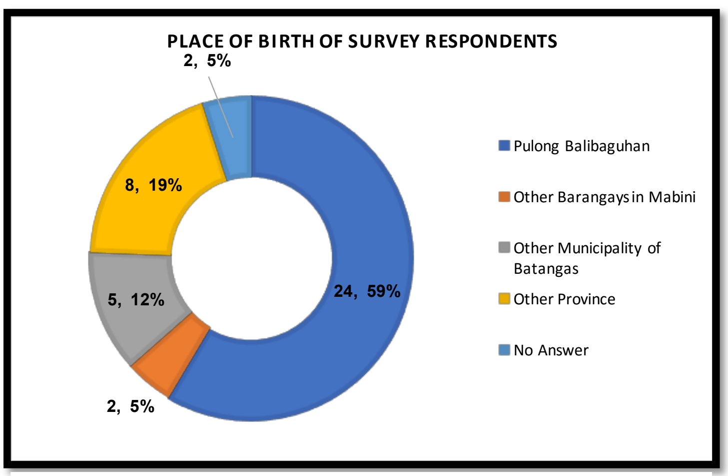


Figure 112 - Birthplace of Respondents

Civil Status. Most of the respondents were married with 76% of the total respondents. There were 15% who were single. There were 7% separated from their partners and 2% widowed.

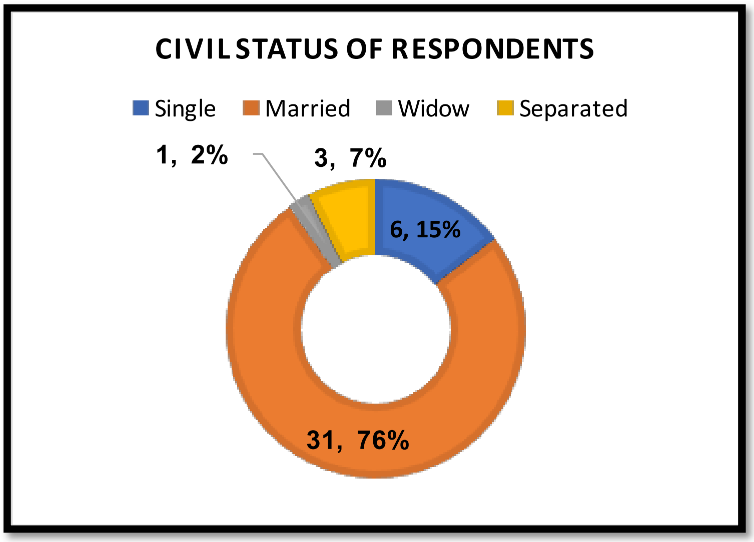


Figure 113 - Civil Status of Respondents

Religion. The Religion of almost all of the respondents (40) or 98% were Catholics. One of the respondents refused to divulge its religious affiliation.

Educational Attainment. Majority of the respondents were college graduates (32%), followed by those who have reached high school education but were not able to complete level (22%) and there were 17% of them who took college courses.

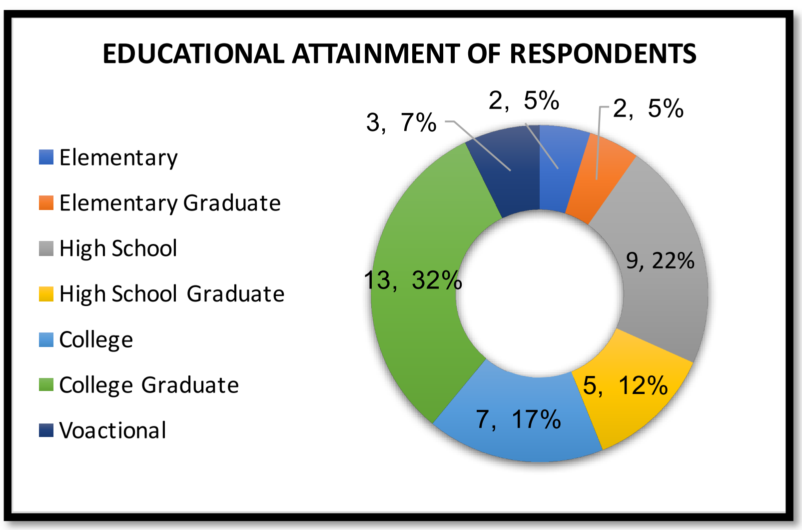


Figure 114 - Highest Educational Attainment of Respondents

Settlement History. Almost a quarter (22%) of the respondents have been in the barangay for 51 to 60 years. The same percentage of respondents also stayed in the barangay for 31 to 40 years. There were 14% who have been in the barangay for 21 to 30 years and 12% have stayed for 11 to 20 years.

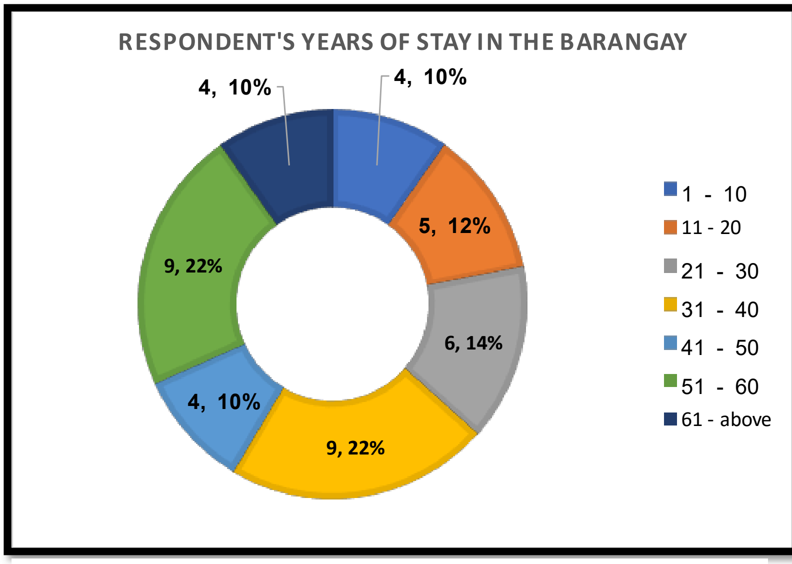


Figure 115 - Settlement History of the Respondents

Income Sources. There were 21 respondents (51%) who were employed during the conduct of the survey. Most of them were employed in government offices (33.33%) followed by those who were engaged in business (23.81%). Similar statistics, (14.29%) were gathered for those who are employed in private company/corporations and those who were engaged as workers/laborers. A single respondent replied who sourced income from farming activities.

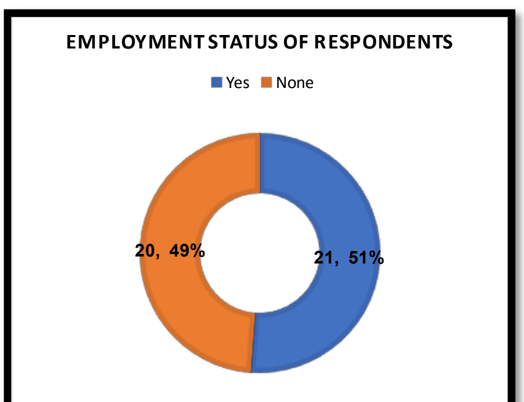


Figure 116 -- Employment Status of Respondents

Table 101. Income Sources of Respondents

Income Sources	No.	%
Farming	1	4.76
Government Employment	7	33.33
Private Company Employment	3	14.29
Business	5	23.81
Worker/Laborer	3	14.29
Others	2	9.52
Total	**21**	**100.00**

Monthly Income. Majority of the respondents (33%) who were employed or have sources of income had an estimated monthly income of Php 5,001 to 10,000. There were 19% who were earning Php 15,001 to 20,000 and the same percentage were earning less than Php 1,000.00.

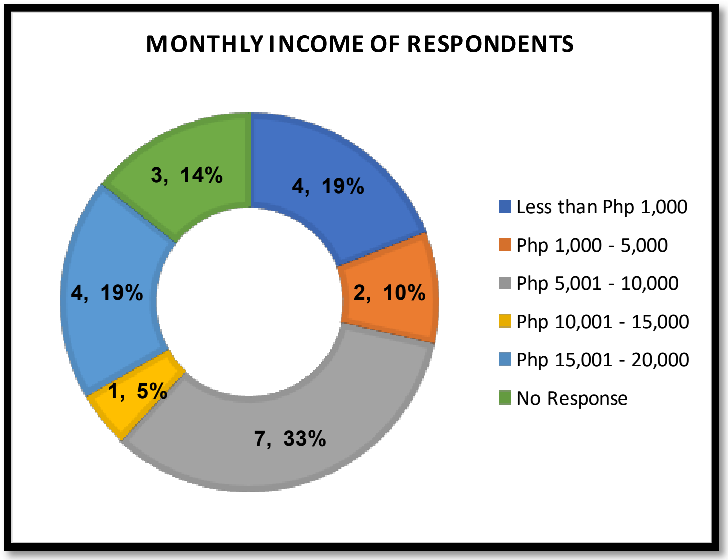


Figure 117 - Monthly Income of Respondents

2.4.6.2 Household Information

Household Size. Most of the respondents (32%) belong to 3 to 4 household size followed by those who had 5 to 6 household size (27%). Twenty percent (20%) of the respondents belong to a relatively small household size of 1 to 2. Two (2) respondents who belong to 1 to 2 household size had non-relative household members while one (1) respondent belonging to a 5 to 6 household size also had non-relatives staying with them.

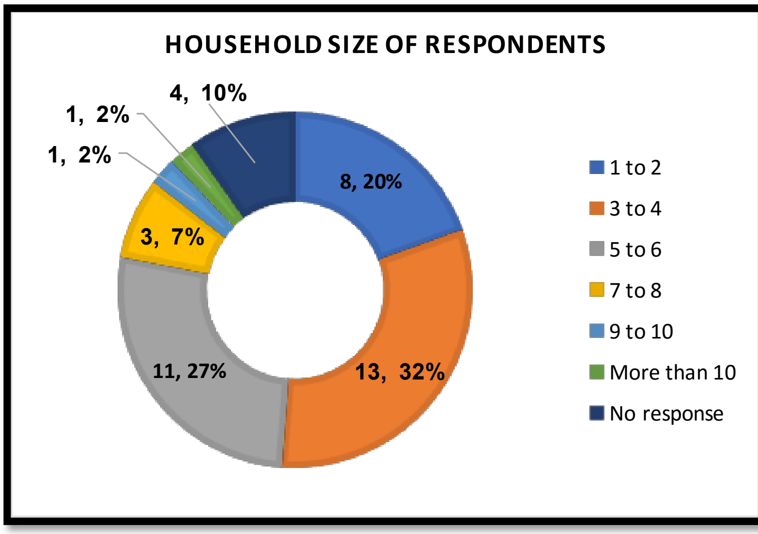


Figure 118 - Household Size of Respondents

2.4.6.3 Housing Condition

House Ownership. Majority of the respondents (81%) own the house where they are staying and only 17% do not own the house that they occupy. More than half (56%) personally spent for the construction of their houses.

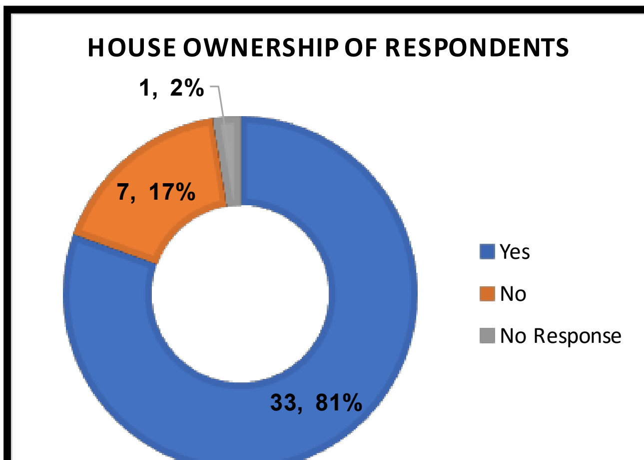


Figure 119 - House Ownership of the Respondents

Housing Materials. Most of the respondents (81%) used the combination of cement and galvanized iron/ aluminum as outer wall and roofing materials for their houses. Others also used wood and bamboo combined with cement and galvanized iron/aluminum.

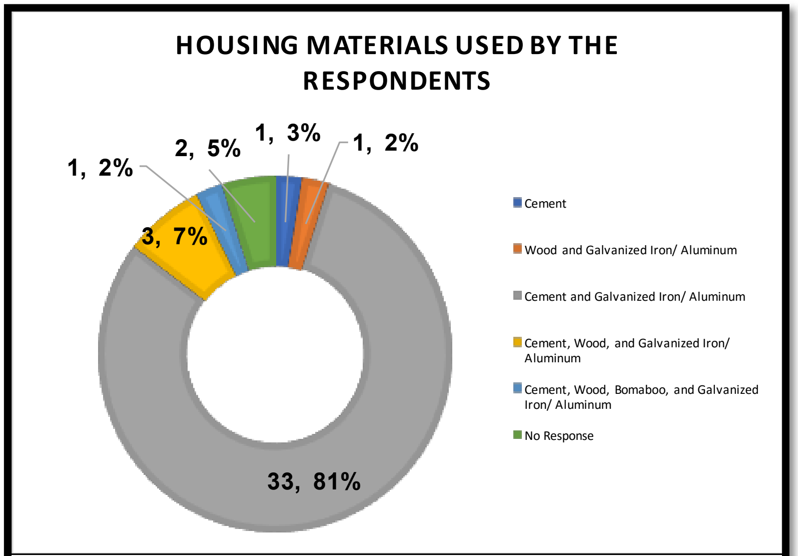


Figure 120 - Housing Materials used by the Respondents

2.4.6.4 Community Problems and Concerns

Table 102 presents the perceived problems of the respondents in Barangay Pulong Balibaguhan. Most of the responses identified the Lack of Livelihood Support (28.99%) as the main problem in the barangays. Lack of support for schooling (13.04%), Unemployment (11.59%), and Lack of Medical Supplies and Equipment (10.14%) were also identified as major concerns. Problems were also perceived in the Lacking Support to Train People's Organizations, Lack of Water for Irrigation, Poverty, and Lack of Recreational Facilities. The need to orient and train residents on Solid Waste Management was also identified. Concerns on the Lack of Small Business Capital, Air Pollution, and Inaccessibility to Clean and Drinking Water were also raised.

Table 102 - Perceived Community Problems and Concerns

Community Problems	No. of Responses*	Percentage	Rank
Unemployment	8	11.59	3rd
Limited teachers	1	1.45	8th
Insufficient support for schooling	9	13.04	2nd
Lack of livelihood support	20	28.99	1st
Lack of medical supplies and equipment	7	10.14	4th
Lack of support in training People's Organization	4	5.80	5th
Lack of water for irrigation	4	5.80	5th

Community Problems	No. of Responses*	Percentage	Rank
Poverty	4	5.80	5th
Inaccessible clean and drinking water	1	1.45	8th
Lack of recreational facilities	4	5.80	5th
Lack of orientation and training on Solid Waste Management	3	4.35	6th
Lack of small business capital	2	2.90	7th
Others: Air Pollution - Dust	2	2.90	7th
Total	**69**	**100.00**	

* Multiple Responses

The respondents provided possible solutions to the identified community problems. Various proposals presented in Table 103 were provided by the respondents covering the aspects on Health Assistance, Income and Livelihood Development, Support to Education, Leadership and Community Values, and Environment Management. One of the respondents proposed that the none-pursuance of the project might be a solution to resolve the concern on dust emission.

Table 103 - Proposed Solutions on the Perceived Community Problems

Aspects	*Proposed Solutions*
Health Assistance	Establishment of Medical Clinic/ Hospital
	Availability of Medical Supplies
Income and Livelihood Development	Development of Livelihood Opportunities
	Capital for Livelihood
	Employment
	Livelihood Projects for Senior Citizens
	Formation of Cooperatives
Support to Education	Support to Education
	Scholarship Program
	Competent Teachers
Leadership and Community Values	Unity and Cohesiveness in the Barangay
	Regular Communication/ Discussion between the residents and Barangay Officials
	Good plans for the barangay and well-organized systems among the leaders in the Barangay

Aspects	*Proposed Solutions*
Environmental Management	Control fugitive dust emission: conduct regular water sprinkling activity in affected areas
Other	Not to pursue the project

2.4.6.5 Project Awareness and Acceptability

Figure 121 shows the level of awareness of the respondents on the proposed project. Majority of the respondents (83%) lacks knowledge on the proposed project. Only 12% of the respondents are aware of the proposed project.

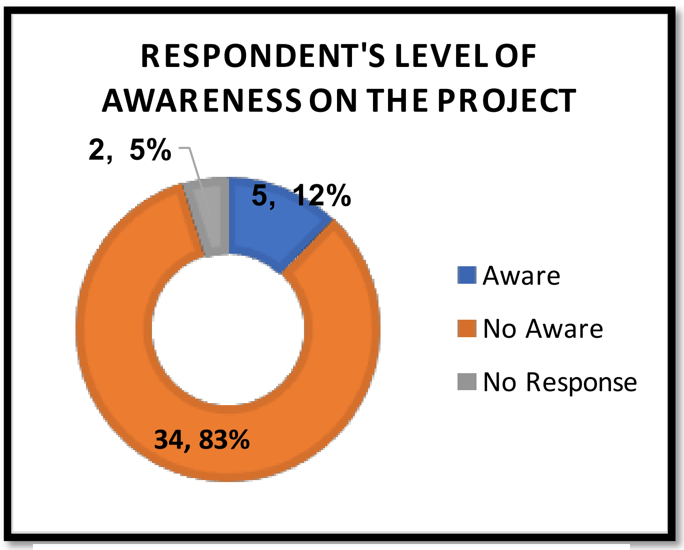


Figure 121 - Level of Awareness on the Project

For the 12% who answered that they are aware of the proposed project, they got the information from government/ barangay officials and from their relatives/ friends/ neighbors.

The respondents were asked on their perceived effects of the projects in Barangay Pulong Balibaguhan. Thirteen or 32% said that the project will bring positive effects on their community. On the other hand, 24% said that it will bring negative impact to their area. One of the respondents was uncertain on the possible effect of the project, while 42% gave no response on the question. The low level of awareness on the project may be the reason why the majority refused to give their perceived effect of the project.

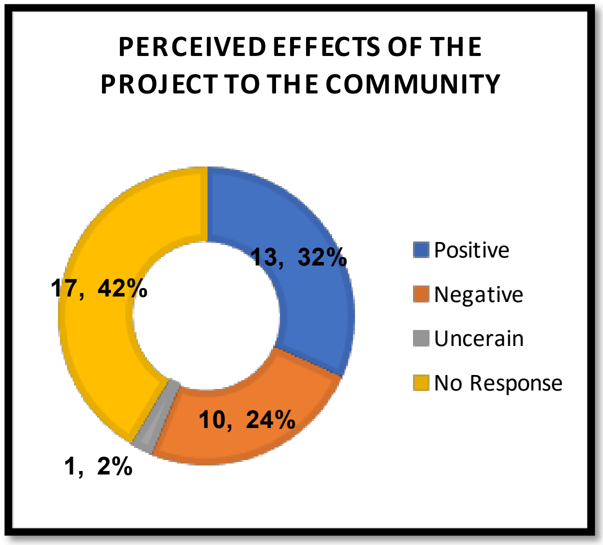


Figure 122 - Perceived Effects of the Project

Looking into the details, ***Table 104*** presents specific answers of respondents on the possible positive and negative effects of the project to their community. Most of the responses (22.62%) stated that the project is perceived to cause air pollution in the community. However, 13.10% of the responses stated that the project will bring progress and development to the barangay/municipality. Also 9.52% responses specified that the project will bring employment to the locality.

Table 104 - Perceived Positive and Negative Effects of the Project

Effects	***Details***	***No. of Responses****	***%***
Positive	Employment	8	9.52
	Progress and development of barangay/ municipality	11	13.10
	Improvement of small businesses	3	3.57
	Lesser depreciation of private and public vehicles because roads are maintained	2	2.38
	The environment/ surroundings will be aesthetically improved	1	1.19
Negative	Air Pollution	19	22.62
	Water Pollution	7	8.33
	Root crops, trees, and plants will be destroyed	5	5.95
	Loss or diminution of houses	5	5.95

Effects	Details	No. of Responses*	%
	Loss or pollution of drinking water	7	8.33
	Increase in number of people or houses caused by in-migration	9	10.71
	Destruction or pollution of the environment	7	8.33
	Total	**84**	**100.00**

*Multiple Responses

Recommendations on the possible actions to be undertaken to prevent or mitigate the perceived negative impacts were also gathered from the respondents. There were many suggestions that will help resolve the perceived negative effects and somehow prevent/mitigate possible adverse impacts however, there were two (2) responses that expressed aversion on the continuance of the project.

Table 105 - Recommended Actions to Prevent/Mitigate Negative Impacts

Possible Actions to Prevent or Mitigate Negative Impacts
Employ needed measures to prevent air pollution
Implement measures to protect the well-being of the residents especially the children
Implement safety measures and acquire required clearances from the DENR
B Use modern/advanced equipment to resolve air pollution problem
Identify right ways to resolve possible negative effects of the project
Install equipment to prevent fugitive dusts
Install conveyor system
Removal of plant
The project should not be implemented
Good planning activity should be conducted
Ensure enough supply of water to prevent dust

Opinions of the respondents on the possible benefits of the communities if the project will be pursued were also gathered. The respondents perceived that their community will benefit on the employment opportunities as well as from the increased income of the barangay sourced from the paid taxes and fees in relation to the project.

Finally, the level of support of the respondents to the project was asked. Most of the respondents (36%) were uncertain if they agree or not on the implementation of the proposed project. Many respondents (32%) also refused to answer the question. The uncertainty and refusal of the respondents to directly answer the question may be due to the reason that they still need to get more information and details about the proposed project. There were 9 or 22% of the respondents are supportive of the project, 10% of the respondents answered otherwise. Those who expressed support to the project recognized that the project will greatly help their barangay and the residents because it will bring employment, and additional income to the barangay. Those who are not in favor expressed concerns on the possible pollution of air that will impact on the health of the residents.

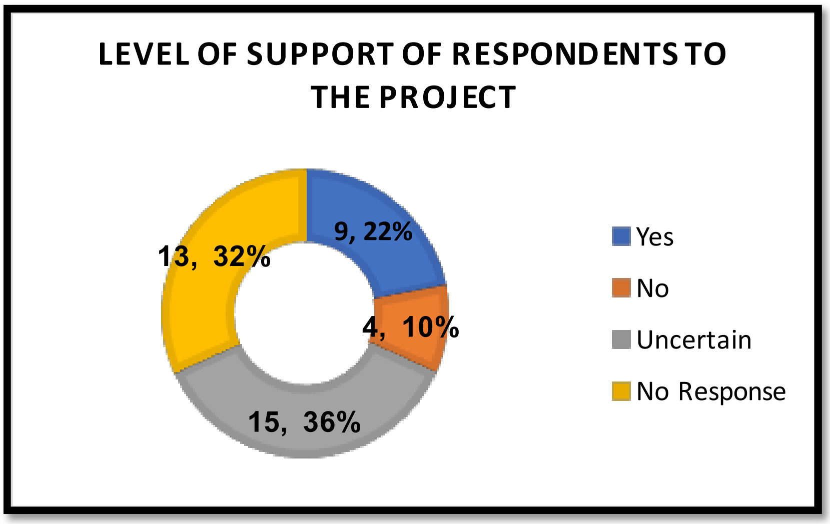


Figure 123 - Level of Support of Respondents to the Project

2.4.7 Focus Group Discussion

Focus Group Discussions (FGD) were conducted in the two (2) identified impact barangays of Holcim Mabini, Barangays Pulong Balibaguhan and Talaga East. The FGD aimed to gather perception and views of stakeholder groups' representatives about the current operation of Holcim Mabini and the proposed modifications. During the FGD, their concerns and opinions were expressed.

Separate FGDs were conducted for the impact barangays. The FGDs were conducted on February 24, 2017. It was attended by the members of Sangguniang Barangay (Barangay Chairperson and Councilors), Barangay Functionaries (Barangay Secretary, Barangay Treasurer, and Barangay Healworkers), Purok Leaders, and Sectoral/ People's Organizations.

The documentation of the conducted FGD is attached as ***Annex R***. The highlights of discussion, containing the responses of each group to the guide questions, are presented in ***Table 106*.**

Table 106 - Highlights of Focus Group Discussions

Guide Questions	***Barangay***	
	Pulong Balibaguhan	***Talaga East***
Familiarity of the proposed project modification	Information on the proposed project modification was sourced from the employees of Holcim Mabini.	The participants became familiar with the project through the conducted IEC and Public Scoping activities.
Perceived Benefits of the Community and specific sectors from the proposed project	Barangay residents will greatly benefit from the employment opportunities that will be brought by the proposed project.	It was expressed that the barangay will greatly benefit from the proposed project if the residents will be prioritized in the hiring of employees/workers. Also, it was mentioned that the barangay will benefit through the conduct of programs such as yearly medical mission, livelihood program, and distribution of low-grade cement to construct waste bins.
Perceived negative effects of the proposed project to the community	Diseases/ Sickness and dust generation were the main concerns raised.	Health hazards caused by the generated dust and noise from the operation. Barangay Talaga East is affected by the operation of Holcim Mabini, though the plant is in Barangay Pulong Balibaguhan. It was also raised that the barangay does not benefit from the taxes and fees being paid by the Company, unlike Barangay Pulong Balibaguhan.

Guide Questions	***Barangay***	
	Pulong Balibaguhan	***Talaga East***
		However, Barangay Talaga East is the receiver of the dust generated from the operation because of the topography compared to Barangay Pulong Balubaguhan. Barangay Talaga East is located in the lower portion of the barangay.
Suggestions on how to avoid/mitigate the negative effects	The improvement of the plant was suggested focusing on the substitution of parts/equipment that needs to be replaced and enhancement of routine maintenance to avoid accidents.	It was suggested that Holcim Mabini should install effective pollution control devices, regularly spray water to suppress dust, delegate street sweepers, and road repairs.
Perceived benefits of the community from the proposed project	The company not to close or shut down suddenly or immediately. The community will also benefit from the Implementation of programs/projects like Medical Missions, Bloodletting Program, and Scholarship Program for the youth.	The barangay will benefit through the implementation of livelihood programs.
Community's acceptability on the proposed project modification	The participants expressed support in the realization of the project because Holcim Mabini brought progress and development to their barangay.	The response of the participants is uncertain.

In the course of the discussion, issues and concerns on the current operation were brought up. The highlight of the discussion is presented in the Table below:

Table 107 - Issues and Concerns of the Communities on the Current Operations

Barangay	*Points Raised and Issues/Concerns*	*Response from the Company*
Pulong Balibaguhan	Observations on the generation of dust: - Improvement on the roto was suggested in order to avoid generation of dust - More dust was observed during the morning, but dust was not observed coming-out from the plant. There were insinuations that the operation of Holcim Mabini is being conducted in the evening.	Holcim-Mabini discussed that dust collection system is installed and continuous improvement on pollution control devices is being undertaken.
	Holcim-Mabini did not respond positively to the request of the Barangay to give drums and tonner bags to use as waste bins.	The company explained that they are not allowed to donate tonner bags bearing the logo of Holcim, as part of the Company Policy. Also, donation of drums is not also allowed because drums contain oil that is considered as hazardous materials by the EMB. The company will have to follow the rules of the EMB, that only accredited hazardous waste transporters and treaters will receive the drums. Holcim is willing to assist the barangay in the provision of waste bins, coordinate the request to the assigned personnel of Holcim.
Talaga East	Dust generation in the pier area during loading and unloading of materials	Based on the investigation of Holcim, the dust was coming from the adjacent company

Barangay	***Points Raised and Issues/Concerns***	***Response from the Company***
		(Golden Bay). Holcim conducted dialogues with Golden Bay to resolve the issue, however, held meetings and consultations did not result in positive outcome. The participants were informed that Holcim decided to settle the issue through legal means.
	The participants requested Holcim to install equipment that would lessen/ mitigate the generation of dust during loading/unloading	It was explained that part of the modification is the installation of eco-hopper that will address the concern. It was illustrated by Holcim that an eco-hopper is an environment-friendly equipment that will straightly suction the materials and thus will prevent the spread of the dust. Also, Holcim sees to it that during strong winds, the operation is being stopped to avoid the spread of dust. In addition to this, Holcim has established the monitoring system, through the assigned personnel and installed CCTVs.
	Hauler trucks that do not have covers, therefore, exposing the cement products, and were always observed parked on the roadside	Holcim responded that truck cover is a minimum requirement of Holcim to the haulers. Holcim has strict monitoring procedure to ensure that trucks coming out from the plant comply with this requirement.

Barangay	Points Raised and Issues/Concerns	Response from the Company
	Trucks were observed parked on the roadside, outside Holcim. When asked why they are parked on the roadside, they replied that Holcim does not allow them to park inside.	It was made clear with the haulers and service contractors that they are not allowed to park on the roadside outside Holcim because it poses danger to passing motorist. Holcim requested the participants to immediately report violators to them. It was also mentioned that Holcim constructed additional parking area to accommodate all the haulers.
	What are the livelihood projects to be implemented in the Barangay? The survey must have covered those who have relatives working abroad or Overseas Filipino Workers.	Holcim stated that a survey was conducted to determine the livelihood needs of the Barangay. The results showed that barangay residents do not need livelihood assistance. However, Holcim pointed out that it is always open to accommodate requests to address the needs of the community. Holcim iterated that it is open to implementing livelihood project needs of the communities. The request can be channeled through the Barangay Officials.
	How to inform the leadership of Holcim on the ideas and projects to be implemented that will benefit the residents of Barangay Talaga East?	The survey is one of the ways to solicit the community's suggestions/recommendations. Insights from the community may also be relayed to Holcim through the Barangay Officials.

Barangay	***Points Raised and Issues/Concerns***	***Response from the Company***
		Holcim will conduct further community consultation to validate recommendations.
	Ships were seen dumping garbage in the shoreline. This occurrence is not being seen/monitored by the coast guard. It is hoped that Holcim will regulate and prevent such practice.	It was explained that Holcim will not tolerate such practice. The company requested the participants to provide evidence such as photographs as proof in order for the formally notify the offenders. There is an installed system to monitor all the arriving vessels. A chandelle is assigned to ensure the supply of water and food of the staff as well as on proper waste disposal. If ever it will be proven that the vessels commit such violations, they will be forced to be closed.

2.4.8 Potential Socio-Economic Impacts of the Project

The proposed project modification has potential socioeconomic impacts to the people and communities. These impacts are currently experienced with the ongoing operation of Holcim-Mabini, the proposed modification will also bring the same impacts but magnitude may vary depending on the phase of the project. Since the project modification will not expand in terms of land area, there will be no displacement of settlers or displacement/disturbance of properties. Outlined below are the identified potential socio economic impacts of the proposed project modification in every phase of the project:

- Development/Construction Phase
  - Creation of employment opportunities
  - Population influx resulting to social tensions
  - Noise and dust pollution
  - Coastal/ Marine water pollution
  - Health and safety impacts

  - Increase in business opportunities
  - Increase in traffic and road safety hazards
  - Generation of additional revenue for the Local Government

- Operation Phase
  - Noise and dust pollution
  - Coastal/ Marine water pollution
  - Health and safety impacts
  - Employment opportunities
  - Increase in business opportunities
  - Increase in traffic and road safety hazards
  - Improved services and community development potential
  - Generation of additional revenue for the Local Government

- Decommissioning and Closure Phase
  - Temporary increase in employment opportunities followed by a decrease
  - Decline in economic activities
  - Noise and dust pollution
  - Coastal/ Marine water pollution
  - Change in socio/community development benefits
  - Change in the revenue collection of the Local Government

3.0 IMPACT MANAGEMENT PLAN

The Impact Management Plan (IMP) is formulated to minimize the potential adverse impacts while enhancing the beneficial effects of implementation of the project. This IMP, as summarized in ***Table 108***, shall serve as the implementing guideline to ensure that environmental requirements are met during the project implementation. Programs indicated can be updated during the monitoring of the perceived project impacts.

Further, since the proposed project will not deviate from the existing processes that the company utilize but, is rather, more on the increase in production, the management/mitigating measures stipulated below encompass the existing measures with some minor additional procedures.

3.1 Land Resources

Since there will be no area expansion and majority of the project area was already paved, the impact on land is very minimal. The foreseen impact on land is the generation of solidwaste. This shall be mitigated by implementing the solidwaste management thru proper segregation and disposal.

3.2 Water Resources

The impacts of the proposed project on water resources are siltation and possible oil spill. This shall be mitigated and controlled through installation of Sandboxes and oil water separators along the drainage canals. Oil spill contingency plan will be developed in case of accidental oil spills.

3.3 Air Quality

Release of fugitive emissions from any source, such as vehicular movement, transportation of materials, and construction, without provision or implementation of mitigation measures are prohibited pursuant to Clean Air Act rules (Part VII, Rule XXV, Section 13 (Prohibited Acts). Hence, mitigation measures to control dust emissions should be implemented to limit or reduce particulate emissions to within the prescribed ambient air quality standards set for particulates.

3.4 People

Significant social impacts include psychosocial impacts and influx of migrant. These shall be mitigated through the continued implementation of the different programs such as the IEC, and the established safety, health and environmental programs/procedures.

Table 108 - Impact Management Plan

Project phase/ Environmental aspect	Environmental component likely to be affected	Potential impact	Options for prevention, mitigation or enhancement	Responsible entity	Cost	Guarantee / Financial agreement
Construction Phase						
Rehabilitation and upgrading of port in-loading/port facility and cement dispatch	Water Quality	Generation of contaminated runoff coming from the construction area	• Enclose the construction area; • Install sandboxes and oil and water separator along the drainage canals • Regular maintenance of the drainage canals	Holcim	Part of construction cost	Work Program
		Accidental oil spill	• Develop and implement an oil spill contingency plan; • Install spill booms • Continuous training of personnel involved/ ensure that the workers provided by the contractor are trained and competent	Holcim	Part of construction cost	Work Program
		Creation of employment opportunities - Availability unskilled and semi-skilled work opportunities for the construction works	• Set-up local labor desk in the barangay in order to identify local labor pool • Implementation of skills development program to ensure support to local population in obtaining employment opportunities	Holcim-Mabini Human Resources Office (HRO) and Community Relations Office (CRO)	Included in project cost	Human Resource Program Corporate Social Responsibility (CSR) Program

Project phase/ Environmental aspect	Environmental component likely to be affected	Potential impact	Options for prevention, mitigation or enhancement	Responsible entity	Cost	Guarantee / Financial agreement
				Barangay LGU TESDA		
		Population influx resulting to social tensions • The creation of employment opportunities may also result to in-migration, contributing to the existing population growth rate of the barangays. This may also prevent barangay residents to leave the area to search for employment opportunities outside the barangay, decreasing the rate of out-migration. • The increase in population may result to overuse of public utilities/services and competition on the use of resources. • The proliferation of informal settlements may also happen.	• Implement policy on preferential hiring of locals from the impact barangays • Provide assistance to the barangay to ensure efficient and effective delivery of social services • Provide assistance to the Local Government to meet housing backlogs for informal settlement. • Proper induction of construction workers to prevent the occurrence of peace and order problems or security breaches. • Coordination with the Barangay Councils, Barangay Peace and Security Officers (BPSO) as well as with the Local Police. • Provide assistance to the Barangay on maintenance of peace and order.	Holcim-Mabini HRO, CRO, and Security Office - Barangay/ Municipal LGU (BPSO and Local Police)	Included in project cost	Human Resource Program Corporate Social Responsibility (CSR) Program Security Program

Project phase/ Environmental aspect	Environmental component likely to be affected	Potential impact	Options for prevention, mitigation or enhancement	Responsible entity	Cost	Guarantee / Financial agreement
		• Maintenance of peace and order may also be a concern.				
		Health and safety impacts • Noise and dust generation, as well as the increased traffic, may negatively impact the health and safety of workers and community residents	• Implement Safety and Health Programs for the workers and impact communities to reduce or avoid health and safety risks • Strict compliance on the proper wearing of Personal Protective Equipment (PPE) for workers • Provide assistance to the Barangays on the delivery of efficient healthcare services.	Holcim-Mabini Safety and Health Office and CRO Barangay/ Municipal Health Office Local office of Department of Labor and Employment	Included in project cost	Occupational Safety and Health Program Community Safety and Health Projects through CSR Program
		Increase in business opportunities • The influx of population and construction activities will increase demand for goods and services. Increase in income-earning	• Coordination with Barangay and Municipal LGUs to ensure proper zoning of business area, peace and order, sanitation, and solid waste management • Explore possibilities to include training opportunities for developing business/livelihood opportunities	Holcim-Mabini CRO Barangay/ Municipal LGU	Included in project cost	CSR Program

Project phase/ Environmental aspect	Environmental component likely to be affected	Potential impact	Options for prevention, mitigation or enhancement	Responsible entity	Cost	Guarantee / Financial agreement
		opportunities will also increase spending potential, providing opportunities for supply of services, indirectly increasing the overall wealth of the area	• Provide assistance in establishing livelihood projects	(Business Permit and Licensing Office)		
		Increase in traffic hazards • Construction activities will lead to a significant increase in vehicular traffic. This will add up to the current volume of hauling trucks passing along the Bauan-Mabini Circumferential Road	• Proper scheduling of construction materials delivery trucks to avoid traffic congestion • Ensure proper parking area for hauling and delivery trucks, and ensure compliance. Proper orientation on haulers must always be conducted. Violators must be reprimanded. • Implement Traffic Management Plan with the Barangay/Municipal LGUs including installation of traffic signs to avoid road accidents	Holcim-Mabini Safety and Health Office, Engineering Office and CRO	Included in project cost	Community Safety and Health Projects through Safety and Health and CSR Program
		Generation of additional revenue for the Local Government • Introduction of new economic opportunities and establishment of new businesses will increase revenue collection of the LGUs from taxes and fees	• Ensure suppliers and service providers payment of required payment of taxes and fees • Ensure prompt and timely payment of local taxes and fees due to Holcim-Mabini	Holcim-Mabini CRO and Procurement Office	Included in project cost	CSR Program

Project phase/ Environmental aspect	Environmental component likely to be affected	Potential impact	Options for prevention, mitigation or enhancement	Responsible entity	Cost	Guarantee / Financial agreement
				Holcim Finance Office		
Operation Phase						
Activities at the Port	Water Quality	Accidental oil spill	• Develop and implement an oil spill contingency plan; • Install spill booms • Continuous training of personnel • Impose a policy of no shipboard waste disposal	Holcim	Part of operating expenses	Work Program
Activities at the cement plant	Water Quality	Generation of silted runoff coming from the dusts washed out from the roads	• Maintenance and regular desilting of drainage canals. • Install silt traps or sand boxes along the canals • Install and regular replacement of dust arresting bag filters to minimize the dusts along the roads	Holcim	Part of operating expenses	Work Program
Storage of fuel/oil	Land/Water	Soil and water contamination due to accidental spills	• Provide secondary containment with capacities greater than the oil/fuel contained in tanks • Regular training of Oil Spill Response Team	Holcim	Part of operating expenses	Work Program
Generation of wastes	Land Water	Water pollution, land contamination	• Monitoring of waste generated by the project, use appropriate storage	Holcim	Part of operating expenses	Work Program

Project phase/ Environmental aspect	**Environmental component likely to be affected**	**Potential impact**	**Options for prevention, mitigation or enhancement**	**Responsible entity**	**Cost**	**Guarantee / Financial agreement**
			containers especially for hazardous wastes to prevent any leakage or spill			
			• Disposal and treatment of hazardous waste to DENR accredited transporter/treater.	Holcim	Part of operating expenses	Work Program
			• Implement waste segregation, provide adequate trash bins at the site	Holcim	Part of operating expenses	Work Program
Use of water for domestic and industrial use	Water	Water Use Competition Project water demand is considered to be minimal due to the cement manufacturing process involved (dry process). Also, water used for cooling equipment is recirculated with minimal make up water.	• Continuous implementation of water conservation measures	Holcim	Part of operating expenses	Work Program
Stockpiling of loose materials	Water – Water Quality	Generate silted runoff	• Construction of silt traps along drainage canals	Holcim	Part of operating expenses	Work Program

Project phase/ Environmental aspect	Environmental component likely to be affected	Potential impact	Options for prevention, mitigation or enhancement	Responsible entity	Cost	Guarantee / Financial agreement
Increased unloading activities, vessel traffic, human activities	Marine – Marine Ecology	Sediment intrusion; silt embedded in sea bottom may get re-suspended temporarily; • Loss of portions of the few remaining coral colonies that nurture fisheries and biodiversity values (secondary impact area only); • Increased turbidity where some sediments may settle into coral colonies and suffocate polyps leading to additional mortality (secondary impact area)	• There are no significant coral colonies, seagrass beds, mangroves in the primary impact area of the project. • The most modern sediment curtailment measures and engineering designs will be adopted by the project to address all water discharges from the site and inland facilities. Silt curtains will be employed and entrapment mechanisms will be adopted in order to prevent sediments and silt from spilling into coastal water. • Annual coral reef monitoring and fish visual census will be undertaken to determine changes in distribution and abundance. Divers will be employed to monitor disturbance to corals, if any, so that appropriate recommendations can be given to the engineering teams. In extreme cases, project can initiate coral trans-location where appropriate, employing artificial reef structures as relocation site. • Investigations on the propagation of seagrass communities in the reef flat will be undertaken and implemented if technically feasible.	Holcim	Part of operating expenses	Work Program

Project phase/ Environmental aspect	Environmental component likely to be affected	Potential impact	Options for prevention, mitigation or enhancement	Responsible entity	Cost	Guarantee / Financial agreement
			• Mangrove reforestation will be supported in coordination with CENRO where they are feasible.			
Increased unloading activities, vessel traffic, human activities	Marine – Marine Ecology	Noise pollution can be carried way beyond the port area	• Altered fish population structure as some species will seek to evade areas of noise generation; loss of fisheries productivity	Holcim	Part of operating expenses	Work Program
Alteration of inter-tidal zone if structures to further accommodate human and cargo access by sea		Disruption to benthic and in-faunal population of mollusks Loss of commercially important macro invertebrate/bivalve stocks	• No additional permanent structures shall be set in the sea floor itself or inter-tidal areas near the port complex. Alterations in the wharf area will be kept to the minimum. All temporary structures will be removed immediately. • Shellfish populations will be monitored for potential enhancement of stocks. • No permanent structures will be built in sensitive areas where bivalves are assessed to reproduce.	Holcim	Part of operating expenses	Work Program
Increase sea vessel traffic		Potential oil pollution Slicks may reach coral reefs leading to loss of species and associated demersal fish (in secondary impact area only)	• There are no coral colonies in the berthing docks. • Policy of no shipboard waste disposal will be enforced. • An oil spill mitigating plan (part of the disaster risk reduction and mitigation program) will be adopted.	Holcim	Part of operating expenses	Work Program

Project phase/ Environmental aspect	Environmental component likely to be affected	Potential impact	Options for prevention, mitigation or enhancement	Responsible entity	Cost	Guarantee / Financial agreement
Increase sea vessel traffic	Marine – Marine Ecology	Inadvertent introduction of exotic species through disposal of ballast water Alteration of the marine species trophic level; potential loss of key prey	• Clear and forceful policy on management of ballast water discharge supported by monitoring schemes.	Holcim	Part of operating expenses	Work Program
Bag House Operation	Air Quality	Baghouse stack	• Regular replacement of baghouse filters to lessen release of particulate emissions. • Routine emissions monitoring of particulates and other air pollutants (metals in air and CO).	Holcim	Part of operating expenses	Work Program
Pier operation		Materials handling (loading and unloading) at the pier and at the stockpiles that may contribute to possible air pollution	• Installation of eco hoppers at the pier area • Installation of dust/wind barriers along sides of barges to lessen emissions during material grabbing • Enhance the existing buffer strips of bamboos to increase its effectiveness on controlling dust emissions at adjacent residential areas west of the project site. Additional buffer strips of bamboos or other appropriate trees/vegetation should be used as additional buffer strips.	Holcim	Part of operating expenses	Work Program

Project phase/ Environmental aspect	Environmental component likely to be affected	Potential impact	Options for prevention, mitigation or enhancement	Responsible entity	Cost	Guarantee / Financial agreement
			• Installation of permanent storage areas (tents or roofing with dust/wind barriers) on raw materials that are currently on stockpile • Provision of appropriate covers on all stockpiles while awaiting construction/installation of additional storage areas with roofing and wind/dust barriers; • Temporary dust measures by wet suppression of stockpiles while awaiting completion of permanent storage areas • Installation of wind monitors (including air temperature, rainfall, and air temperature monitors) to effectively monitor direction of wind flows and occurrence of light to strong breezes. Meteorological monitors are effective in implementing mitigation measures, such as reduction or rescheduling of materials handling (loading and unloading at the pier area) during occurrences of strong breeze to high winds, particularly when households or residents are downwind during said activity.			
Stockpile Operation	Air Quality	Stockpile wind erosion	• Installation of permanent storage areas (tents or roofing with dust/wind	Holcim	Part of operating expenses	Work Program

Project phase/ Environmental aspect	Environmental component likely to be affected	Potential impact	Options for prevention, mitigation or enhancement	Responsible entity	Cost	Guarantee / Financial agreement
			barriers) on raw materials that are currently on stockpile • Provision of appropriate covers on all stockpiles while awaiting construction/installation of additional storage areas with roofing and wind/dust barriers; • Temporary dust measures by wet suppression of stockpiles while awaiting completion of permanent storage areas. • Alternative use of atomized misting, which is an effective dust control for relatively larger open areas, particularly during very dry condition			
Paved roads and pavements		Dust generation	• Provision of dust suction trucks or sweepers to regularly remove dust on paved areas (e.g. roads, pavements, parking areas, and paved areas adjacent grinding mill). • Regular wet suppression or water spraying of paved areas (including unpaved areas). • Continue implementation of speed limits within the project site, including transport of materials and finished products outside the facility • Provision of covers all trucks carrying raw materials and finished products.	Holcim	Part of operating expenses	Work Program

Project phase/ Environmental aspect	Environmental component likely to be affected	Potential impact	Options for prevention, mitigation or enhancement	Responsible entity	Cost	Guarantee / Financial agreement
			• Provision of wheel and tire washing facilities/equipment, specifically during wet season when tires of vehicles are exposed to mud/dirt • Provision of concrete wash bays within the project site			
Transfer points and conveyor systems	Air Quality	Dust generation	• Continue provision of dust curtains at transfer points • Frequent cleaning of conveyor belts • Improve belt support to reduce spillage and dust • Installation of off-pulley cleaners (or scavenger conveyor), which is used to contain cleaned materials at conveyors and discharge it to chutes at belt return.	Holcim	Part of operating expenses	Work Program
Other emission sources (vehicle emissions, vents, and open areas)			• Installation of eco hoppers at the pier area • Installation of dust/wind barriers along sides of barges to lessen emissions during material grabbing • Enhance the existing buffer strips of bamboos to increase its effectiveness on controlling dust emissions at adjacent residential areas west of the project site. Additional buffer strips of bamboos or other appropriate trees/vegetation should be used as additional buffer strips.	Holcim	Part of operating expenses	Work Program

Project phase/ Environmental aspect	Environmental component likely to be affected	Potential impact	Options for prevention, mitigation or enhancement	Responsible entity	Cost	Guarantee / Financial agreement
			• Installation of permanent storage areas (tents or roofing with dust/wind barriers) on raw materials that are currently on stockpile • Provision of appropriate covers on all stockpiles while awaiting construction/installation of additional storage areas with roofing and wind/dust barriers; • Temporary dust measures by wet suppression of stockpiles while awaiting completion of permanent storage areas • Installation of wind monitors (including air temperature, rainfall, and air temperature monitors) to effectively monitor direction of wind flows and occurrence of light to strong breezes. Meteorological monitors are effective in implementing mitigation measures, such as reduction or rescheduling of materials handling (loading and unloading at the pier area) during occurrences of strong breeze to high winds, particularly when households or residents are downwind during said activity.			
	Air, Noise and Social Aspect	Noise and dust pollution • It is likely that the operation may still cause noise and	• Conduct of regular maintenance of plant equipment specifically the installed pollution control devices.	- Holcim-Mabini	Included in project cost	

Project phase/ Environmental aspect	Environmental component likely to be affected	Potential impact	Options for prevention, mitigation or enhancement	Responsible entity	Cost	Guarantee / Financial agreement
		dust emission. Though, it is expected that generation of noise and dust emissions will be decreased due to the installation of new equipment including pollution control devices as part of the proposed project modification.	• Conduct of routine monitoring to assess effectiveness of installed pollution control devices.	Environmental Management Office		Environmental Management Program
	Marine Environment and Social Aspect	Coastal/ Marine water pollution • Vessels docking in the port area to deliver materials may be a source solid and liquid wastes that may pollute the coastal area and marine waters. The community has observations on the occurrence of improper waste disposal coming from the vessels.	• Strictly implement the program to ensure proper solid waste disposal of the vessels. Ensure proper orientation of crew on proper solid waste disposal. • The routine inspection must be conducted. Violators must be reprimanded. • Implement coastal clean-up activities in partnership with the LGUs.	- Holcim-Mabini Environmental Management Office	Included in project cost	Environmental Management Program
	Social	• Health and safety impacts • Health and safety issues will impact on local populations. Increases in traffic, potential dust and marine water pollution, and emissions from the plant	• Implement Safety and Health Programs for the workers and impact communities to reduce or avoid health and safety risks • Strict compliance on the proper wearing of Personal Protective Equipment (PPE) for workers	Holcim-Mabini Safety and Health	Included in project cost	Occupational Safety and Health Program

Project phase/ Environmental aspect	Environmental component likely to be affected	Potential impact	Options for prevention, mitigation or enhancement	Responsible entity	Cost	Guarantee / Financial agreement
		may negatively impact on the health condition of the populace. Further, increases in levels of traffic close to pedestrian areas may cause physical injury.	• Provide assistance to the Barangays on the delivery of efficient healthcare and protective services.	Office and CRO Barangay/ Municipal Health Office Local office of Department of Labor and Employment		Community Safety and Health Projects through CSR Program
	Socio Economic	Employment opportunities • During the operation, the minimal workforce will be added to the existing manpower of Holcim-Mabini. With sufficient training during the construction phase, a proportion of this workforce may be sourced from the local communities.	• Priority hiring of locals • Coordinate with the Barangay Councils to identify local labor pool	Holcim-Mabini Human Resources Office (HRO) and Community Relations Office (CRO) Barangay LGU	Included in project cost	Human Resource Program CSR Program

Project phase/ Environmental aspect	Environmental component likely to be affected	Potential impact	Options for prevention, mitigation or enhancement	Responsible entity	Cost	Guarantee / Financial agreement
	Socio Economic	Increase in business opportunities • Increase in employment will improve household income levels and livelihood that would likely increase the number of small businesses in operation, creating new enterprise opportunities	• Coordination with Barangay and Municipal LGUs to ensure proper zoning of business area, peace and order, sanitation, and solid waste management. • Explore possibilities to include training opportunities for developing business/livelihood opportunities. • Provide assistance in establishing livelihood projects.	Holcim-Mabini CRO Barangay/ Municipal LGU (Business Permit and Licensing Office)	Included in project cost	CSR Program
	Social	Increase in traffic hazards • Traffic in relation to the operation of Holcim-Mabini may still pose impacts to the locals. Hauling/ delivery trucks should not disrupt the free-flow of traffic along Bauan-Mabini Circumferential Road.	• Ensure proper parking area for hauling and delivery trucks, and ensure compliance. Proper orientation on haulers must always be conducted. Violators must be reprimanded. • Implement Traffic Management Plan with the Barangay/Municipal LGUs including installation of traffic signs to avoid road accidents; provision of assistance to ensure effectiveness of traffic enforcement.	Holcim-Mabini Safety and Health Office and CRO	Included in project cost	Community Safety and Health Projects through Safety and Health and CSR Programs
	Social	Improved services and community development potential	• Provision of assistance to improve health care and education services within the impact Barangays. • Implement infrastructure improvement projects with the Barangay and Municipal LGUs.	Holcim-Mabini CRO	Included in project cost	CSR Program

Project phase/ Environmental aspect	Environmental component likely to be affected	Potential impact	Options for prevention, mitigation or enhancement	Responsible entity	Cost	Guarantee / Financial agreement
		• Holcim-Mabini extends Social/Community Development projects to the impact communities that will provide opportunities for continued improvement of basic services and infrastructures.	• Conduct gender-responsive livelihood development assistance activities especially to marginalized sector of the communities; especially to women, youth, farmers, fisher folks, senior citizens and persons with disabilities.	Barangay Development Councils		
	Socio Economic	Generation of additional revenue for the Local Government - The results of the proposed modification will somehow increase the taxes and fees to be complied and settled by Holcim-Mabini. Additional revenues of the LGUs may also be collected from the new business establishments established due to the development brought by the operation.	• Ensure suppliers and service providers payment of required payment of taxes and fees • Ensure prompt and timely payment of local taxes and fees due to Holcim-Mabini	Holcim-Mabini CRO and Procurement Office Holcim Finance Office	Included in project cost	CSR Program
Abandonment Phase						

Project phase/ Environmental aspect	Environmental component likely to be affected	Potential impact	Options for prevention, mitigation or enhancement	Responsible entity	Cost	Guarantee / Financial agreement
Clearing / removal of support facilities	Land / Water / People	Accidental spill of toxic and hazardous wastes	• Proper implementation of the approved rehabilitation and abandonment plan • Use of DENR-accredited haulers/TSD companies for hazardous wastes	Holcim		Work Program
	Socio Economic	Temporary increase in employment opportunities followed by a decrease • Closure and decommissioning of the plant and port facilities will need additional manpower. However, after the decommissioning activities, reduction of manpower employed in Holcim-Mabini will happen. Also, indirect employment from business enterprises dependent on the operations will most likely decrease.	• Development of retrenchment package and implementation of re-training activities during operational stage • Provide employees with clear and transparent information on planned activities and closure dates • Offer full retrenchment package or relocation to maintain employment in other operation sites where possible • Provide skills training to communities to increase employability to find other job opportunities	Holcim-Mabini Human Resources Office (HRO) and Community Relations Office (CRO)	Included in project cost	Human Resource Program CSR Program
	Socio Economic	Possible decline in economic activities • Closure of small business dependent on the	• Provide assistance to small businesses dependent on the plant and port operations to search for alternative market	Holcim Mabini CRO Barangay LGUs	Included in project cost	CSR Program

Project phase/ Environmental aspect	Environmental component likely to be affected	Potential impact	Options for prevention, mitigation or enhancement	Responsible entity	Cost	Guarantee / Financial agreement
		operation of Holcim-Mabini might happen		Business owners/ Entrepreneurs		
	Noise and Air Pollution	Noise and dust pollution • Generation of noise and dust pollution associated with decommissioning activities	• Appropriate planning of decommissioning activities and restriction of hours of decommissioning activities • Establishment of buffer zones • Regular sprinkling of water to identified sources of dust	Holcim-Mabini Environmental Management Office and Engineering Office Decommissioning/ Demolition Contractor	Included in project cost	Environmental Management Program
	Marine	Coastal/ Marine water pollution • Disturbance and generation of solid waste due to decommissioning activities	• Appropriate planning of decommissioning activities and proper disposal of waste materials	Holcim-Mabini Environmental Managemen	Included in project cost	Environmental Management Program

Project phase/ Environmental aspect	Environmental component likely to be affected	Potential impact	Options for prevention, mitigation or enhancement	Responsible entity	Cost	Guarantee / Financial agreement
				t Office and Engineering Office Decommissioning/ Demolition Contractor		
	Socio Economic	Change in socio/community development benefits • Assistance from the company on the improvement and effective delivery of social services, infrastructure development, and livelihood development will be stopped	• Proper turn-over of accomplished social development projects and services to the Barangay LGUs • Link the Barangays to other entities that provide free assistance to ensure effective and efficient delivery of social services	Holcim-Mabini CRO Barangay LGUs Non-Government Organizations and Foundations	Included in project cost	CSR Program
	Socio Economic	Change in the revenue collection of the Local Government		Holcim-Mabini CRO	Included in project cost	CSR Program

Project phase/ Environmental aspect	Environmental component likely to be affected	Potential impact	Options for prevention, mitigation or enhancement	Responsible entity	Cost	Guarantee / Financial agreement
		• The closure of Holcim-Mabini may decrease the revenues of LGUs from taxes and other fees	• Transfer of assets that will be beneficial to LGUs to implement income generating activities			

4.0 RISK ASSESSMENT

The risk assessment[4] considers the hazards of the project operation with regards to safety, environment and the social aspects.

Risk Assessment is the overall process of risk analysis and risk evaluation.

Risk Analysis is the systematic use of available information to determine how often specified events may occur and the magnitude of their consequences. It is the systematic approach for describing and/or calculating risk. It involves the identification of undesired events, and the causes and consequences of these events.

Risk Evaluation is the process used to determine risk management priorities by comparing the level of risk against predetermined standards, target risk levels or other criteria.

In risk assessment the words Hazards and Risks are often used and it is necessary to be clear. In this document, a hazard is anything that has the potential to cause harm and risk is how likely it is that a hazard will cause actual harm.

During the risk assessment, hazards are evaluated in terms of the likelihood that a problem may occur and the damage it would cause if such an event did occur. Adequate safety and emergency preparedness requires considering all of the possible hazards that could be encountered. Some hazards, however, are more likely to cause problems than others at a given time and some would result in greater damage than others.

These differences are identified by conducting a risk analysis. The outcome of the analysis can be used to target resources at the types of events that are most likely to occur and/or are most destructive.

Emergency situations that are very likely to happen and would do considerable damage to people and property was targeted for immediate remediation and/or plans should be made for effective response if remediation isn't possible.

The guiding framework used in the risk assessment is the Australian/New Zealand Standard for Risk Management (AS/NZS 4360:2004). This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee OB-007, Risk Management as a revision of AS/NZS

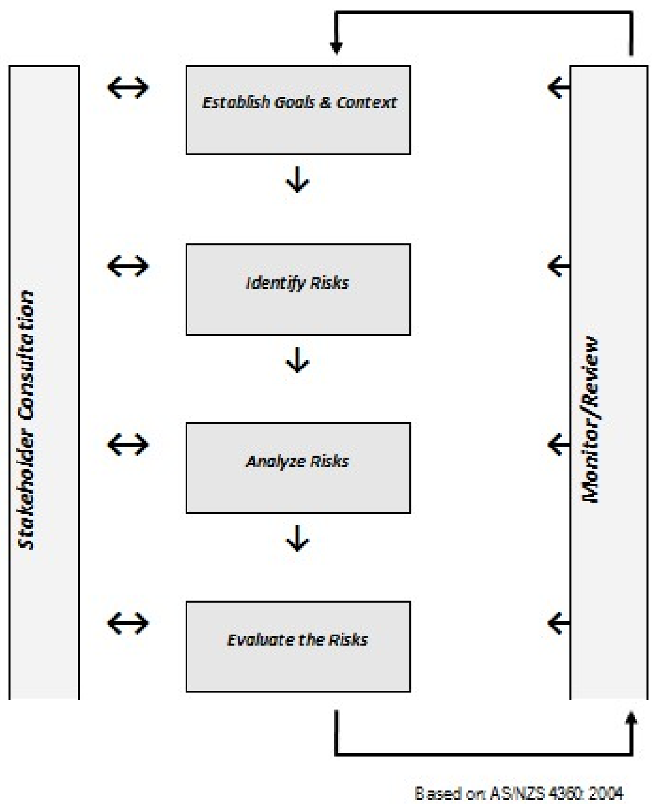
[4] From compilation and notes and interpretation of PNTidalgo

4360:1999. It provides a generic framework for establishing the context, identifying, analyzing, evaluating, treating, monitoring and communicating risk.

Modifications were made to adapt to the present conditions and local legal considerations of the Project specifically DAO 2005-07.

As a guide, the general step in doing the risk assessment is thru the AS/NZS4360:2004 are as follows:

Table 109 - Risk Assessment Framework



The main elements of the risk management process based on AS/NZS 4360:2004 are:

- <u>Communicate and consult</u> - Communicate and consult with internal and external stakeholders as appropriate at each stage of the risk management process and concerning the process as a whole.
- <u>Establish the context</u> - Establish the external, internal and risk management context in which the rest of the process will take place. Criteria against which risk will be evaluated should be established and the structure of the analysis defined.

- Identify risks - Identify where, when, why and how events could prevent, degrade, delay or enhance the achievement of the objectives.
- Analyze risks - Identify and evaluate existing controls. Determine consequences and likelihood and hence the level of risk. This analysis should consider the range of potential consequences and how these could occur.
- Evaluate risks - Compare estimated levels of risk against the pre-established criteria and consider the balance between potential benefits and adverse outcomes. This enables decisions to be made about the extent and nature of treatments required and about priorities.
- Treat risks - Develop and implement specific cost-effective strategies and action plans for increasing potential benefits and reducing potential costs.
- Monitor and review - It is necessary to monitor the effectiveness of all steps of the risk management process. This is important for continuous improvement. Risks and the effectiveness of treatment measures need to be monitored to ensure changing circumstances do not alter priorities.

To determine the degree of risks, a ***Risk Register*** was prepared for the Project based on the safety, environmental and social risks. The initial plans for mitigating each high level risk and responsibilities of the prescribed mitigation strategies are discussed under the Risk Management.

The ***Risk Register*** has six (6) columns with the following description.

1. The Risk: what can happen and how it can happen
2. The consequences of an event happening
3. Existing/proposed controls
4. Consequence Rating
5. Likelihood Rating
6. Level of Risk

4.1 Consequence Rating

Qualitative measures of **"Consequence"** or impact (based on AS/NZS 4360:1999)

Table 110 - Qualitative Measures of Consequence

Level	Descriptor	Example of Description
1	Insignificant	No injuries, low financial loss
2	Minor	First aid treatment, on-site release immediately contained, medium financial loss

Level	Descriptor	Example of Description
3	Moderate	Medical treatment required, on-site release contained with outside assistance, high financial loss
4	Major	Extensive injuries, loss of production capability, off-site release with no detrimental effects, major financial loss
5	Catastrophic	Death, toxic release off-site with detrimental effect, huge financial loss

4.2 Likelihood Rating

Qualitative measures of **"Likelihood"** (based on AS/NZS 4360:1999).

Table 111 - Qualitative Measures of Likelihood

Level	Descriptor	Description
A	Almost certain	Is expected to occur in most circumstances
B	Likely	Will probably occur in most circumstances
C	Possible	Might occur at some time
D	Unlikely	Could occur at some time
E	Rare	May occur only in exceptional circumstances

4.3 Level of Risk

Qualitative risk analysis matrix – level of risk (based on AS/NZS 4360:1999).

Table 112 - Qualitative Risk Analysis Matrix

Likelihood	Consequences				
	Insignificant 1	Minor 2	Moderate 3	Major 4	Catastrophic 5
A (almost certain)	H	H	E	E	E
B (likely)	M	H	H	E	E
C (possible)	L	M	H	E	E
D (unlikely)	L	L	M	H	E
E (rare)	L	L	M	H	H

E = **Extreme Risk** - Immediate action required.
H = **High Risk** - Closure Team attention required.
M = **Moderate Risk** - EHS Personnel attention required.
L = **Low Risk** - Manage by routine procedures.

4.4 Sources of Risk

4.4.1 <u>On Safety</u>

Risk	How it can happen	Receptor	Consequence(s)	Existing Controls	Consequence Rating	Likelihood Rating considering controls	Level of Risk
Falling from high places/facilities that are being constructed/rehabilitated	Non-observance of safety precautions; Unsafe acts/ conditions	Personnel/contractors	Body injury or death	A Safety and Health Program (SHP) that was established and is being implemented by Holcim - Mabini	5	E	H
Being hit by falling objects/debris from facilities/equipment being installed/maintained	Unstable slopes, non-observance of safety precautions; Unsafe acts/ conditions; No PPE	Personnel/contractors	Body injury or death	SHP that was established and is being implemented by Holcim - Mabini	5	E	H
Exposure from hazardous wastes/chemicals	Non-compliance with the safety procedures in disposing/storing hazardous materials; Non-observance of safety precautions; Unsafe acts/ conditions; No PPE	Personnel/contractors	Body injury or death	SHP and Standard Operating Procedure for handling toxic and hazardous materials that was established and is being implemented by Holcim - Mabini	5	E	H

Risk	How it can happen	Receptor	Consequence(s)	Existing Controls	Consequence Rating	Likelihood Rating considering controls	Level of Risk
				Provision and usage of PPEs			
Trips and slips	Unsafe acts/conditions; Non-observance of safety precautions	Personnel/contractors	Body injury/muscular stress	SHP that was established and is being implemented by Holcim - Mabini	2	D	L
Dust Exposure	Lack of PPE	Personnel/contractors	Shortness of breath, respiratory illness, eye injury	SHP that was established and is being implemented by Holcim - Mabini; Provision and usage of PPEs	2	D	L
Noise	Exposure to high level of noise	Personnel/contractors	Hearing impairment	SHP that was established and is being implemented by Holcim - Mabini; Provision and usage of PPEs	3	D	M
Caught between moving parts	Unsafe acts/condition; Lack of training	Personnel/contractors	Body injuries	SHP that was established and is being implemented by Holcim - Mabini; Provision and usage of PPEs; Trainings conducted for the usage of equipment;	4	D	H

Risk	How it can happen	Receptor	Consequence(s)	Existing Controls	Consequence Rating	Likelihood Rating considering controls	Level of Risk
				Warning/safety signages established			
Vehicular accidents	Reckless driving; Poor maintenance of vehicle; Lack of safety warning devices	Personnel/contractors	Body injury or death	SHP that was established and is being implemented by Holcim - Mabini; Warning/safety signages established	5	E	H
Flooding, earthquake and soil erosion	Occurrence of natural calamities	Personnel/contractors	Body injury or death	SHP that was established and is being implemented by Holcim - Mabini; Provision and usage of PPEs; Trainings conducted for the usage of equipments; Warning/safety signages established	4	D	H

4.4.2 On the Environment

Table 113 - Risk Analysis - Environment

Risk	*How it can happen*	*Receptor*	*Consequence(s)*	*Existing Controls*	*Consequence Rating*	*Likelihood Rating Considering Controls*	*Level of Risk*
Spillage of hazardous wastes	Non-compliance with the safety procedures in disposing/storing hazardous materials	Nearby water bodies	Pollution of water bodies	Standard Operating Procedure for handling toxic and hazardous materials that was established and is being implemented by Holcim - Mabini	4	D	H
Excessive dust generation.	Wind dispersal of particulates; Vehicle and/or equipment generated dust.	Nearby community	Impact on the visual amenity, safety of personnel and health of community	Established vehicular speed limits; Constant water spraying; Covering of materials being hauled by trucks	2	C	M
Water Pollution.	Failure of pollution control devices; transport of silt materials emanating from the Plant	Nearby water bodies	Siltation/contamination of nearby water bodies	Periodic checking and maintenance of pollution control devices; Established drainage canals within the vicinity of the plant	4	D	H

Risk	How it can happen	Receptor	Consequence(s)	Existing Controls	Consequence Rating	Likelihood Rating Considering Controls	Level of Risk
Noise Pollution	Excessive noise associated with project operation and movement of vehicles and equipment	Fauna and community	Agitation/disturbance to fauna and nearby communities	Installed mufflers on vehicles; Restriction of work hours during day time	2	C	M
Failure of pollution control devices	Poor design and/or maintenance	Nearby water bodies; Community	Pollution of nearby water bodies which could lead to consequential effects to flora, fauna, and the community	Periodic maintenance of pollution control devices	5	D	E

4.5 Risk Management

The succeeding **Risk Management Plan** contains measures/activities that Holcim – La Union will implement in order to address/mitigate the identified risks.

4.5.1 On Safety

Table 114 - Risk Management-Safety

Risk	Level of Risk	Proposed Action/Risk management	Responsibilities	Resources	Timeframe	Monitoring
Falling from high places/facilities that are being constructed/rehabilitated	H	Implementation of the SHP; Conduct of safety seminars/briefings/ trainings; Setting up of safety signage; Provision and use of PPEs	Holcim- Mabini Safety, Environment, and Community Relations (SEC) Department Personnel All Holcim - Mabini Mill Plant Employees	Project Cost	During project operation	Holcim - Mabini Internal Monitoring; 3rd Party; MMT
Being hit by falling objects/debris from facilities/equipments beingconstructed /rehabilitated	H	Implementation of the SHP; Conduct of safety seminars/briefings/ trainings; Setting up of safety signage; Provision and use of PPEs	Holcim - Mabini SEC Department Personnel All Hocim - Mabini Employees	Project Cost	During project operation	Holcim - Mabini Internal Monitoring; 3rd Party; MMT
Exposure from hazardous wastes/chemicals	H	Implementation of the SHP and Standard Operating Procedure for handling toxic and hazardous materials; Conduct of safety seminars/briefings/ trainings; Setting up of safety signage; Provision and use of PPEs	Holcim - Mabini SEC Department Personnel All Holcim - Mabini Employees	Project Cost	During project operation	Holcim - Mabini Internal Monitoring; 3rd Party; MMT

Risk	Level of Risk	Proposed Action/Risk management	Responsibilities	Resources	Timeframe	Monitoring
Trips and slips	L	Implementation of the SHP; Conduct of safety seminars/briefings/ trainings; Setting up of safety signage; Provision and use of PPEs	Holcim - Mabini SEC Department Personnel All Holcim - Mabini Employees	Project Cost	During project operation	Holcim - Mabini Internal Monitoring; 3rd Party; MMT
Dust Exposure	L	Implementation of the SHP; Conduct of safety seminars/briefings/ trainings; Setting up of safety signage; Provision and use of PPEs	Holcim - Mabini SEC Department Personnel All Holcim - Mabini Employees	Project Cost	During project operation	Holcim - Mabini Internal Monitoring; 3rd Party; MMT
Noise	M	Implementation of the SHP; Conduct of safety seminars/briefings/ trainings; Setting up of safety signage; Provision and use of PPEs	Holcim - Mabini SEC Department Personnel All Holcim - Mabini Employees	Project Cost	During project operation	Holcim - Mabini Internal Monitoring; 3rd Party; MMT
Caught between moving parts	H	Implementation of the SHP; Conduct of safety seminars/briefings/ trainings; Setting up of safety signage; Provision and use of PPEs	Holcim - Mabini SEC Department Personnel All Holcim - Mabini Employees	Project Cost	During project operation	Holcim - Mabini Internal Monitoring; 3rd Party; MMT
Vehicular accidents	H	Implementation of the SHP; Conduct of safety seminars/briefings/ trainings; Setting up of safety signage; Provision and use of PPEs	Holcim - Mabini SEC Department Personnel All Holcim - Mabini Employees	Project Cost	During project operation	Holcim - Mabini Internal Monitoring; 3rd Party; MMT

Risk	Level of Risk	Proposed Action/Risk management	Responsibilities	Resources	Timeframe	Monitoring
Flooding, earthquake and soil erosion	H	Implementation of the SHP; Conduct of safety seminars/briefings/ trainings; Setting up of safety signage; Provision and use of PPEs	Holcim - Mabini SEC Department Personnel All Holcim - Mabini Employees	Project Cost	During project operation	Holcim - Mabini Internal Monitoring; 3rd Party; MMT

4.5.2 On the Environment

Table 115 - Risk Management - Environment

Risk	Level of Risk	Proposed Action/Risk management	Responsibilities	Resources	Timeframe	Monitoring
Spillage of hazardous wastes/chemicals	H	Implementation of the Standard Operating Procedure for handling toxic and hazardous materials; Progressive disposal of hazardous wastes	Holcim - Mabini SEC Department Personnel All Holcim - Mabini Employees	Project Cost	During project operation	Holcim - Mabini Internal Monitoring; 3rd Party; MMT
Excessive dust generation.	M	Establish vehicular speed limits; Constant water spraying; Covering of materials being hauled by trucks	Holcim - Mabini SEC Department Personnel All Holcim - Mabini Employees Personnel in charge or part of the implementation of the activities relative to the management of excessive dust generation	Project Cost	During project operation	Holcim - Mabini Internal Monitoring; 3rd Party; MMT

Risk	Level of Risk	Proposed Action/Risk management	Responsibilities	Resources	Timeframe	Monitoring
Water Pollution.	H	Periodic checking and maintenance of pollution control devices	Holcim - Mabini SEC Department Personnel All Holcim - Mabini Employees	Project Cost	During project operation	Holcim - Mabini Internal Monitoring; 3rd Party; MMT
Noise Pollution	M	Installation mufflers on and maintenance of all vehicles; Restriction of work hours during day time	Holcim - Mabini SEC Department Personnel All Holcim - Mabini Employees	Project Cost	During project operation	Holcim - Mabini Internal Monitoring; 3rd Party; MMT
Failure of pollution control devices	E	Implementation of environmental management in accordance with what was prescribed in the law; Periodic maintenance of pollution control devices	Holcim - Mabini SEC Department Personnel All Holcim - Mabini Employees	Project Cost	During project operation	Holcim - Mabini Internal Monitoring; 3rd Party; MMT

5.0 SOCIAL DEVELOPMENT PLAN AND IEC IMPLEMENTATION

5.1 Indicative Social Development Program (SDP)

The current operations of Holcim-Mabini provide social/community development assistance to the identified impact communities, Barangays Pulong Balinaguhan and Talaga East. From 2014 to 2016, Holcim-Mabini implemented programs for the impact communities focusing on Education Assistance, Enhancement of Socio-cultural practices, Calamity Assistance, Environmental Protection and Enhancement, Community Health Projects and Community Infrastructure Projects. The enumerated projects were implemented through the Corporate Social Responsibility (CSR) Program of the Company. ***Table 116*** presents the details of the implemented projects.

The identified impact of the proposed project modification, as well as the continuous operation of the plant and port facilities of Holcim-Mabini to the communities, will be addressed and compensated through the continuous implementation of social/community development projects through the Company's CSR Program. The results of the socio-economic assessment, perception survey, and focus group discussion were considered in the development of social development framework. ***Table 117*** presents the indicative social development framework to be implemented in relation to the proposed modification and enhancement of Holcim Mabini's operation.

The participation of the impact communities, specifically the Barangay Councils, Sectoral Organizations, Different Government Institutions, Businesses, and Industries is necessary for the implementation of the indicative social development framework. Holcim-Mabini will ensure partnership undertakings with the identified stakeholders.

Table 116 - List of Previously Implemented Social Development Program, 2014-2016

Year of Implementation	*Project Activity*	*Status of Implementation*	*Number and Category of Beneficiaries (Per Year)*
2014 and 2015	Adopt-a-School Project Continuing HPI support to renovation and improvement of public schools at Talaga Elementary School, Anselmo National High School and Mabini Central School in order create a safe and conducive to the learning environment for students thru cement donations. This project includes improvement of playground, classrooms, halls and pavements of the three adopted schools	Completed	1,000 public students 80 teachers, school administrators and school guests
2014 and 2015	Calamity Assistance Project Continuing HPI support to improving transportation of calamity-wrecked roadways within Mabini. The project reconstructed roadways of affected barangays	Completed	1,000 transporters 500 visitors/tourists
2014 and 2015	Brigada Eskwela	Completed	1,000 public students

Year of Implementation	Project Activity	Status of Implementation	Number and Category of Beneficiaries (Per Year)
	Active participation in general clean-up, maintenance and improvement of public schools (Talaga Elementary School, Mabini Central School and Anselmo National High School). The implemented activities include cleaning of school ground, painting of classrooms, chairs and tables, improvement of path walk		80 teachers, school administrators and school guests
2014 and 2015	Sociocultural Project Fiesta donations at Pulong Balibaguhan, Talaga East and the Municipality of Mabini. As part of socio-cultural celebration, Hocim-Mabini subsidized food for bands, performers, guests and provide assistance in fiesta decorations	Completed	5,000 residents 1000 visitors
2014 and 2015	OJT Program Provision of support for on-the-job training of students from Batangas State University and other colleges/universities in Batangas. Maximum of 6 OJTs per semester	Completed	12 students

Year of Implementation	***Project Activity***	***Status of Implementation***	***Number and Category of Beneficiaries (Per Year)***
2014 and 2015	Medical Mission and Blood Letting Activity Health and public service support to Pulong Balibaguhan and Talaga, Mabini, Batangas through general check-up and blood-letting activity	Completed	100 residents
2014 and 2015	Annual Coastal Clean-up at Talaga, Mabini, Batangas Batangas Bay coastal cleanup	Completed	Various residents
2015	Community Assessment To know the baseline of community service and relations within host barangays (qualitative)	Completed	Impact Barangays
2016	Clean and Green project of Brgy. Pulong Palibaguhan and Talaga East Participated in cleaning public drainage and seashores where lots of garbage coming from the city went to the coastal area of the		200 Community residents living ashore and near the highway

Year of Implementation	***Project Activity***	***Status of Implementation***	***Number and Category of Beneficiaries (Per Year)***
	barangay. Provided resources such as manpower and tools (e.g. grass cutters, rakes, broomsticks, garbage bags, etc.) in order to clean the environment		
2016	School Safety Inspection Inspection of schools to evaluate the safety of its infrastructures. Plant safety officer and civil engineer inspected school buildings	Completed	Students and faculty of Mabini Central School, ASMNHS, St Francis de Paola HS 200 Students and teachers 500 Parents and visitors
2016	Herbal Medicine Awareness Campaign Introduced the use of herbal plants over synthetic medicine to folks. IEC and herbal plant distribution	Completed	Residents of Brgy Pulong Balibaguhan and Talaga East, LGU 300 Community residents 500 Members of families
2016	Annual Brigada Eskwela program of DepEd and Adopt-A-School Provided refurbishing materials, paints, learning tools and manpower thru employee	Completed	Students and faculty of Mabini Central School, ASMNHS, St Francis de Paola HS 200 Students and teachers 500 Parents and visitors

Year of Implementation	Project Activity	Status of Implementation	Number and Category of Beneficiaries (Per Year)
	voluntarism. Repaired and repainted school classrooms and other facilities		
	Infrastructures Development and/or Calamity Assistance Project Donation of cement for infra projects of barangay such as road repair, plastering of the building, rip rapping of landslide-prone areas, seawall, roofing.	Completed	Residents of Brgy Pulong Balibaguhan and Talaga East, LGU 300 Community Residents 500 Visitors
2016	Sociocultural activity Participation in socio-cultural programs in the impact communities to support traditional activities like the fiesta, Flores de Mayo and Christmas party.	Completed	Residents of Brgy Pulong Balibaguhan and Talaga East, LGU 400 Community Residents 1000 Visitors
2016	Wellness program through Sports Provision of sports materials and uniform subsidies for barangay players to keep them away from illegal drugs	Completed	30 Barangay Players 150 Family members/ barangay
2016	Coastal Cleanup		

Year of Implementation	***Project Activity***	***Status of Implementation***	***Number and Category of Beneficiaries (Per Year)***
	Participation in Coastal Protection: Cleaning up of coastal area	Completed	Residents of Brgy. Pulong Balibaguhan and Talaga East, LGU 200 Community Residents 500 Family members/ barangay
2016	Domestic Waste Management Campaign on "use, reduce, recycle" of waste. Reached out to community leaders in turning wastes into useful crafts	Completed	Residents of Brgy. Pulong Balibaguhan and Talaga East, LGU 50 Community Residents 500 Family members/ barangay
2016	OJT program Train college students in mechanical, industrial, admin skills	Completed	10 College Students 40 Family members
2016	Blood Letting Activity Contribute to the supply of blood for patients	Completed	100 Blood Recipients 400 Family members
2016	Marine Biodiversity Survey: Biodiversity Baseline To identify the marine resources.	Completed	Residents of Brgy. Pulong Balibaguhan and Talaga East, LGU

Table 117 - Social Development Program

Concerns	***Community Beneficiary***	***Community Member Responsible***	***Government Agency/ Non-government Agency and Services***	***Proponent***	***Indicative Timeline***	***Source of Fund***
Livelihood						
• Gender Responsive Livelihood Program and Credit Facilities (Marginalized Sector: Women, Youth, Fisherfolks, Farmers, Fisher folks, Senior Citizens, Persons With Disabilities) • Employment Program: On-the-Job Training; Special Program for Employment of Students • Skills training program: to give local residents of impact barangays the chance to qualify and compete for available employment opportunities during the implementation of the project or in other areas	• Interested Community Residents – Marginalized Sector	• Barangay officials • Association Chairperson	• LGU Municipal Planning and Development Office • Impact Barangays • Municipal Social Worker Department (MSWD) • Municipal Public Employment Services Office • TESDA • Cooperative Development Authority • Local Department of Labor and Employment	• Community Relations Officer	• Pre-construction • Construction • Operation	• LGU –IRA/ Holcim-Mabini CSR Program

Concerns	*Community Beneficiary*	*Community Member Responsible*	*Government Agency/ Non-government Agency and Services*	*Proponent*	*Indicative Timeline*	*Source of Fund*
Health Services						
• Provision of Medicines and Medical Equipment • Skills enhancement for barangay health workers • Support to the improvement of health facilities • Conduct of Wellness Program/ Sports and Recreation Program • Conduct of Medical Mission and Blood-Letting Activity • Disease Prevention Awareness Program	• Impact Barangay • Men, Women, Children, Youth, Senior Citizens, PWDs	• Barangay Officials • Municipal and Barangay Health Workers	• Municipal Health Office (MHO) • Barangay Health Center • Impact Barangays	• Community Relations Officer • Safety and Health Officer	• Pre-construction • Construction • Operation	• LGU –IRA/ Holcim-Mabini CSR Program
Education Assistance						
• Adopt-a-School Program • Brigada Eskwela • Assistance for development/improvement	• Public Schools within the Impact Barangays	• Barangay Officials (specifically the Council	• Department of Education (DepEd) • Public Schools	• Community Relations Officer	• Pre-construction • Construction • Operation	• LGU –IRA/ Holcim-Mabini CSR Program

Concerns	*Community Beneficiary*	*Community Member Responsible*	*Government Agency/ Non-government Agency and Services*	*Proponent*	*Indicative Timeline*	*Source of Fund*
of school facilities (day care centers, existing schools) • Provision of scholarship to qualified students • Capacity building of teachers	• Students, Teachers	Member for Education)	• Impact Barangays			
Public Infrastructure, Environment, and Sanitation						
• Coastal Clean-up • Implementation of Solid Waste Management in compliance with Republic Act 9003 • Good Housekeeping and Sanitation • Infrastructure Development (Cement Docnation) for Physical Improvement of the area that will impact on sanitation and safety	• Impact Communities	• Barangay Officials (specifically the Council Member for Environment)	• Municipal Environment and Natural Resources Office (ENRO) • Host Barangays	• Community Relations Officer • Mine Environmental Protection and Enhancement Officer / Pollution Control Officer	• Pre-construction • Construction • Operation	• LGU –IRA/ Holcim-Mabini CSR Program
Road Safety and Protective Services						

Concerns	*Community Beneficiary*	*Community Member Responsible*	*Government Agency/ Non-government Agency and Services*	*Proponent*	*Indicative Timeline*	*Source of Fund*
• Support for the Peace and Order Program of the Barangay and Municipal LGU • Partnership in the implementation of Traffic Management Program • Emergency Response/ Calamity Assistance	• Impact Communities	Barangay Officials Barangay Peace and Security Officers	• Municipal Police • Municipal Engineer's Office • Municipal Disaster Risk Reduction and Management Office	• Community Relations Officer Mine Environmental Protection and Enhancement Officer / Pollution Control Officer Safety Officer	• Pre-construction • Construction • Operation	• LGU –IRA/ Holcim-Mabini CSR Program • Environmental Management Program • Safety and Health Program
Socio-Cultural Activities						
• Provision of support/assistance to LGUs in the conduct of activities that strengthens community cohesiveness (Fiestas, Flores de Mayo, Christmas Party, Barangay Assemblies)	• Impact Barangays	Barangay LGU	• MSWDO • MPDO	• Community Relations Officer	• Pre-construction • Construction • Operation	• LGU –IRA/ Holcim-Mabini CSR Program

5.2 Information and Education Campaign (IEC)

Implementation of an intensive and consistent IEC Plan is the key to build a positive rapport with the impact communities and other stakeholders. Through this, an open communication line is established between the Holcim-Mabini, Barangay and Municipal LGUs, and the residents of impact barangays. An open communication ensures accessibility of bringing community concerns to the attention of the company. It is also a way for the Company to communicate efforts and activities that addressed community concerns, intervention to avoid or mitigate negative impacts of the operations, as well as to enhance positive impacts through a strong partnership with the impact communities.

Holcim-Mabini implements IEC activities to communicate updates on the results of the proposed modifications and its current operations. The details of the activities are presented in ***Table 118.***

As part of the EIA process, an intensive IEC was also conducted through the conduct of Public Scoping, Perception Survey, and Focus Group Discussions. The documentation of the held public consultations is presented in ***Table 119.***

Continuing IEC activities will be conducted based on the IEC framework outlined in ***Table 120.***

Table 118 - List of previously conducted Information, Education, and Communication Program Activities, 2016

Year of Implementation	IEC Program/Activity and Medium Used	Status of Implementation
2016	IEC on Sustainable Development, Environment Protection, Biodiversity and Health and Safety Conducted every quarter Visiting schools and communities for IEC	Completed
2016	Pulung-pulong with Barangay Official IEC on Plant Improvement Gathering of technical working group to present plant operation – "Better operation and beyond standards in air and water quality, noise level"	Completed

Table 119 - Documentation of Public Consultations

Date/ Venue of Public Consultation	*Issues Raised*	*Who Raised the Issues*	*Response from Proponent/ Preparer*
Public Scoping May 17, 2016 Sea's Spring Resort, Barangay Mainit, Mabini, Batangas (Detailed Documentation Annex ___)	Possible displacement of laborers/ employees due to automation of manual palletizing	Imelda C. Ilagan (President of Senior Citizen in Talaga East)	The automation will not result to streamlining of the labor force.
	Will the automation project minimize the generation of dust? Because dust is an everyday problem in the neighborhood. Follow-up information was sought	Neria A. Magpantay (Talaga East Barangay Member)	Holcim-Mabini already developed a hill (artificial mountain) planted with carabao grass. It was also planted with 200 seedlings. Instead

Date/ Venue of Public Consultation	*Issues Raised*	*Who Raised the Issues*	*Response from Proponent/ Preparer*
	on the installation of cover/divider from the plant to contain generated dust.		of a fence, the trees will serve as the buffer/ divider.
	Is Auto Palletizing within a close compass area? Is it going to be in the current Manual Pelletizing area? It was observed that Manual Pelletizing process generates dust. If the location of Auto Pelletizing equipment is close/ contained, this may not generate dust compared to Manual Palletizing.	Manuel M. Basit (P. Balibaguhan Barangay Kagawad)	The area of Auto Pelletizing is close since this has a conveyor. There will be 2 locations of Auto Pelletizing equipment, in the warehouse and in the port area.
	Every morning there is a lot of dust in the neighborhood. Everybody cleans the house in the morning. It was observed that in the after, there is no dust. It is assumed that Holcim-Mabini is releasing dust during night time.	Carlos Maramut (P. Balibaguhan Barangay Kagawad)	Holcim is not releasing dust. The company cannot afford to release dust or cement since this is our product. It will be a loss from our side. In Holcim, we always do the right things. Holcim already conducted the greening program to avoid dust generation from idle lots. The old stockpile that possible

Date/ Venue of Public Consultation	***Issues Raised***	***Who Raised the Issues***	***Response from Proponent/ Preparer***
	The dust may be coming from “danghaw"? From the truck that emits dust.		source of dust was already removed. The plant is not the only source of dust.
	Clarification on the issued ECC that will be subjected to amendments. Because the old ECC will be used, is there any chance that the operation will be put to stop because the ECC is already approved in 1997.	Dindo Maramot (P. Balibaguhan – Barangay Justice)	The 1997 ECC of Holcim covers the current operation. All the conditions in the 1997 ECC are currently being complied with. With the proposed modification the ECC will have to be amended before the project will be realized.
	Does Holcim have an Environmental Management Plan? If it has a plan, is this being implemented? We are oriented on the integrity of the equipment to be installed, we want to know if there is a plan that will manage the operationalization of the equipment and measures to mitigate the impact to the environment.	Ronal Castillo (Municipal Agriculturist and active member of Bayan ng Mabini)	Holcim has an Environmental Management Plan, it is a mandatory requirement. The project modification will replace old parts with new ones. It is essentially upgrading the parts of the equipment.

Date/ Venue of Public Consultation	*Issues Raised*	*Who Raised the Issues*	*Response from Proponent/ Preparer*
	Is the issued ECC not renewable? Or the EC will be renewed because of the new machines/equipment to be installed? Are you going to get a new ECC because of the new machines/equipment? The old machine/equipment severely affects the adjacent barangays, the installation of the new machine/equipment might result in more impact than the old ones.	Demson D. Maramot (P. Balibaguhan Barangay Kagawad)	The proposed modification requires the processing of the ECC, to be amended. It will be processed in the EMB Central Office. To be included in the amendment of the ECC will be the creation of the Multi-Partite Monitoring Team. The team will monitor the performance of Holcim based on the conditions stipulated in the amended ECC. There will be members from the two (2) impact Barangays. With this, the barangays will be well-informed on the details of the operations and the implementation of the Environmental Management Plan.
	The Barangay recognized that Holcim responds to our observations. If there will be a partnership in this undertaking, it is hoped that the benefits will not		The parts of the old equipment are no longer available in the market and the installation of new equipment will prevent the occurrence of dust and an MMT

Date/ Venue of Public Consultation	***Issues Raised***	***Who Raised the Issues***	***Response from Proponent/ Preparer***
	only be for Holcim, the community should also benefit from the project. It is also hoped that the benefits will be given rightfully and excellently.		Team will be formed that will include the community in the conduct of the monitoring activities. Additional response to the concern raised about the Environmental Management Plan, the Environmental Performance Report and Management Program that will be prepared in relation to the ECC amendments also include an Environmental Management Plan covering the current operations and the proposed modifications. The amended ECC will not be issued if Monitoring and Environmental Management Plan will not be prepared/submitted.
Focus Group Discussion in Barangay Pulang Balibaguhan	Discussed in Section 2.4.7 of this document.		
Focus Group Discussion in Barangay Talaga East			

Table 120 - Information and Education Campaigns

Target Sector Identified as Needing Project IEC	Major Topics of Concern in Relation to the Project	IEC Schemes/ Strategy/ Methods	Information Medium	Indicative Timeline and Frequency	Indicative Cost
▪ Local Government Units ▪ Households and Businesses surrounding Holcim-Mabini ▪ Local Non-Government/ Community Organizations ▪ Relevant National/ Regional Government Agencies	▪ Approval of the ECC Amendments and stipulated conditions ▪ Project description (i.e. project components, size/coverage ▪ Environmental Performance Report and Management Plan	▪ Intensive information dissemination on the approved ECC and EPRMP ▪ Consultation-Meetings	▪ Reproduction and Distribution of the approved ECC and EPRMP to the concerned LGUs ▪ Print materials: Brochure about the approved modifications ▪ Audio-Visual Presentations	▪ Prior to construction and installation of new equipment/ machine	▪ Cost of printing the IEC materials ▪ Cost of holding consultation meetings
▪ Local Government Units ▪ Households and Businesses	▪ Presentation of project activities in relation to the construction and	▪ Printed information about the project updates and posting at impact barangays bulletin	▪ Print Materials: Posters or project bulletin ▪ Audio-Visual Presentations	▪ During construction and installation of new equipment/ machine	▪ Cost of printing the IEC materials ▪ Cost of holding consultation meetings

Target Sector Identified as Needing Project IEC	***Major Topics of Concern in Relation to the Project***	***IEC Schemes/ Strategy/ Methods***	***Information Medium***	***Indicative Timeline and Frequency***	***Indicative Cost***
surrounding Holcim-Mabini ▪ Local Non-Government/ Community Organizations	installation of new equipment ▪ Discussion on predicted impact and mitigation plan ▪ Gathering of community issues and concerns on the ongoing construction/ installation of new equipment ▪ Reporting of results of project monitoring	board or information centers ▪ Consultation-meetings			
▪ Local Government Units ▪ Households and Businesses	▪ Presentation of project activities in relation to the operations	▪ Printed information about the project updates and posting at impact barangays bulletin	▪ Print Materials: Posters/ project bulletin/ newsletter ▪ Audio-Visual Presentations	▪ During operations	▪ Cost of printing the IEC materials ▪ Cost of holding consultation meetings

Target Sector Identified as Needing Project IEC	***Major Topics of Concern in Relation to the Project***	***IEC Schemes/ Strategy/ Methods***	***Information Medium***	***Indicative Timeline and Frequency***	***Indicative Cost***
surrounding Holcim-Mabini ▪ Local Non-Government/ Community Organizations	▪ Gathering of community issues and concerns on the on-going operations ▪ Dissemination of the Corporate Social Responsibility Programs, possible partnership for the implementation and reporting of accomplishments ▪ Dissemination of program implementation and accomplishment on the Environmental Management Plan	board or information centers ▪ Consultation-meetings			

Target Sector Identified as Needing Project IEC	*Major Topics of Concern in Relation to the Project*	*IEC Schemes/ Strategy/ Methods*	*Information Medium*	*Indicative Timeline and Frequency*	*Indicative Cost*
	▪ Dissemination of program implementation and accomplishment of Occupational Safety and Health ▪ Quarterly reporting of results MMT monitoring				
▪ Local Government Units ▪ Households and Businesses surrounding Holcim-Mabini ▪ Local Non-Government/ Community Organizations	▪ Presentation decommissioning and closure plan ▪ Provision of updates on the decommissioning and closure activities ▪ Gathering of community issues	▪ Printed information about the project updates and posting at impact barangays bulletin board or information centers ▪ Consultation-meetings	▪ Print Materials: Posters/ project bulletin/ newsletter ▪ Audio-Visual Presentations	▪ During Decommissioning and Closure Phase	▪ Cost of printing the IEC materials ▪ Cost of holding consultation meetings

Target Sector Identified as Needing Project IEC	*Major Topics of Concern in Relation to the Project*	*IEC Schemes/ Strategy/ Methods*	*Information Medium*	*Indicative Timeline and Frequency*	*Indicative Cost*
▪ Relevant National/ Regional Government Agencies	and concerns on the decommissioning and closure activities ▪ Reporting of updates on the monitoring of decommissioning and closure activities				

6.0 ENVIRONMENTAL COMPLIANCE MONITORING

This section presents the proposed framework for compliance monitoring of the project, which includes, among others, the environmental parameters necessary to monitor the identified key environmental impacts of the proposed project.

As required by DENR Memorandum Circular No. 2010-14 and RPM for DAO 2003-30, and as a pro-active tool in minimizing/eliminating adverse project consequences to the environment, an "Environmental Quality Performance Level" (EQPL) has been identified for each critical parameter associated with identified significant project impacts. The limit level shall be the regulated threshold of pollutant (standard that must not be exceeded) while the action level is set lower than the limit level wherein management measures must be implemented so as not to reach the regulated threshold.

The following mechanisms and monitoring schemes are also discussed:

- Environmental Monitoring Plan;
- Multi-sectoral Monitoring Framework; and
- Environmental Guarantee and Monitoring Fund Commitment.

6.1 Environmental Monitoring Plan

The EQPLs presented below for the Environmental Monitoring Plan is only applicable for Effluent and Emissions regulations. The EQPLs in the table below were initially assigned the following values:

- Limit → DENR standard value
- Alert → 70% of the limit.
- Action →80% of the limit

These EQPLs are initial values. Final thresholds for management limits, action, and alert levels will be determined from monitoring data and concurred by the MMT members, EMB, and Holcim.
The salient point of the said table is that Alert and Action EQPLs were only assigned to parameters that can be controlled by the project during construction and operation phases.

Module	Environmental Sector	Parameters to be monitored	Sampling and Measurement: Method	Sampling and Measurement: Frequency	Sampling and Measurement: Location	Lead Person/ Office	Annual Estimated Cost (Php)	EQPL Management Scheme – EQPL Range: Alert	EQPL Range: Action	EQPL Range: Limit	Management Measure: Alert	Management Measure: Action	Management Measure: Limit
Pre-construction/Development Phase													
WATER													
Water Quality	Marine Water Quality (Ambient)	▫ pH ▫ Temperature ▫ Dissolved Oxygen	In-situ measurement using hand-held water quality tester	Monthly	MW1, MW2	PCO	100,000	▫ pH 6.8-7.0 or pH 8.0-8.2 ▫ Temp 25.6-26°C or Temp 28-29 °C ▫ DO 5.3-5.4 mg/l	▫ pH 6.6-6.8 or pH 8.3-8.4 ▫ Temp 25.2-25.5 °C or Temp 29-30°C ▫ DO 5.1-5.2 mg/l	▫ pH=6.5 or pH=8.5 ▫ Temp=25°C or Temp=31°C ▫ DO=5mg/l min	▫ Investigate the source and identify possible pollutant sources	▫ Investigate the source ▫ If the problem is within the operation area, conduct adjustments/ appropriate corrective action at identified pollutant source ▫ Reconduct sampling / water quality monitoring	▫ Temporarily stop activities contributing to the pollutant load ▫ Evaluate existing mitigation measures for possible need for additional mitigation measures ▫ If the source is not related to the project, inform MMT regarding possible source for the group's investigation and coordination with LGU
		▫ Total Suspended Solids ▫ Oil and Grease	Grab sampling and laboratory analysis					▫ TSS 50-64mg/l ▫ O&G 2.0-2.1 mg/l	▫ TSS 65-75mg/l ▫ O&G 2.2-2.5mg/l	▫ TSS=80mg/l ▫ O&G=3mg/l			
Water Quality	Groundwater Quality	▫ pH ▫ Temperature	In-situ measurement using hand-held water quality tester	Monthly	GW1	PCO	50,000	▫ pH 6.8-7.0 or pH 8.2-8.4 ▫ Temp 25.6-26°C or Temp 28-29 °C	▫ pH 6.6-6.8 or pH 8.5-8.9 ▫ Temp 25.2-25.5 °C or Temp 29-30°C	▫ pH=6.5 or pH=9 ▫ Temp=25°C or Temp=31°C			
		▫ Chloride	Grab sampling and laboratory analysis					▫ Cl^- 250-299mg/l	▫ Cl^- 300-325mg/l	▫ Cl^-=350mg/l			
Air													
Air Emissions	Release of particulate and gaseous pollutants	▫ PM, SO_X, NO_X, and CO	▫ NOX- U.S.EPA Methods 1 through 4 and Method 7 ▫ CO -U.S.EPA Method 3 or 10 ▫ PM – Methods 1 to 5 ▫ Metals in ambient air – USEPA Methods 1 through 5 or 29	▫ Quarterly	Baghouse stack	Project proponent/accredited third party stack samplers	PhP 100,000 per quarter	≥75% of NESSAP Values. EQPL (Alert Mininum in mg/Nm³) SO_X =525 NO_X = 375 PM = 112.5 CO = 375 Hg = 3.8 Sb = 7.5 As = 7.5 Cd = 7.5 Pb=-7.5 Others – all other values prescribed in NESSAP	≥90% of NESSAP Values. EQPL (Action Minimum in mg/Nm³) SO_X =630 NO_X = 450 PM = 135 CO = 450 Hg = 4.5 Sb = 9 As = 9 Cd = 9 Pb=-9 Others – all other values prescribed in NESSAP	NESSAP Values (in mg/Nm³) SO_X =700 NO_X = 500 PM = 150 CO = 500 Hg = 5 Sb = 10 As = 10 Cd = 10 Pb=-10 Others – all other values prescribed in NESSAP	▫ Monitor levels ▫ Check grinding process and hot gas generator system	▫ Proponent to correct high levels, as necessary.	▫ Reduce production or suspend operation
	Release of particulate and gaseous pollutants	▫ PM, SO_X, NO_X, and CO	▫ NOX- U.S.EPA Methods 1 through 4 and Method 7 ▫ CO -U.S.EPA Method 3 or 10 ▫ PM – Methods 1 to 5	Annual	Ecohopper gensets	U.S.EPA Methods	PhP 100,000	≥75% of NESSAP Values. EQPL (Alert Minimum in mg/Nm³) SO_X =525 NO_X = 1500 PM = 112.5 CO = 375 Hg = 3.8	≥90% of NESSAP Values. EQPL (Action Minimum in mg/Nm³) SO_X =630 NO_X = 1800 PM = 135 CO = 450 Hg = 4.5	NESSAP Values (in mg/Nm³) SO_X =700 NO_X = 2000 PM = 150 CO = 500 Hg = 5	▫ Monitor levels ▫ Check genset operating system	▫ Proponent to correct high levels, as necessary.	▫ Reduce load or suspend operation

Module	Environmental Sector	Parameters to be monitored	Sampling and Measurement			Lead Person/ Office	Annual Estimated Cost (Php)	EQPL Management Scheme					
								EQPL Range			Management Measure		
			Method	Frequency	Location			Alert	Action	Limit	Alert	Action	Limit
			▫ Metals in ambient air – USEPA Methods 1 through 5 or 29					Sb = 7.5 As = 7.5 Cd = 7.5 Pb=-7.5 Others – all other values prescribed in NESSAP ▫	Sb = 9 As = 9 Cd = 9 Pb=-9 Others – all other values prescribed in NESSAP ▫	Sb = 10 As = 10 Cd = 10 Pb=-10 Others – all other values prescribed in NESSAP ▫			
Ambient Air	Release of fugitive dusts	▫ Ambient TSP	▫ High Volume/ gravimetric	Monthly or as frequent as necessary	Receptors or ASR's downwind of prevailing winds at the time of monitoring	Project proponent through PCO	PhP 40,000 per month	▫ EQPLs may not be applicable as laboratory results are known few days or weeks after air sampling ▫ Recommend daily visual inspection of fugitive dust emissions and meteorological monitoring (please see next item below) ▫ Air sampling using High Volume/Gravimetric is intended to check compliance with the NAAQS			▫ Part of environmental mitigation plan/measure is to ensure compliance with the NAAQS set for TSP at 300 µg/Nm³ and PM_{10} at 200 µg/Nm³		
Ambient air	Release of fugitive dusts	▫ Ambient TSP/Fugitive dust	Visual inspection and meteorological monitoring	Daily during operation during dry condition	Sources of air emissions at the project site	Project proponent through PCO and contractor	Part of Environmental Officer's scope	Fugitive dust is generated within or close to the equipment, barges, stockpiles, etc at wind speed < 5.4 m/s (equivalent to Beaufort Scale 3 – leaves and small twigs constantly moving, light flags extended) (Note: Threshold wind speed of 5.4 m/s to be refined based on local condition, i.e., generation fugitive dust at certain wind threshold)	Fugitive dust is generated within or close the equipment, barges, stockpiles, etc. at winds speed > 5.4 m/s (equivalent to Beaufort Scale 3 – leaves and small twigs constantly moving, light flags extended) (Note: Threshold wind speed of 5.4 m/s to be refined based on local condition i.e., generation fugitive dust at certain wind threshold)	Fugitive dust is visually transported outside property boundaries (or at ASRs) during high wind speeds (> 5.4 m/s) (equivalent to Beaufort Scale 3 – leaves and small twigs constantly moving, light flags extended) (Note: Threshold wind speed of 5.4 m/s to be refined based on local condition i.e., generation fugitive dust at certain wind threshold)	Check if regular dust mitigation measures are implemented	▫ Inform equipment operator or contractor on its generated dust emissions ▫ Reduce vehicle travelling speed (e.g., 30 km/hr from 40 km/hr) ▫ Minimise dust generating activities	Suspend operation (i.e., materials handling) until favourable condition is meet (e.g., low wind speed) and/or additional mitigation measures are in placed (e.g., increase wetting frequency) •
Construction/ Installation of new equipment and machines	Creation of employment opportunities	No. of workers employed from the impact communities, including employment	HR Manpower Monitoring Report FGDs/ KIIs/ Community Consultations	Semi-Annual	Plant/ Impact Communities	Proponent through HR Manager and CRO	5,000/ monitoring	Manifestations/ observations during monitoring that minimal labor force	Incident report on non-prioritization of hiring locals	Complaint received on non-hiring of locals	Implement measures to mitigate negative impact	Verify and validate report Implement measures to mitigate negative impact	Conduct investigation Take action to address negative impact

Module	Environmental Sector	Parameters to be monitored	Sampling and Measurement			Lead Person/ Office	Annual Estimated Cost (Php)	EQPL Management Scheme					
								EQPL Range			Management Measure		
			Method	Frequency	Location			Alert	Action	Limit	Alert	Action	Limit
		from contractors						came from the local communities					
	Population influx resulting to social tensions	Peace and order in the local community	Crime Incidence Report FGDs/ KIIs/ Community Consultations	Semi-Annual	Plant/ Impact Communities	Proponent through Security Manager and CRO	5,000/ monitoring	Manifestations/ observations during monitoring on possible occurrence of social tensions	Incident Report on social tensions related to construction activities	Complaint received on the threat to security and safety of the locals	Implement measures to mitigate negative impact	Verify and validate report Implement measures to mitigate negative impact	Conduct investigation Take action to address negative impact
	Health and safety impacts	Accidents and morbidity cases related to the construction	Work related-accident report and review of community health condition FGDs/ KIIs/ Community Consultations	Semi-Annual	Plant/ Impact Communities	Proponent through Safety Officer and CRO		Manifestations/ observations during monitoring that will result in negative impact	Incident Report on accidents and morbidity cases	Complaint received on accidents and negative health condition of the local communities	Implement measures to mitigate negative impact	Verify and validate report Implement measures to mitigate negative impact	Conduct investigation Take action to address negative impact
	Increase in business opportunities	No. of business established due to the construction	Ocular/Filed Observations Gather secondary data from Barangay/ Municipal LGUs FGDs/ KIIs/ Community Consultations	Semi-Annual	Impact Communities	Proponent through CRO	5,000/ monitoring	Manifestations/ observations during monitoring that will result in negative impact	Incident Report on negative impact	Complaint received on the negative impact	Implement measures to mitigate negative impact	Verify and validate report Implement measures to mitigate negative impact	Conduct investigation Take action to address negative impact
	Increase in traffic hazards	No. of road/ traffic accidents	Gather data from Barangay/ Municipal LGUs FGDs/ KIIs/ Community Consultations	Semi-Annual	Impact Communities	Proponent through CRO	5,000/ monitoring	Manifestations/ observations during monitoring that will result in negative impact	Incident Report on negative impact	Complaint received on the negative impact	Implement measures to mitigate negative impact	Verify and validate report Implement measures to mitigate negative impact	Conduct investigation Take action to address negative impact
	Generation of additional revenue for the Local Government	LGU Income aside from IRA	Gather data from Barangay/ Municipal LGUs FGDs/ KIIs/ Community Consultations	Semi-Annual	Impact Communities	Proponent through CRO	5,000/ monitoring	Manifestations/ observations during monitoring that will result in negative impact	Incident Report on negative impact	Complaint received on the negative impact	Implement measures to mitigate negative impact	Verify and validate report Implement measures to mitigate negative impact	Conduct investigation Take action to address negative impact
Land													
Installation of new equipment	Land	housekeeping	Observations records	Quarterly	Applicable areas	Proponent through PCO; MMT, third party	10,000.00/ monitoring	Incident Report			Implementation of 5S of housekeeping		
OPERATION PHASE													

Module	Environmental Sector	Parameters to be monitored	Sampling and Measurement			Lead Person/ Office	Annual Estimated Cost (Php)	EQPL Management Scheme					
			Method	Frequency	Location			EQPL Range			Management Measure		
								Alert	Action	Limit	Alert	Action	Limit
Water Quality	Marine Water Quality (Ambient)	▫ pH ▫ Temperature Dissolved Oxygen	In-situ measurement using hand-held water quality tester	Monthly	MW1, MW2	PCO	100,000	▫ pH 6.8-7.0 or pH 8.0-8.2 ▫ Temp 25.6-26°C or Temp 28-29 °C DO 5.3-5.4 mg/l	▫ pH 6.6-6.8 or pH 8.3-8.4 ▫ Temp 25.2-25.5 °C or Temp 29-30°C DO 5.1-5.2 mg/l	▫ pH=6.5 or pH=8.5 ▫ Temp=25°C or Temp=31°C DO=5mg/l min	Investigate the source and identify possible pollutant sources	▫ Investigate the source ▫ If the problem is within the operation area, conduct adjustments/ appropriate corrective action at identified pollutant source ▫ Reconduct sampling / water quality monitoring	▫ Temporarily stop activities contributing to the pollutant load ▫ Evaluate existing mitigation measures for possible need for additional mitigation measures If the source is not related to the project, inform MMT regarding possible source for the group's investigation and coordination with LGU
		▫ Total Suspended Solids Oil and Grease	Grab sampling and laboratory analysis					▫ TSS 50-64mg/l O&G 2.0-2.1 mg/l	▫ TSS 65-75mg/l O&G 2.2-2.5mg/l	▫ TSS=80mg/l O&G=3mg/l			
Water Quality	Groundwater Quality	▫ pH Temperature	In-situ measurement using hand-held water quality tester	Monthly	GW1	PCO	50,000	▫ pH 6.8-7.0 or pH 8.2-8.4 Temp 25.6-26°C or Temp 28-29 °C	▫ pH 6.6-6.8 or pH 8.5-8.9 Temp 25.2-25.5 °C or Temp 29-30°C	▫ pH=6.5 or pH=9 Temp=25°C or Temp=31°C			
Air Emissions	Release of particulate and gaseous pollutants	PM, SO_X, NO_X, and CO	● NOX- U.S.EPA Methods 1 through 4 and Method 7 ● CO -U.S.EPA Method 3 or 10 ● PM – Methods 1 to 5 Metals in ambient air – USEPA Methods 1 through 5 or 29	Quarterly	Baghouse stack	Project proponent/accredited third party stack samplers	PhP 100,000 per quarter	≥75% of NESSAP Values. EQPL (Alert Mininum in mg/Nm³) SO_X =525 NO_X = 375 PM = 112.5 CO = 375 Hg = 3.8 Sb = 7.5 As = 7.5 Cd = 7.5 Pb=-7.5 Others – all other values prescribed in NESSAP	≥90% of NESSAP Values. EQPL (Action Minimum in mg/Nm³) SO_X =630 NO_X = 450 PM = 135 CO = 450 Hg = 4.5 Sb = 9 As = 9 Cd = 9 Pb=-9 Others – all other values prescribed in NESSAP	NESSAP Values (in mg/Nm³) SO_X =700 NO_X = 500 PM = 150 CO = 500 Hg = 5 Sb = 10 As = 10 Cd = 10 Pb=-10 Others – all other values prescribed in NESSAP	Monitor levels Check grinding process and hot gas generator system	Proponent to correct high levels, as necessary.	Reduce production or suspend operation
	Release of particulate and gaseous pollutants	PM, SO_X, NO_X, and CO	● NO_X- U.S.EPA Methods 1 through 4 and Method 7 ● CO -U.S.EPA Method 3 or 10 ● PM – Methods 1 to 5 ● Metals in ambient air – USEPA Methods 1 through 5 or 29	Annual	Ecohopper gensets	U.S.EPA Methods	PhP 100,000	≥75% of NESSAP Values. EQPL (Alert Minimum in mg/Nm³) SO_X =525 NO_X = 1500 PM = 112.5 CO = 375 Hg = 3.8 Sb = 7.5 As = 7.5 Cd = 7.5 Pb=-7.5	≥90% of NESSAP Values. EQPL (Action Minimum in mg/Nm³) SO_X =630 NO_X = 1800 PM = 135 CO = 450 Hg = 4.5 Sb = 9 As = 9 Cd = 9 Pb=-9	NESSAP Values (in mg/Nm³) SO_X =700 NO_X = 2000 PM = 150 CO = 500 Hg = 5 Sb = 10 As = 10 Cd = 10 Pb=-10	Monitor levels Check genset operating system	Proponent to correct high levels, as necessary.	Reduce load or suspend operation

Module	Environmental Sector	Parameters to be monitored	Sampling and Measurement			Lead Person/ Office	Annual Estimated Cost (Php)	EQPL Management Scheme					
			Method	Frequency	Location			EQPL Range			Management Measure		
								Alert	Action	Limit	Alert	Action	Limit
								Others – all other values prescribed in NESSAP	Others – all other values prescribed in NESSAP	Others – all other values prescribed in NESSAP			
Ambient Air	Release of fugitive dusts	Ambient TSP	● High Volume/ gravimetric	Monthly or as frequent as necessary	Receptors or ASR's downwind of prevailing winds at the time of monitoring	Project proponent	PhP 40,000 per month	▫ EQPLs may not be applicable as laboratory results are known few days or weeks after air sampling ▫ Recommend daily visual inspection of fugitive dust emissions and meteorological monitoring (please see next item below) ▫ Air sampling using High Volume/Gravimetric is intended to check compliance with the NAAQS			Part of environmental mitigation plan/measure is to ensure compliance with the NAAQS set for TSP at 300 µg/Nm³ and PM_{10} at 200 µg/Nm³		
Ambient air	Release of fugitive dusts	Ambient TSP/Fugitive dust	Visual inspection and meteorological monitoring	Daily during operation during dry condition	Sources of air emissions at the project site	Project proponent and contractor	Part of Environmental Officer's scope	Fugitive dust is generated within or close to the equipment, barges, stockpiles, etc at wind speed < 5.4 m/s (equivalent to Beaufort Scale 3 – leaves and small twigs constantly moving, light flags extended) (Note: Threshold wind speed of 5.4 m/s to be refined based on local condition, i.e., generation fugitive dust at certain wind threshold)	Fugitive dust is generated within or close the equipment, barges, stockpiles, etc. at winds speed > 5.4 m/s (equivalent to Beaufort Scale 3 – leaves and small twigs constantly moving, light flags extended) (Note: Threshold wind speed of 5.4 m/s to be refined based on local condition i.e., generation fugitive dust at certain wind threshold)	Fugitive dust is visually transported outside property boundaries (or at ASRs) during high wind speeds (> 5.4 m/s) (equivalent to Beaufort Scale 3 – leaves and small twigs constantly moving, light flags extended) (Note: Threshold wind speed of 5.4 m/s to be refined based on local condition i.e., generation fugitive dust at certain wind threshold)	Check if regular dust mitigation measures are implemented	▫ Inform equipment operator or contractor on its generated dust emissions ▫ Reduce vehicle travelling speed (e.g., 30 km/hr from 40 km/hr) ▫ Minimise dust generating activities	Suspend operation (i.e., materials handling) until favourable condition is meet (e.g., low wind speed) and/or additional mitigation measures are in placed (e.g., increase wetting frequency)
Ambient Noise													
Ambient Noise	Increase in noise levels	Ambient noise (outside periphery of proponent)	Noise	Monthly or as frequent as necessary	Nearest receptor (household)	Project proponent and contractor	Part of environmental budget	▫ Ambient: 51dBA (daytime)* ▫ Morning/evening-46 dBA* ▫ Nighttime – 41 dBA* ▫ *Add factor of +5 dBA if area (monitoring station) is directly facing two-lane road	▫ Ambient: 53dBA (daytime)* ▫ Morning/evening-48 dBA* ▫ Nighttime – 43 dBA* ▫ Add factor of +5 dBA if area (monitoring station) is directly facing two-lane road	▫ Ambient: 55dBA (daytime)* ▫ Morning/evening-50 dBA* ▫ Nighttime – 45 dBA* ▫ *Add factor of +5 dBA if area (monitoring	▫ Continue monitoring noise levels ▫ Check background noise levels	Conduct noise assessment to mitigate noise source that contribute to higher noise levels	Reduce or suspend activities that attenuate high noise levels exceeding standards especially during nighttime

Module	Environmental Sector	Parameters to be monitored	Sampling and Measurement			Lead Person/ Office	Annual Estimated Cost (Php)	EQPL Management Scheme					
								EQPL Range			Management Measure		
			Method	Frequency	Location			Alert	Action	Limit	Alert	Action	Limit
								▫ (Note: Assumes noise sources are from the project only; no other background sources)	▫ (Note: Assumes noise sources are from the project only; no other background sources)	station) is directly facing two-lane road ▫ (Note: Assumes noise sources are from the project only; no other background sources)		Implement noise attenuation measures	
People													
Plant Operations	Health and safety impacts	Accidents and morbidity cases related to the construction	Work related-accident report and review of community health condition FGDs/ KIIs/ Community Consultations	Annual	Plant/ Impact Communities	Proponent through Safety Officer and CRO		Manifestations/ observations during monitoring that will result in negative impact	Incident Report on accidents and morbidity cases	Complaint received on accidents and negative health condition of the local communities	Implement measures to mitigate negative impact	Verify and validate report Implement measures to mitigate negative impact	Conduct investigation Take action to address negative impact
	Employment opportunities	No. of workers employed from the impact communities, including employment from contractors	HR Manpower Monitoring Report FGDs/ KIIs/ Community Consultations	Annual	Plant/ Impact Communities	Proponent through HR Manager and CRO	5,000/ monitoring	Manifestations/ observations during monitoring that minimal labor force came from the local communities	Incident report on non-prioritization of hiring locals	Complaint received on non-hiring of locals	Implement measures to mitigate negative impact	Verify and validate report Implement measures to mitigate negative impact	Conduct investigation Take action to address negative impact
	Increase in business opportunities	No. of business established due to the operation	Ocular/Filed Observations Gather secondary data from Barangay/ Municipal LGUs FGDs/ KIIs/ Community Consultations	Annual	Impact Communities	Proponent through CRO	5,000/ monitoring	Manifestations/ observations during monitoring that will result in negative impact	Incident Report on negative impact	Complaint received on the negative impact	Implement measures to mitigate negative impact	Verify and validate report Implement measures to mitigate negative impact	Conduct investigation Take action to address negative impact
	Increase in traffic hazards	No. of road/ traffic accidents	Gather secondary data from Barangay/ Municipal LGUs FGDs/ KIIs/ Community Consultations	Annual	Impact Communities	Proponent through CRO	5,000/ monitoring	Manifestations/ observations during monitoring that will result in negative impact	Incident Report on negative impact	Complaint received on the negative impact	Implement measures to mitigate negative impact	Verify and validate report Implement measures to mitigate negative impact	Conduct investigation Take action to address negative impact
	Improved services and community	No. of Community Development Programs/	Gather secondary data from Barangay/	Annual	Impact Communities	Proponent through CRO	5,000/ monitoring	Manifestations/ observations during monitoring that will	Incident Report on negative impact	Complaint received on the negative impact	Implement measures to mitigate negative impact	Verify and validate report	Conduct investigation Take action to address negative impact

Module	Environmental Sector	Parameters to be monitored	Sampling and Measurement			Lead Person/ Office	Annual Estimated Cost (Php)	EQPL Management Scheme					
			Method	Frequency	Location			EQPL Range			Management Measure		
								Alert	Action	Limit	Alert	Action	Limit
	development potential	Projects/ Activities implemented and No. of beneficiaries	Municipal LGUs and beneficiaries FGDs/ KIIs/ Community Consultations					result in negative impact				Implement measures to mitigate negative impact	
	Generation of additional revenue for the Local Government	LGU Income aside from IRA	Gather data from Barangay/ Municipal LGUs FGDs/ KIIs/ Community Consultations	Semi-Annual	Impact Communities	Proponent through CRO	5,000/ monitoring	Manifestations/ observations during monitoring that will result in negative impact	Incident Report on negative impact	Complaint received on the negative impact	Implement measures to mitigate negative impact	Verify and validate report Implement measures to mitigate negative impact	Conduct investigation Take action to address negative impact
Decommissioning Phase													
Decommissioning of Machines/ Equipment Demolition of facilities Closure of operation	Temporary increase in employment opportunities followed by a decrease	No. of workers employed from the impact communities, including employment from contractors	HR Manpower Monitoring Report FGDs/ KIIs/ Community Consultations	Annual	Plant/ Impact Communities	Proponent through HR Manager and CRO	5,000/ monitoring	Manifestations/ observations during monitoring that minimal labor force came from the local communities	Incident report on non-prioritization of hiring locals	Complaint received on non-hiring of locals	Implement measures to mitigate negative impact	Verify and validate report Implement measures to mitigate negative impact	Conduct investigation Take action to address negative impact
	Possible decline in economic activities	No. of business affected due to closure	Ocular/Filed Observations Gather data from Barangay/ Municipal LGUs FGDs/ KIIs/ Community Consultations	Annual	Impact Communities	Proponent through CRO	5,000/ monitoring	Manifestations/ observations during monitoring that will result in negative impact	Incident Report on negative impact	Complaint received on the negative impact	Implement measures to mitigate negative impact	Verify and validate report Implement measures to mitigate negative impact	Conduct investigation Take action to address negative impact
	- Disturbance and generation of solid waste due to decommissioning activities	Volume of generated waste properly disposed	Ocular/Filed Observations Gather data from Barangay/ Municipal LGUs FGDs/ KIIs/ Community Consultations	Annual	Impact Communities	Proponent through the Environment Officer and CRO	5,000/ monitoring	Manifestations/ observations during monitoring that will result in negative impact	Incident Report on negative impact	Complaint received on the negative impact	Implement measures to mitigate negative impact	Verify and validate report Implement measures to mitigate negative impact	Conduct investigation Take action to address negative impact
	Change in \socio/community development benefits	No. of implemented Community Development Programs/ Projects/ Activities continuously managed or sustained by	Gather secondary data from Barangay/ Municipal LGUs and Beneficiaries	Annual	Impact Communities	Proponent through CRO	5,000/ monitoring	Manifestations/ observations during monitoring that will result in negative impact	Incident Report on negative impact	Complaint received on the negative impact	Implement measures to mitigate negative impact	Verify and validate report Implement measures to mitigate negative impact	Conduct investigation Take action to address negative impact

Module	Environmental Sector	Parameters to be monitored	Sampling and Measurement			Lead Person/ Office	Annual Estimated Cost (Php)	EQPL Management Scheme					
								EQPL Range			Management Measure		
			Method	Frequency	Location			Alert	Action	Limit	Alert	Action	Limit
		the beneficiaries	FGDs/ KIIs/ Community Consultations										
	Change in the revenue collection of the Local Government	Possible decrease in Local Government revenues	Monitor decrease in LGU Income	Gather data from Barangay/ Municipal LGUs FGDs/ KIIs/ Community Consultations	Semi-Annual	Impact Communities	Proponent through CRO	5,000/ monitoring	Manifestations/ observations during monitoring that will result in negative impact	Incident Report on negative impact	Complaint received on the negative impact	Implement measures to mitigate negative impact	Verify and validate report Implement measures to mitigate negative impact

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6.2 Multi-sectoral Monitoring Framework

Multi-sectoral monitoring for the project shall be based on the guidelines/requirements of the Revised Procedural Manual for DENR Administrative Order 2003-30 (Implementing Rules and Regulations of Presidential Decree No. 1586, Establishing the Philippine Environmental Impact Statement System).

A Multi-partite Monitoring Team (MMT) will be established to assess and validate compliance with the relevant environmental standards. The MMT will be composed by representatives of the following offices:

- Municipal Environment and and Natural Resources Officer (Chairman)
- Rural Health Unit
- Local Government Unit – Barangays Punong Balibaguhan and Talaga East
- Non-Government Organization
- Locally recognized Community Leaders (maximum of two representatives)
- Department of Trade and Industry (DTI)

The MMT shall have the following functions:

- Monitor, assess, and validate the project's compliance as stated in the EIA Report, ECC, and other relevant environmental standards
- Set-up project specific (location-based) environmental standards in accordance with environmental standards identified above
- Prepare members of the MMT to handle monitoring activities through proper trainings
- Management and disposition of complaints formally filed against the project proponent and its contractors
- Fiduciary management of funds allocated for the above purposes

As stated under the Philippine Environmental Impact Statement System (PEISS), MMTs are organized to encourage public participation, to promote greater stakeholder vigilance and to provide an appropriate check and balance mechanisms in the monitoring of project implementation. The MMT is recommendatory to EMB. MMTs have the primary responsibility of validation of Proponent's environmental performance, with the following specific functions:

i. Validate project compliance with the conditions stipulated in the ECC and the EMP;
ii. Validate Proponent's conduct of self-monitoring;

iii. Receive complaints, gather relevant information to facilitate determination of validity of complaints or concerns about the project and timely transmit to the Proponent and EMB recommended measures to address the complaint;
iv. Prepare, integrate and disseminate simplified validation reports to community stakeholders;
v. Make regular and timely submission of MMT Reports based on the EMB-prescribed format.

6.3 Environmental Guarantee and Monitoring Fund Commitment

The proponent, Holcim Philippines, Inc. - Mabini Plant shall establish an Environmental Monitoring Fund (EMF) and an Environmental Guarantee Fund (EGF) based on the guidelines stipulated in the Philippine EIS System (PEISS).

As defined by the PEISS, the **Environmental Monitoring Fund (EMF)** is a fund that a proponent shall commit to establish in support of the activities of the MMT for the compliance monitoring. The EMF will be established as agreed upon and specified in the Memorandum of Agreement (MOA) between DENR-EMB and the Proponent, with conformity of the MMT members. The actual amount to be allocated for the EMF shall be determined based on the Annual Work and Financial Plan (AWFP) that would be agreed upon by the MMT, derived from the Proponent's Environmental Monitoring Plan (EMoP). The rates or amounts that will be used in the preparation of the Work and Financial Plan shall be in accordance with the rates agreed upon and within the limits set by the PEISS or as prescribed in pertinent government guidelines. The EMF budget for this project is Php 500,000 replaceable.

The **Environmental Guarantee Fund (EGF)**, on the other hand, is a fund that proponent shall commit to establish when an ECC is issued for projects or undertakings determined by EMB to pose significant risk to answer for damage to life, property, and the environment caused by such risk, or requiring rehabilitation or restoration measures. It shall also be used to implement damage prevention measures, environmental education, scientific or research studies, IEC, training on environmental risk or environmental accident-related matters.

The EGF shall be established and used for the following risk-management related purposes:

1) 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;

2) The just compensation of parties and communities affected by the negative impacts of the project;
3) the conduct of scientific or research studies that will aid in the prevention or rehabilitation of accidents and/or risk-related environmental damages; or
4) 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.

The total EGF to be utilized by the project is PhP 5,000,000.

7.0 EMERGENCY RESPONSE POLICY AND GUIDELINES

To address emergency situations such as those involving the loss of life and damage to property, a comprehensive system of procedures that includes, among others, the identification of potential occurrence of emergencies, appropriate response procedures, and personnel training was established by the company.

As part of the mandated Safety and Health Program (SHP), emergency plan procedures for specific emergency situations were created and enacted. Appropriate equipment that is essential for carrying said procedures were and shall continually be identified and acquired. Adequate prevention systems and/or early warning devices were also installed throughout the project area. Moreover, periodic drills will still be conducted to test the procedures, understanding of all personnel regarding said procedures, and the readiness of the response teams.

7.1 Emergency Response Team

As part of the Safety and Health Office, an Emergency Response Team was established by the company. This team, headed by the designated Safety Manager, will still carry out the safety procedures whenever an emergency is reported and shall be continually be comprised, but not limited, of the following:

- First Aid Team;
- Rescue and Recovery;
- Logistics;
- Security and Crowd Control;
- Fire Brigade;
- Internal and External Communications; and
- Hazardous Material Control.

7.2 Emergency Procedures

Specific procedures for each type of emergency have already been established by HPHI - Mabini, which shall be continually documented, employed, and disseminated. These procedures shall also still be given as part of the training of personnel.

General rule when emergency occurs:

The **person who discovers the emergency** must keep calm, assess the situation, and alert the company by setting of local alarm (if available) and/ or contacting the Admin Lobby Security Guard / Emergency Call Receiver either by:

- Radio

The person who discovers the emergency must:

- State clearly that it is an EMERGENCY
- Provide his/ her name
- State the type of Emergency – Medical, Fire and etc. and assistance required
- State exact Location of the Emergency
- Provide Phone Number if available
- State the company where he/ she is employed
- Ensure that his/ her message has been understood

7.2.1 Fire and Explosion

7.2.1.1 Fire Prevention

1. Observe rules and regulations on safety in the installation, operation, and maintenance of the equipment. (Refer to Electrical Code, Mechanical Professional Code, Occupational Health and Safety Laws, Fire Code of the Philippines);
2. Implement “No Smoking” policy on all fire-critical areas within the plant. “No Smoking” signs indicate that there are inflammable materials and fire-risk condition in the area;
3. Keep flammable storage areas well ventilated and free from sources of ignition;
4. Dispose all flammable waste materials immediately. Place flammable scraps and oil-contaminated rags in “Hazardous Waste” bin;
5. Change clothes immediately if they are soaked with oil, kerosene, gasoline or any flammable liquids;
6. Unplug electrical equipment when not in use, more importantly, those that build up heat such as fans, air pots, ovens, hot plates and stoves; and
7. Avoid spaghetti wirings. Secure wires and cables.

7.2.1.2 Fire Preparedness

1. Install adequate firefighting equipment such as fire extinguishers, fire hydrants and other equipment
    - Inspect fire extinguishers monthly using Fire Extinguisher Register;
    - Inspect fire hydrants and accessories quarterly using Fire Hydrant Inspection Checklist;
    - Inspect other firefighting equipment such as fire water pump quarterly; and
    - Test and inspect fire alarm system annually.
2. Organize Fire Fighting Team in each areas of the plant;
3. Conduct fire drills at least twice a year;
4. Conduct regular firefighting skills training for all Fire Fighting and Emergency Response Team members;
5. Conduct orientation training on fire prevention and fire fighting for all employees;
6. Know all fire exits and location of nearest fire extinguishers in the work area;
7. Place critical equipment in FIRE PROOF or not FIRE hazard areas; and
8. Important documents and files must be placed in FIRE PROOF cabinet

7.2.1.3 In Case of Fire

7.2.1.3.1 Person who discover Fire

For Small Fire, extinguish the fire using Fire Extinguisher. If out of control, facilitate evacuation to designation area. Leave the area through the designated emergency exits. In case of mass evacuation, follow the evacuation marshals, and proceed to designated assembly area.

7.2.1.3.2 Emergency Response Team

Responsible for the hands-on controlling of Fire.
Make contact with the person who reported the emergency and assess the situation with respect to the following:

- Safety to access area (Do not place additional personnel at risk)
- Assist injured person, if any
- Securing plant and equipment

7.2.1.3.3 Authorized Fire Truck Driver

Drives the emergency response vehicles and assist where possible

7.2.1.3.4 Medical Staff

Provide medical assistance at scene and in clinic. Drive ambulance to the scene if required.

7.2.1.3.5 Area Controller

Contact ERT Leader at the emergency scene immediately and control all operational aspects of emergency.

7.2.2 Material, Oil, Chemical, Spills and Gas Leaks

Chemical, oil materials spills, and gas leaks may happen during receiving, transport, storage, and use of product. For prevention guidelines for such spills, refer to Handling, Storage, Usage and Disposal of Chemicals and Waste Management.

Appropriate PPE shall be worn when controlling spills and gas leaks.

7.2.2.1 For the Area Owner

- Stop source of spill or leak, if possible, turn off valve or cover opening of container.
- Shut off operations if needed.
- **For liquid and solid substances:** Provide barriers to prevent or slow down further spread of spill. Use appropriate spill control equipment such as boom (for spills in water or sea) rags, raw mix, saw dust, sand or other absorbent materials.
  Note: Never use sawdust or any combustible materials for strong acid.

- **For Gas Leak:**
  - If you smell gas or suspect leak, shut off operations if needed. Take actions to ensure your personal safety.
  - Leave the area at once and pull the nearest fire / evacuation alarm to initiate evacuation.
- Put up barricades and signs to warn off personnel passing by.
- Increase ventilation to prevent build up of noxious fumes and vapors if possible.

- Eliminate all possible sources of ignition in the area.

- Gather information of the spill or leak.
- Inform Superior of situation.
- CCR operator or control room operator to notify the Incident Commander.
- If spill or gas leak cannot be controlled: (Refer to General Rule when Emergency Occur)
- Do not re-enter the scene until authorized by the Incident Commander.

7.2.2.2 Emergency Response Team

1. Help in spill/ leak control detailed above.
2. Assess situation as to the level of emergency.
   - need for recovery operation
   - evacuation of areas affected
   - communication requirements
3. Recover spilled oil or chemical, if possible. Place in labeled containers. Dispose recovered oil and oil-contaminated materials according Handling, Storage, Usage and Disposal of Chemicals

7.2.3 Natural Disasters

Natural disaster cannot be prevented. However, adequate preparedness and response procedures may be done to avoid or at least reduce their adverse effect.

7.2.3.1 Earthquake

7.2.3.1.1 Preparedness

- Ensure security and integrity of buildings and other infrastructure.
- Secure fallings hazards with rails and other suitable guards. Place large objects on lower shelves and securely fasten shelves into wall.
- Secure all top-heavy furniture and appliances to the wall.
- Ensure that LPG tanks, gas cylinders and gas-operated appliances do not topple over in the event of earthquake; and sturdy flexible connections are in place between the connectors and the pipes.
- Store flammable materials such as fuel, paint, thinner, alcohol and solvents in a warehouse away from the densely populated buildings/ areas.

7.2.3.1.2 During an Earthquake

- If caught indoor, stay there. Get under a sturdy desk or table, or brace under a doorframe or corner.
- Stay away from windows, glass, cabinets, tall furniture, hanging plants and other objects which may topple or sway.
- In a high-rise building, expect the fire alarms and sprinklers to go off during a quake. Do not use the elevator. Beware of the possibility of fire.
- If caught outdoor, find a clear spot away from buildings, trees, power lines, chimneys or electric cables. Drop to the ground.
- If riding a vehicle, slow down and drive to a clear place. Activate emergency blinkers. Do not park under bridges, tall buildings and overhead wires. Stay in the car until the shaking stops. Beware of the possible damages to bridges and road.

7.2.3.1.3 After the Earthquake

- Check self for injuries.
- Check others for injuries. Do not move seriously injured persons unless their location is in immediate danger. If possible, give first aid for serious injuries.
- Shut off water and electrical mains. Check for gas leaks and possible electrical sparks. Do not light matches or candles unless it is sure that there is no gas leak.
- Look for and extinguish small fire, if any.
- Wear heavy work clothes and sturdy shoes to be safe from debris and broken glass.
- Cordon off fallen electrical lines.
- Check water lines from breaks and leaks; check the sewage lines before flushing the toilet.
- Check the integrity of water and food supplies. Avoid using the telephone except for emergency calls.
- Listen to the radio for instructions.
- Prepare for aftershocks.
- Inspect the whole building for damage. Do not go inside damaged buildings. Get everyone out, if it is unsafe.

7.2.3.2 Lightning

- Do not carry metal objects and tools with pointed ends.
- People struck by lightning carry no electrical charge and van be handled safely. The injured person has received an electrical shock and may be burned. Check for burns. Being struck by

lightning can also cause nervous systems damage, broken bones, and loss of hearing or eyesight.

- Give first aid. If breathing has stopped, begin rescue breathing. If the heart stopped beating, a trained person should give CPR. If the person has pulse and is breathing, look and care for other possible injuries.

7.2.4 Work Accidents and Instructions for First Aid

First aid kits shall be provided in strategic areas within the Plant to be ready for any worker accident that would require first aid. The Plant Nurses shall regularly check these kits and ensure that adequate first aid items such, antiseptics, bandages and scissors are available. Medicines shall be maintained at the Plant Clinic and shall be issued upon request.

7.2.4.1 When a co-worker meets an accident

- Do not panic. Maintain presence of mind.
- Contact Admin Lobby Guard / Emergency Call Receiver
  (Refer to General Rule when Emergency occurs)

7.2.4.2 Emergency Response Team

- ERT / First-aider to administer first aid, assists medical experts, gathers relevant information on the incident while administering first aid.

7.2.4.3 Ambulance Driver

- Drive the ambulance to the emergency location and park in the most appropriate place or as directed by the ERT Leader, Medical Coordination etc.
- Remain at the emergency site until relieved or the emergency is completed. Be prepared to assist, relocate or drive the vehicle to an external emergency location (e.g. Hospital)
- Remain in contact with the ERT Leader and site security at all times if possible.

7.2.4.4 Medical staff

Visit the injured at the scene. Take responsibility for any treatment required:

1. Fractures

- A simple fracture does not pierce through the skin. If it is not handled properly, it could become a compound fracture. If a fracture is suspected, check for swelling around the affected area. If there are discoloration or bruises, call the doctor immediately.
- A compound fracture pierces through the skin, Serious bleeding may occur with thus kind of wound. Do not apply pressure to compound fracture to stop bleeding. Cover the injured part with sterile pad. Apply a splint to keep the bone from causing further injury to the surrounding tissues. Wait for medical help. Avoid moving the victim, but keep him warm, comfortable and assured.

2. Concussions and Contusions

A sharp blow to the head could result in concussion or jostling of the brain inside its protective, bony covering. A more serious head injury may result in concussion or bruise in the brain. A period of unconsciousness may indicate brain damage. While waiting for help to arrive, keep the victim lying down in the recovery position. Control any bleeding. Be sure that the victim is breathing properly. Do not give the victim any liquid to drink. If the victim becomes unconscious, keep track of this information so that you can report it when medical help arrives.

3. Cuts and Abrasions

Cleanse area thoroughly with soap and warm water, carefully washing away any dirt. Apply direct pressure to wound until bleeding stops. Put sterile bandage on wound. If cut is deep, bring to the hospital for suturing and medical intervention.

4. Abrasions (scratches)

Wash thoroughly with soap and warm water. If it bleeds or oozes, apply bandage to protect from inspection.

5. Burns

Never put greasy ointments on a burn. They seal heat into the wound and may cause infection. Seek medical attention if burn covers more than oe body part; burn is located on any sensitive area of the body (hand, face, feet, etc.); burn is third degree; and burn is caused by chemicals.

For first-degree burn that damaged the outer layer of the skin and characterized by redness, mild pain, and swelling, immediately submerge the affected part in cold water. Hold it under cold running water or place cold, wet clothes on it until the pain decreases. Cover with clean, dry gauze dressing for protection.

6. Electric Shock

Remove the source of electricity from the victim before you touch him. Either turn off the master switch to disconnect the power, or use a non-metal, dry object such as stick to pull the wire or electrical source away from the victim's body. If the victim is not breathing, begin cardiopulmonary resuscitation (CPR). If the person is unconscious, but is breathing and has heartbeat, place him/her in a recovery position and monitor his/her breathing and heart rate until medical help arrives.

7. Bleeding

A. External bleeding

Apply direct pressure. Place a clean, folded cloth over the injured area and firmly apply pressure. If blood soaks through do not remove it. Instead, cover that cloth with another one and continue to apply pressure to the wound for 7-10 minutes. If the bleeding is from the ear, place a clean bandage over the ear, lay the victim on his side, and allow blood to drain out through the bandage. Elevate injured part. Position the wounded part of the body above the level of the heart if possible while you apply direct pressure. Know the pressure point. If direct pressure and elevation do not sufficiently slow down the blood flow, find a pressure point. Large arteries found close to the skin's surface supply blood to the head and to arms and legs. The most common pressure points used during first are located in the upper arms and legs. Apply pressure closest to the wound so that the artery is pressed between your finger and the bone directly behind the artery. If using the pressure point on a leg, you may need to use the heel of your hand instead of your finger. Resort to a tourniquet. On very rare occasions everything listed above may fail. To prevent the victim from dying, you should apply a tourniquet. Use a tourniquet ONLY if everything mentioned above has failed. If you use a tourniquet, write down somewhere on the victim the time it was applied, so medical staff will know how long it has been applied.

B. Internal Bleeding

Internal bleeding results when blood vessels rupture, allowing blood to leak into body cavities. It could be a result of a direct blow to the body, a fracture, a sprain, or a bleeding ulcer. If a victim receives an injury to the chest or abdomen, internal bleeding should be suspected. He will probably feel pain and tenderness in the affected area. Check for an open airway and begin rescue breathing if necessary. Call for medical help as soon as possible and keep the victim comfortable until help arrives.

8. Heat Exhaustion

Heat exhaustion is a common occurrence. Its symptoms are pale and clammy skin, rapid and weak pulse, and complaints by the victim of weakness, headache, or nausea. The victim may have cramps in abdomen or limbs.

9. Heat-stroke

Heat stroke is completely different from heat exhaustion. Its symptoms are a flushed and hot skin and a rapid and strong pulse. The victim is often unconscious.

Cool the body of a heat-stroke victim immediately. If possible put him in cool water; wrap him in cool wet clothes; or sponge his skin with cool water, rubbing alcohol, ice, or cold packs. Once the victim's temperature begins to rise again, you will need to repeat the cooling process. If he/she is able to drink, you may give him some water. DO NOT GIVE A HEATSTROKE VICTIM ANY KIND OF MEDICATION. You should watch for signs of shock while waiting for medical attention.

10. Chemical Poisoning

Poisoning is characterized by rash blistering swelling burning and itching. Remove any contaminated clothing. Wash the affected area of the skin thoroughly with soap and cool water to remove any poisoning residue. Be sure the water used to clean the area does not spread poison by running over other parts of the body. Using washcloth could alsospread the poison. Rinse the area with rubbing alcohol. Apply calamine lotion to the area to relieve itching and burning. If the victim develops a fever for several days or experiences an excessive amount of inflammation, irritation, oozing, or itching, a doctor should treat him.

11. Other

Moving Injured Persons:

Do not move an injured person before a physician or experience ambulance crew arrives unless there is a real danger of his receiving further injury by being at the accident site. If possible, control bleeding, maintain breathing, and splint all suspected fracture sites before moving. In carrying the injured person to an area where stretcher van be manipulated, use either the two, or three-man carry method, depending on the type and severity of the injury, the available help, and he physical surroundings (stairs, walls narrow passages, etc.) The one and two-man systems are ideal for transporting a person who is unconscious from asphyxiation or drowning, but are unsuited for carrying a person suspected of having fractures or other severe injuries. In these cases, always use the three-man carry method. An effective stretcher can be made by buttoning two shirts or a coat over two sturdy branches, or by wrapping a blanket in thirds about the branches or poles. If the victim must be moved, a stretcher must be used.

- Remove injured to the clinic or hospitals as appropriate if required.
- Ensure any hospitals are made aware that patients are on their way.

7.2.5 Bomb Threat

Security and Gate Control shall be strictly implemented to prevent possible entry of lawless elements. The following are guidelines in case of bomb threat. Response procedure for explosion is described in Fire and Explosion work instruction.

7.2.5.1 For employee or anyone who received the bomb threat

1. A bomb threat may be received by anyone in the organization either through phone, mail or message at any time.
2. When a bomb threat is received through phone call:

a. Do not panic nor disregard the threat.
b. Be calm and courteous.
c. Listen and do not interrupt the caller.
d. The receiver must extract all information such as:

- location of the bomb

- time set of explosion / detonation
- description of the container / explosive
- type of explosive
- reason and motive of call or threat

e. Try to keep the caller talking as long as possible. The receiver must take note of the following:

- date and time message is received /sent
- language or dialect
- gender of caller (male / female / third sex)
- identifiable noise background like: music, trucks, cars, engines

3. Inform and report immediately threat to the Incident Commander

7.2.5.2 Holcim Philippines, Inc. – Mabini Plant Management

1. Evaluate the emergency / threat.
2. Seek help from Experts (Explosive and Disposal Team), if needed.
3. Secure / shutdown equipment. Remove critical equipment and records.
4. Provide support to Explosive and Ordinance Disposal Team (EODT)
5. Conduct monitor and investigate.
6. Conduct debriefing and assessment.

7.2.6 <u>Terrorist Attacks</u>

The following are recommended courses of action to prevent or handle hostage-taking or other terrorist attacks:

1. Appropriate security and intelligence measures shall be provided to avoid terrorist attack.
2. Anyone shall report sighting of suspicious elements within the vicinity of the company to Superior and Security Office.
3. Inform and report immediately to the Incident Commander if terrorist attack is confirmed.
4. Security to call PNP / Military units: *(Agencies' Contact Numbers, refer to Emergency Response Manual)*
5. Assess situation, LEAVE if the area is unsafe.

7.2.7 Theft and Pilferage

A. PREVENTIVE ACTION

1. Maintain good relations with residents of the immediate community.
2. Organize sustainable livelihood programs.
3. Regularly dispose and clean-up scrap items.
4. Store items inventory at Procurement warehouse and department supplies at designated department storage areas.
5. All company-owned items taken out from the plant premises shall be converted with appropriate gate pass.
6. All personnel items brought inside the plant shall be recorded at the gate guard.
7. Employees / workers shall report to immediate supervisor or to the security office presence of suspicious elements/movement or unauthorized activities inside the plant premises.
8. Security group to ensure all entries are checked and authorized.
9. Security group to conduct regular vicinity and border patrol.
10. Contractors to safe keep their equipment before leaving their working areas.
11. Housekeeping should be done before leaving the area.

B. SECURITY PROCEDURES

1. Personnel taking out company items without due authorization shall be apprehended and items to be confiscated by the guard.
2. Security personnel shall prepare appropriate report to Admin. Services Officer who in turn disseminates information to item custodian or department affected.
3. Security and department concerned shall conduct investigation of the incident.
4. File police blotter / record.
5. CSR Department to file appropriate court charges when necessary.
6. Submit investigation report to VP-Operations.

7.2.8 Handling Strike or Demonstration

This serves as guide to management and employees in handling strikes or demonstrations or threats of such actions from employees, community residents or any group, which may have unresolved grievances with company.

It is the policy of the company to hear grievances and open discussions with employees, community, NGO and other groups.

In the event of strike or demonstration, OPCOM shall:

1. Increase security at gates, perimeters and critical areas in the plant. This is to protect employees, company officers, equipment, properties and operations.
2. Assess situation:

- Determine group involved
- Determine and validate issues / grievances
- Decide action on grievances

3. Inform relevant authorities: DOLE, DENR, LGU, Police.
4. Arrange dialogue with involved groups
5. Involve/consult individual who can help resolve the situation
6. Where possible, resolve issues in amicable manner.
7. Any strike or demonstration should be diffused or acted upon immediately

7.2.9 <u>Vehicular Accident</u>

1. Inform the following:

- Immediate Superior
- OH & S Officer
- Plant Nurse
- Admin Services (for insurance claims)

2. In case of injury, call Clinic / Plant Nurse and OHS Officer. Refer to Worker Accidents and Instructions for First Aid.
3. Plant Nurses to assess situation, arrange transport to hospital.
4. Personnel or Plant Nurse to inform hospital of emergency.
5. Security Officer to inform Police for blotter.
6. OHS Officer, Security Services and concerned department to conduct incident investigation. May call on authorized government agencies in case of fatal accident.
7. OHS / Security Officer to prepare incident evaluation and report.

7.2.10 OIL SPILLS

Note: Oil spills may happen during receiving, transport, storage and use of Bunker Fuel Oil (BFO) and liquid alternative fuel.

7.2.10.1 Containment, Recovery and Clean Up

7.2.10.1.1 Area Owner and Team

1. Recover oil spills by scooping using bucket. Place recovered oil spill in drums and dispose to AFR tank. Water containing oil should be passed through the oil-water separator to recover the oil.
2. Clean the sewers and path of the spills with saw dust or raw mix. Oil contaminated materials should be disposed at AFR container for saw dust.
3. If spill reaches oil-water separators, seal the outflow and conduct oil recovery by scooping and absorbing with the use of bucket and oil absorber.
4. Prepare incident report regarding oil spill.
5. If spill cannot be controlled, contact the Admin Lobby Guard / Emergency Call Receiver *(Refer to General Rule when Emergency occur)*

7.2.10.1.2 Emergency Preparedness and Response Team

1. Help in spill / leak controls as detailed above.
2. Assess situations as to the level of emergency
   - Need for recovery operations
   - Evacuation of areas affected
   - Communication requirements
3. Recover spilled oil, if possible. Place in labeled containers.

7.2.11 Structural Collapse

When internal load bearing structural element fail, a structure may collapse into itself and exterior wall are pulled into the falling structure. This scenario may be caused by construction activity, an earthquake, or fire, and may result in dense debris. If the structural failure is caused by an explosion or natural forces such as weather, the structure may collapse in an outward direction, resulting in a less dense and more scattered debris field.

7.2.11.1 Before the collapse

1. Whenever there are reported structural cracks, Project Engineering group to conduct daily structure integrity and crack monitoring, and communicate results to all concerned.
2. Cordon off the area as controlled area. Only authorized personnel are allowed to enter the controlled area.
3. Investigate the extent of structural crack by means of boroscopy or other appropriate verification technology.
4. Implement concrete remediation as recommended by structural experts.
5. In case of silo structure, maintain a maximum silo load level as recommended by structural experts.
6. Install an audible industrial emergency alarm system to alert all personnel for possible evacuation in the event integrity worsen.
7. Contractors and operations personnel on duty to monitor the structure and report on any unusual situation of structure.

7.2.11.2 During Structural Collapse

1. Contact the Admin Lobby Guard / Emergency Call Receiver and then refer to *General Rule when Emergency Occur*
2. Incident command system should be activated immediately. Incident Commander maintains accountability and emergency response operation for all response personnel at the scene.
3. CCR operator to immediately shutdown machineries in emergency mode.
4. The OHS Officer is responsible for monitoring and assessing the safety aspects of the responders during the collapsed structure event.
5. Rescue workers and emergency responders may be required to enter the collapsed structure in command of the Incident Commander.
6. All operation employees, contractors and visitors present during the incident should assemble at the identified evacuation area to conduct head count. All personnel should be accounted for.
7. Medical staff report to the emergency location and take responsibility for any treatment required.
8. Drive the ambulance to the emergency location and remain until emergency is completed. Be prepared to assist, relocate or drive the vehicle to an external emergency location like hospital.

7.2.11.3 After structural collapse

1. Regular employees, contractors, visitors should submit report to the Incident commander confirming the head count and their status.
2. VP-Operations to report the incident to the COO.
3. VP-Operations to formulate official statement (facts) in coordination with Makati-Head Office for concurrence of COO, to inform LGU and conduct press briefing.
4. Incident scene should be cordoned off and restricted after the rescue operation for investigation.
5. Police, LGU, visitors and outside rescue teams should be held at Gate 1 for further instructions from the Incident Commander.

6. Media/press should be advised by the security and crowd control team to stay at the Admin. Training room for further instructions.
7. OHS Manager to conduct After Action Review.
8. OHS Manager to report incident to COO and Corporate OHS.
9. VP-Operations to report incident to relevant regulatory body.

7.3 Program Implementation Requirements

HPHI-Mabini shall retain and continue to implement this program as part of its SHP. Personnel responsible for spearheading these programs will continually be subjected to appropriate trainings and necessary accreditation. Documentation and record relative to the safety and health implementation will still be maintained and made accessible to all interested parties and government agencies.

The emergency response policy and safety and health management system may be subjected to third party certification in the future.

8.0 ABANDONMENT/DECOMMISSIONING/REHABILITATION AND GENERIC GUIDELINES

As with the end of every industry, the closure of the Project can affect the host community, create loss/decrease in taxes, loss of employment, income and/or business opportunities derived from the project.

The following objectives will be considered in the decommissioning plan:

a. Rehabilitate the disturbed areas to a condition that is beneficial to the environment and conforms to the land use plan of the municipality and/or province that is mutually concurred by the community, government agencies, and the company;
b. Manage and control off-site contamination by fortifying environmental control structures and implementation of appropriate rehabilitation methods;
c. Remove and disband unnecessary Project facilities and equipment used in the operation;
d. Conduct a comprehensive management and monitoring of rehabilitated areas until such time that the area is sustaining and is biologically and physically acceptable with the preferred final land-use; and
e. Monitor SDP implementations and implement post-capacity training on the alternative skills and livelihood opportunities that were initiated during the onset of the Project's operation.

8.1 Decommissioning Plan

To carry out the transitional stage between cessation of operation and actual closure, the company also plans to employ the following strategies:

Decommissioning Strategy	Timeframe
Mobilization of the Closure Team. Start of IEC Campaign as part of social preparation, and creation of Closure ComRel Plan.	Closure Planning. Three (3) years before closure
Inventory of all equipment and facilities by the Closure Team.	Part of Closure Planning Within two (2) years before Closure
Assessment of the conditions of equipment and facilities by the Closure Team.	Part of Closure Planning Within 2 years before Closure

Decommissioning Strategy	Timeframe
Planning and review of decommissioning procedures vis-à-vis the standard operating procedures. Coordination with contractors.	Part of Closure Planning Within one (1) year before Closure
Cross matching of company personnel and residents with the decommissioning tasks. Trainings/seminars will be provided as the need arises. Consultation with stakeholders. Strengthening of IEC Campaign as part of social preparation.	Part of Closure Planning Within 1 year before Closure
Decommissioning of equipment and facilities.	Decommissioning and Rehabilitation Phase Within 6 months after closure
Post assessment by the Closure Team on the decommissioned equipment and facilities.	Decommissioning and Rehabilitation Phase Within and after 1 year of closure
Rehabilitation of the decommissioned project component.	Decommissioning and Rehabilitation Phase Within and after 2 year of closure

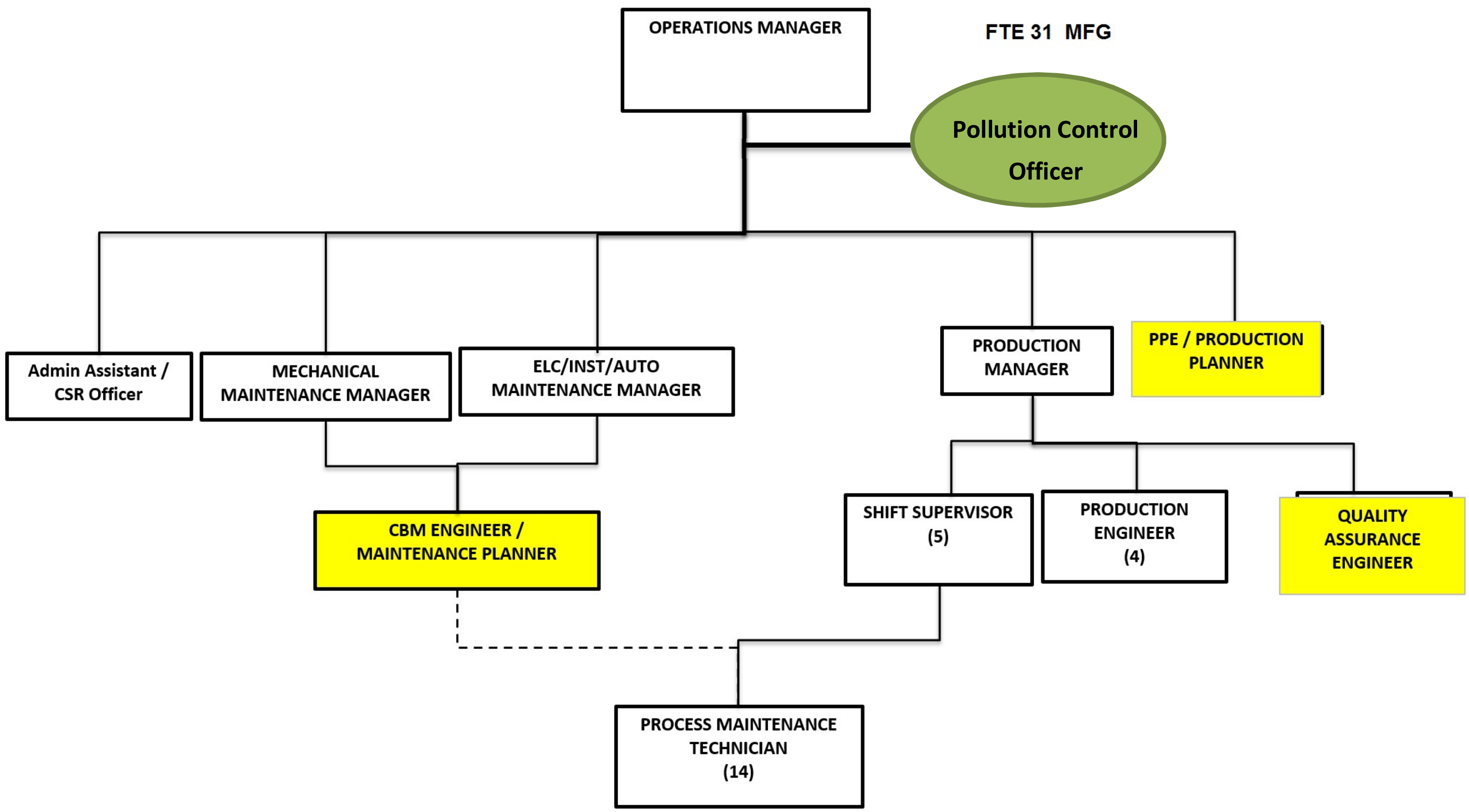
A Closure Team will be established to oversee the implementation of the abovementioned. This team, to be headed by the Plant Manager, will be composed of the various department heads and personnel working under the safety and health, environment, and social departments.

9.0 INSTITUTIONAL PLAN FOR EMP IMPLEMENTATION

The project organizational structure will be comprised mainly by the operations manager and department heads. The pollution control officer will report directly to the operations manager and shall take lead in implementing the environmental management programs as committed in the Impacts Management Plan (IMP) and the Environmental Monitoring Plan (EMoP) presented in this EPRMP.

The PCO shall also have the following functions:

- Monitoring and evaluating the effectiveness of the mitigating and enhancement measures;
- Planning, proposing and implementing modifications or additional measures deemed necessary to effectively protect the environment;
- Coordinating with relevant oversight agencies and other entities, including the local government units to ensure their effective participation in the MMT activities;
- Ensure compliance to ECC conditions and reporting requirements of the DENR-EMB;
- Submission of Compliance Monitoring Report (CMR) in accordance with the specified format in the implementing rules and regulations for Philippine Environmental Impact Statement (PEIS) System; and
- Monitor the actual project impacts vis-à-vis the predicted impacts and management measures presented in the EPRMP Report.


OPERATIONS MANAGER
FTE 31 MFG
Pollution Control Officer
Admin Assistant / CSR Officer
MECHANICAL MAINTENANCE MANAGER
ELC/INST/AUTO MAINTENANCE MANAGER
PRODUCTION MANAGER
PPE / PRODUCTION PLANNER
CBM ENGINEER / MAINTENANCE PLANNER
SHIFT SUPERVISOR (5)
PRODUCTION ENGINEER (4)
QUALITY ASSURANCE ENGINEER
PROCESS MAINTENANCE TECHNICIAN (14)

Annexes

Annex A - ECC-365-BA-120-97

Annex B – Document Transferring the ECC to Mabini Grinding Corporation

Annex C - Graphs of Reef and Substrate Coverage in the Survey Area

Annex D – Self Monitoring Report (SMR)

Annex E – Compliance Monitoring Report (CMR)

Annex F – Ambient Air Monitoring Report

Annex G – Emission Test Report

Annex H - AERMOD View Licensed Certificate and Training Certificate

Annex I - Spreadsheet of Point Source and other Related Information

Annex J - Spreadsheet of the Non-point Sources and Other Related Information

Annex K – Structure Elevation

Annex L - Control Pathway

Annex M - Source Pathway (source inputs)

Annex N - Receptor Pathway

Annex O - Meteorology Pathway and Other Related Information

Annex P - Sample AERMOD Output File

Annex Q – Perception Survey Form

Annex R – FDG Documentation

Annex S – Lease Agreement

Annex T – Issued Environmental Permits