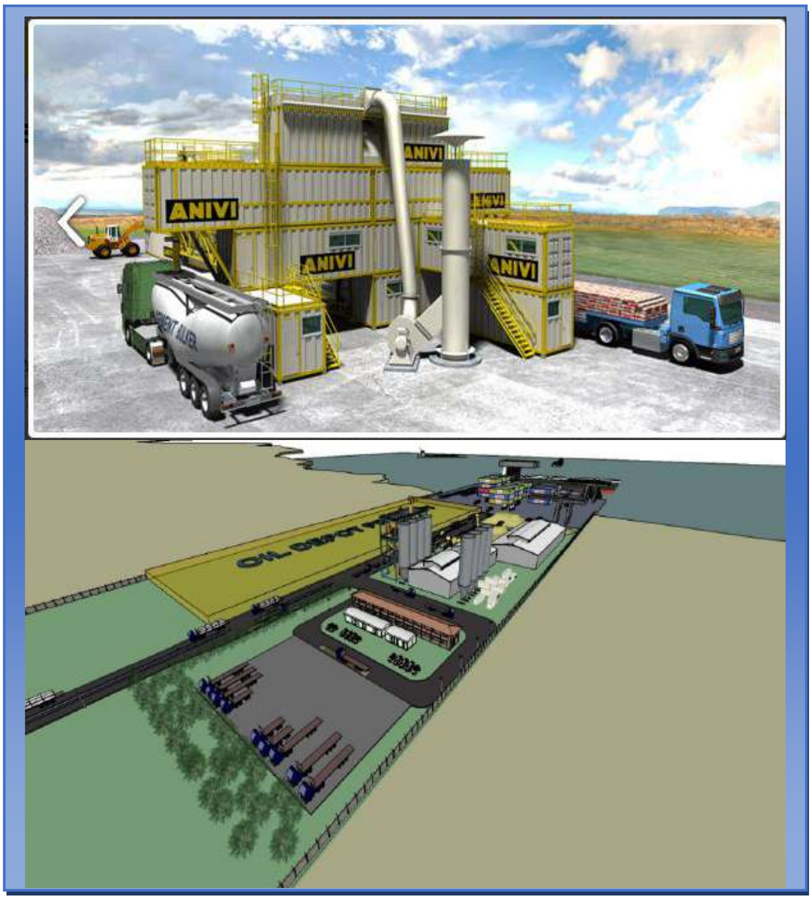
ENVIRONMENTAL PERFORMANCE REPORT AND MANAGEMENT PLAN (EPRMP)

CEMENT FINISHING PLANT PROJECT

BARANGAY LOWER IRASAN, MUNICIPALITY OF PRES. MANUEL A. ROXAS
PROVINCE OF ZAMBOANGA DEL NORTE



PREPARED FOR:

OFFICE ADDRESS: BARANGAY LOWER IRASAN, MUNICIPALITY OF PRES. MANUEL A. ROXAS. PROVINCE OF ZAMBOANGA DEL NORTE
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PREPARED BY:

CENSE TECHNICAL CONSULTANCY SERVICES
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SUBMITTED TO:

DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
Environmental Management Bureau – Central Office
DENR Compound, Visayas Avenue, Diliman, Quezon City

FEBRUARY 2019

PETRA
CEMENT

February 21, 2018

ENGR. METUDIO U. TURBELLA
EMB Director
DENR-EMB Central Office
DENR Compound, Visayas Avenue,
Diliman, Quezon City

ATTENTION : ENGR. ESPERANZA A. SAJUL
CHIEF-EIA

SUBJECT : APPLICATION FOR ENVIRONMENTAL COMPLIANCE CERTIFICATE (ECC) FOR PROPOSED EXPANSION OF *'CEMENT FINISHING PLANT PROJECT'* LOCATED AT BARANGAY LOWER IRASAN, MUNICIPALITY OF MANUEL A. ROXAS, PROVINCE OF ZAMBOANGA DEL NORTE

Dear Director Turbella:

Transmitting herewith Three (3) copy of the **Revised Environmental Performance Report and Management Plan (EPRMP)** for the expansion capacity of '***CEMENT FINISHING PLANT PROJECT'*** for review.

We hope you find the above requirements in order and looking forward to your immediate kind attention on the application.

Thank you very much.

EPRMP Preparer:

CEnSE Technical Consultancy Services

By:

Engr. Venice V. Montemayor
Team Head

Very truly yours,

ENGR. GIL CRUZ
Vice President

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A. PROJECT FACT SHEET

Table ES-1 Project Fact Sheet

Project Name	**Cement Finishing Plant Project**
Project Location	Barangay Lower Irasan, Roxas, Zamboanga Del Norte
Nature of Project	2.1.6C Mineral Processing Project: Non-metallic mineral processing plants like **cement, other cement products**, clinker, limestone, ceramic industries, manufacture of glass and glass products, manufacture and processing of calcium **(Cement Grinding Plant)**
Project Area	52,727 square meters covered by TCT 127-2018000058
Project Capacity	From 50,000 to 1,200,000 MT/year cement production
Environmental Compliance Certificate (ECC) issued	Environmental Compliance Certificate (ECC) with certificate number ECC-R09-1606-0008 to the proponent on June 7, 2016 for the 50,000 MT Annual Production Capacity
Status in terms of Production Process	Site development (xx% completed)
Proponent's Name	Petra Cement Inc.
Proponent's Address	Barangay Lower Irasan, Roxas, Zamboanga Del Norte
Proponent's Contact Person	Engr. Gil Cruz Vice President Mobile No. 09778238585 Email Address: gilcruz@petracement.com Joel Caballero PCO Mobile No.0917-1151192 Email Address: jdcaballero29@gmail.com
Consultant's Contact Person and Address	CEnSE Technical Consultancy Services Unit 301 B No. 375 MJ Building, Quirino Highway, cor. Tandang Sora, Quezon City Engr. Venice Montemayor EIS Team Head Mobile No.: 0927-5116742 Landline : (532)871-5747

Table ES-2. Comparison of the Project Components (Covered by ECC and Proposed Expansion)

Facilities	Covered by existing ECC (ECC Ref. No. ECC-R09-1606-008 issued June 7, 2016)			Proposed Modification/Changes		
	No. of units	Area (sq.m)/ Capacity	Specification/ Description/ Remarks	No. of units	Area (sqm)/ Capacity	Specification/ Description/Remarks
Project Capacity	**50,000 MT/yr**			**1,200,000 MT/yr**		
Project Area	**5.2727 ha**			**5.2727 ha**		
MAJOR COMPONENTS						
Vertical Ball Mill	1	40 MT/hr	Equipment for clinker grinding	2	240 MT/hr	Two (2) with 120MT/hr capacity
Raw Material Storage Facility	1	1,500 sq.m	Includes storage of gypsum, pozzolana and clinker	2	4,500 sq.m	1,500 sq.m for gypsum and pozzolana; 3,000 sq.m for clinker
Cement Silo	3	1,000 tons/silo	Total of 3,000 tons capacity	5	500 tons/silo	Total of 2,500 tons capacity
Conveyor	None	None		1	344.40 meters	Conveyor from the port Facility to the Warehouse
Cement bagging machine	1	50 MT/hr		3	50 MT/hr	Additional machine due to increase in production
Generator Set	1	750 KV		1	750 KV	Standby- In case of power interruption
SUPPORT FACILITIES AND UTILITIES						
Admin Support (Canteen, Office, Clinic, quarters etc.)	1		One (1) Admin office Bldg., one (1) canteen, one (1) clinic, twenty-four (24) parking slots, workers barracks, security outpost etc.	1		One (1) Admin office Bldg., one (1) canteen, one (1) clinic, twenty-four (24) parking slots, workers barracks, security outpost etc.
Water Supply	-	6.5 cu.m/day	Water requirement provided by LWUA	-	12.5 cu.m/day	Water requirement provided by the LWUA
Drainage System	-	-	Engineered surface water drainage and management system			Engineered surface water drainage and management system
POLLUTION CONTROL FACILITIES						
Cooling Tower	1	3 cu.m/hr	Close loop system	1	6 cu.m/hr	Close loop system
Solid Waste Management Facility	1	9 sq.m		1	15 sq.m	Primarily intended for domestic solid waste
Toxic and Hazardous Waste Facility	1	9 sq.m		1	15 sq.m	Intended for hazardous waste only
Settling Pond	1	10 cum		1	50 cum	For wastewater treatment and reuse
Dust Collector	1	0.5 MT/hr	Filter bag type with about 95% efficiency	3	Up to 1 MT/hr	Same filter bag type
Port Operation	**Shared by Seaoil Philippines, Inc. and Petra Cement, Inc. under Memorandum of Agreement (MOA)**					

Figure ES-1 Location of the Project

B. PROCESS DOCUMENTATION

EIA Team

Table ES-3 EIA Team

NAME OF PREPARER's	FIELD OF EXPERTISE	EMB Registration No.
Engr. Venice Montemayor	Team Leader Socio-Economics and Water, EMP	IPCO No. 260
Engr. Rodel Olivares	Chemical, Hazardous Water and EMP, ERA	IPCO No. 132
Arnold Alvarez	Geology and Hydrogeology	None
Rodolfo A. Romarate II Aileen Faith S. Redondo	Terrestrial, Marine and Freshwater Ecology	No.PR4MB 016
	Air Modeling	
Mr. Gil S. Cruz	Legal documents	Proponent (Vice-President)
Mr. Joel Caballero	Project Description, Process and Social Aspect	Proponent (Corporate PCO)

EIA Study Area and Schedule

The EIA Study area focused on the Direct Impact Area (DIA) of the project area in 5.2727 hectares identified as the Marine Water (Sulu Sea), Surface Water (Tanalan Creek) and the People from Barangay Lower Irasan. Secondary impact area identified as Barangay Upper Irasan and Barangay Langatian were considered for Air Sampling and Perception Survey. Schedules of the studies were conducted between April 2018 to October 2018.

Table ES-4 EIA Area and Schedule

EIA Aspect	EIA Study Area	Date conducted
Terrestrial (Flora and Fauna) Sampling	5.2727 has	May 11-14, 2018
Soil Sampling	5.2727 has (5 points)	May 15-18, 2018
Engineering Geological and Geohazard Assessment (EGGAR)	5.2727 has	May 18-20, 2018
Marine Water	Sulu Sea (3 Stations)	May 11-14, 2018
Surface Water	Tanalan Creek (3 stations)	May 11-14, 2018
Air Sampling	Site, Barangays Lower Irasan, Upper Irasan and Langatian (4 stations)	April 11-15, 2018
Air Modelling	Site, Barangays Lower Irasan, Upper Irasan and Langatian	October 2018
People	Barangays Lower Irasan, Upper Irasan and Langatian	March 12-16, 2018 and April 25-26, 2018

Public Participation Activities

In compliance to DAO 2017-15, Public Participation in a form of Consultation and scoping was conducted and enumerated below:

Table ES-5 Public Participation Activities

ACTIVITY	PARTICIPANTS/Attendees	DATE Conducted
Neighbourhood consent and concern gathering	☐ Proponent's representative together with the Barangay Officials, discussed background of the project	July 11, 2015 @ 02:30 PM
Informative and Educational Meeting with Barangay	Officials of Barrio Irasan, Roxas, Zamboanga Del Norte ☐ Official Agreement with the Barangay Officials	July 11, 2015 @ 04:30 PM
Secure Barangay Resolution	Review and Certify acceptability of proposed cement finishing plant	July 20, 2015 @ 09:00 AM
Proponents intension for the increase in the capacity	DENR EMB Region 9, Barangay Lower Irasan, PENRO conducted at EMB Regional Office –	June 1, 2016
Public Consultation	Sitios, Barangays, PENRO, MENRO, Municipalities within the Impact Areas conducted in Barangay Covered Court	September 14, 2016
Special Collaboration Meeting	LGU of Roxas and Naga, MENRO conducted in the Municipality of Roxas	September 26, 2016
Public Scoping	Local Residents of Brgy. Irasan, Municipality of Roxas conducted in Barangay Covered Court	March 9, 2017
Technical Scoping	EMB, LGU, Review Committee, Proponent and Consultant	March 5, 2018
Public Hearing	LGU of Roxas, MENRO conducted in the Municipality of Roxas, Barangays Lower Irasan, Upper Irasan and Langatian	December 13, 2018

The summary of issues raised during the Public Consultation/Scoping and Public Hearing are presented in Table ES-6 and Table ES-7, respectively.

Table ES-6 Summary of Issues During the Public Consultation/Scoping

EIA MODULE	Issues/Suggestions Raised by the Stakeholders	Sector or Representative Who Raised the Issue/Suggestion
1. Project Description	Environmental impact from a perceived full Cement Process.	LGU/Municipality of Roxas
2. Land	Farming to Industrial Zone	ZNFePa
3. Water	Will Petra use Hazardous Chemicals that will Pollute the local waters	PICAPI
4. Air	Quality of Air	LGU/ZNfepa
5. People	Local Hiring of Residents	LGU/Barangay Lower Irasan

Table ES-7 Summary of Issues During the Public Hearing

EIA MODULE	Issues/Suggestions Raised by the Stakeholders	Sector or Representative Who Raised the Issue/Suggestion
1. Project Description	In terms of carrying capacity, can the plant carry the increase in capacity from 50,0000 MT/year to 1,200,000 MT/year. Basis for increase	Serena Cabrera CENRO Manukan
2. Land	No issue was raised.	NA
3. Water	Possible Effect of Calamities Possible Contamination of the Sea	Hon. Narzabal, Brgy. Chairman Lower Irasan Nestor Bastasa, Fisherfolk Chairman Lower Irasan
4. Air	Dust Pollution during Habagat and Amihan	Diosdado Junnaog- Cooperative Chairman, Barangay Langatian
5. People	Integrity of the Perception survey because the proponent mentioned that they conducted a house to house interview. The lady was not interviewed.	Resident from Pasil, Lower Irasan
6. Others	Concreting of Road	Kagawad Lower Irasan

Figure ES-2 Map of Impact Area

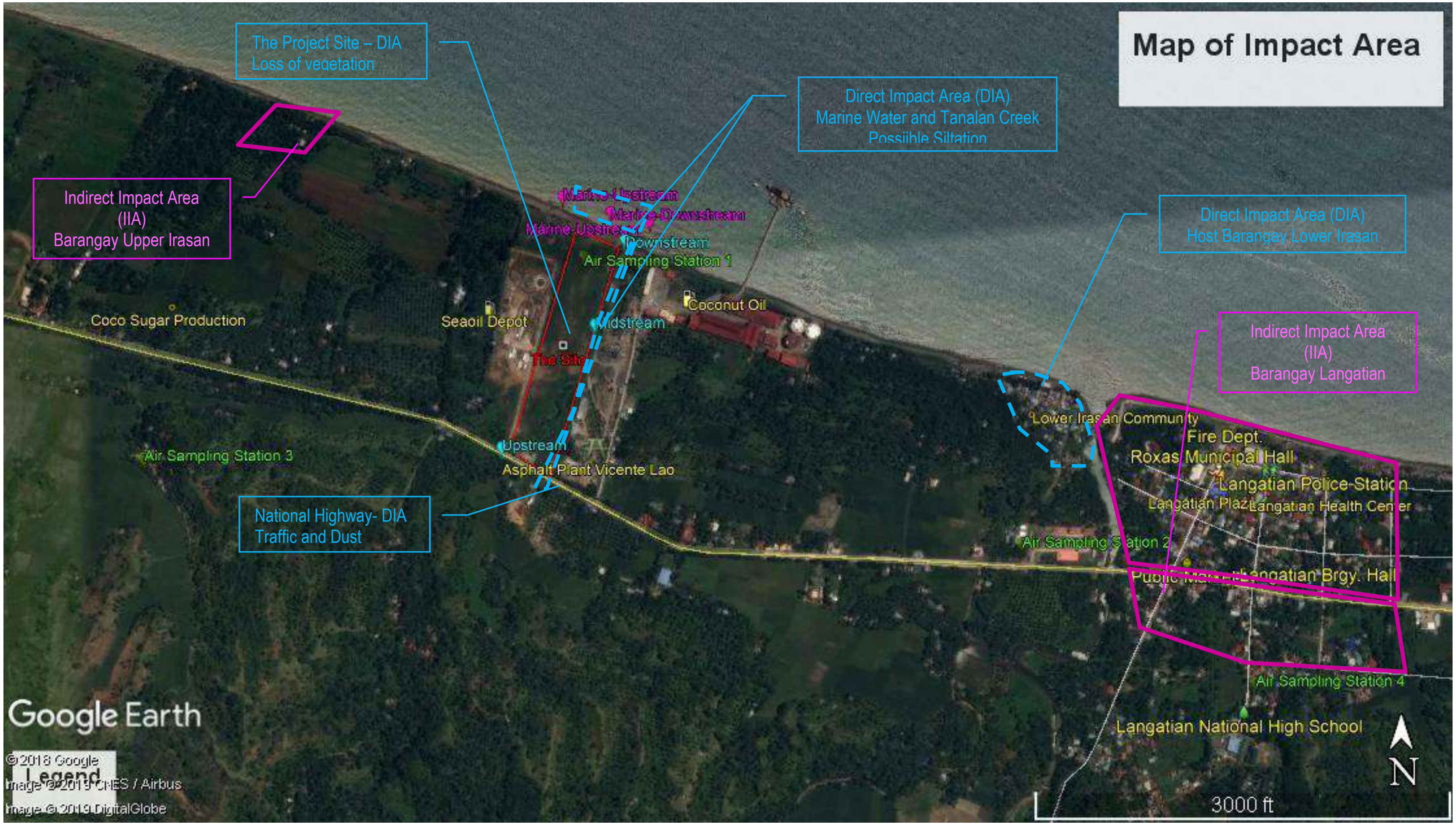

Figure ES-2 Map of Impact Area

EIA Methodology

Table ES-8 shows the corresponding activities along with its methodology:

Table ES-8 EIA Methodology

SCOPE/ACTIVITIES	METHODOLOGY	DATE AND TIME CONDUCTED
LAND		
Monitoring of Status of the Flora and Fauna after the site clearing activities	Actual Observation and Survey	May 11-14, 2018
Engineering Geological Geohazard Assessment Report (EGGAR)	Based on the MGB Available Hazard Maps	May 18-20, 2018
WATER		
Baseline Surface Water Sampling (Midstream Sample Only)	Based on DAO 2016-08	April 28-29, 2016
Monitoring of Surface Water Sampling (Midstream Location)		April 12, 2018
Baseline Surface Water Sampling (Upstream and Downstream)		
Baseline Marine Water Sampling (3 Lots-Left, Center and Right) Berkman Systems, Inc. Environmental Specialist		
AIR		
Baseline Air Quality Sampling (One Sample Only)		April 28, 2016
Monitoring of Air Quality Sampling (Upwind Location-Identified based on the sampling Map)- Between Vicente Lao and Seaoil Depot	Based on DENR NAAQGV for Criteria Pollutants based on 24 hours averaging time	April 11-15, 2018 @24-Hour
Baseline Air Quality Sampling (3-Stations) Station 2-Near Public Market and Bus Terminal Station 3 – Purok Masasigon, Upper Irasan, near Anguit Residences Station 4 – Barangay Langatian. Sarah Compound	Based on DENR NAAQGV for Criteria Pollutants based on 24 hours averaging time	
Air Dispersion Modelling conducted by Aeronics Inc.	Utilized Tier 4 Sophisticated modelling using site specific Meteorological data	October 2018
PEOPLE		
Public Participation	Perception Survey Conducted	March 12-16, and April 25-26, 2018 from 8am to 8:30pm

Public Participation

Public Scoping/Consultation

There were about four (4) consultations in a form of meetings and scoping conducted by the proponent. The objective was to present the project prior to any expansion development or activity. The issues raised were the following: dust pollution, employment, health, social development plan and safety of transportation of materials.

Perception Survey

The perception survey thru house-to-house was conducted to identify the present socio-economic profile of the pre-determined social impact areas and to know the level of awareness of the different people and their acceptance to the proposed expansion project

A total of two hundred forty three (243) respondents distributed to three (3) barangays. Based on the total respondents, 188 or 77.37% came from Barangay Lower Irasan, 5 or 2.06% came from Barangay Upper Irasan, 50 or 20.58% are from Barangay Langatian.

Public Hearing

Invitation letters were sent to the LGU- Provincial Office, LGU-Municipality of Manuel A. Roxas, LGU-Barangay's Lower Irasan, Upper Irasan and Langatian, Municipal Planning and Development Office (MPDO) Roxas, Church – Roman Catholic Charismatic Multi-Purpose Cooperative, NGOs-Kasilingan Parents Association, Inc. (KPAI), Zamboanga del Norte Federal Parents Association, Roxas Motorcab Drivers Association (ROMODA), Musika Pabalikan Agrarian Reform Beneficiaries, Langatian CARP Beneficiaries Multi-Purpose Cooperative, DENR – Biodiversity Management Bureau (BMB), Regional Executive Director IX, Regional Director IX, PENRO, CENRO, and residents of Barangay Lower Irasan, Upper Irasan and Langatian.

Public Hearing was conducted on December 13, 2018, Thursday, 9:00 AM to 2:30 PM at the covered court of Barangay Lower Irasan. The activity was participated by identified stakeholders such as from LGU-Province, Municipality and Barangay, Community and Stakeholders, Church Organization, Peoples Organization, Petra Cement, Inc., Cense Technical Consultancy Services – EPRMP Preparers and EMB Central Office Representatives. All in all there were Three Hundred Thirty Three (333) attendees during the public hearing.

The significant issues raised were possible effect of the calamity such as flood, possible contamination of the sea, dust pollution and people benefit such as employment.

C. EIA SUMMARY

Summary of Alternatives In terms of Siting, Technology Selection/Operation Process and Design

Siting: The project site was selected based on the land use compatibility which is within the industrial zone as classified by the Municipality of Roxas.

Technology Option and Design: Instead of the conventional or traditional way to produce a cement, basically the project adopts the latest technology of compact machine to grind and mix the pre-cooked cement or clinker with limestone and gypsum to produce a cement finishing materials. The technology eliminates emission of smoke or fumes during the process of cooking or heating in a conventional method of producing cement products with built-in dust collection system. Basically the operation of the plant does not involve heating or cooking during the process to produce a cement product.

Integrated Summary of Impacts and Residual Effects After Mitigation

Table ES-9 Summary of Impacts and Proposed Mitigation

POTENTIAL IMPACTS	PROJECT PHASES	MITIGATING MEASURES	RESIDUAL EFFECTS
LAND			
Land Use and Classification			
Compatibility of Land Use	Pre-Construction	Municipal Resolution was secured as presented in *Annex E* and Zoning Certification issued is presented in *Annex F*.	Consistent with the Land use of the Municipality
Contamination and aesthetics due to generation of Solid and Hazardous Waste caused by improper management	Construction Operation Abandonment	Proper implementation of RA 9003 "Ecological Solid Waste Management Act of 2000" and RA 6969 "Toxic Substances and Hazardous and Nuclear Wastes Control Act No. 6969 of 1990	Lessen the volume of solid wastes. Properly managed, labelled and segregated hazardous wastes.
Geology and Geomorphology			
Loss of Vegetation Cover	Construction	Implement re-greening in open areas and along the sides of the creek	Aesthetics and contributes to climate change
Siltation and Erosion	Construction Operation	Construction of permanent erosion control measures such as pile driving and rip-rapping works. Operational and regular maintenance of settling pond.	Eliminates the possible siltation along Tanalan Creek
WATER			
Hydrology			
Flooding	Construction Operation	Increase the elevation of the property to 4.0 meters. Improvement of the drainage system Observed buffer and salvage zone.	Protects the property and machine.
Degradation of Surface Water Quality	Construction Operation	Immediate compaction of open areas, installation of silt traps such as sand bags along the side of the creek. Operational and regular maintenance of settling pond.	Protects Tanalan creek from possible siltation
AIR AND NOISE			
Air Quality			
Dust Pollution	Construction	Sprinkling of water in open areas especially during summer or dry months. Regular maintenance of equipment such as change oil, etc.	Mitigates possible emission of dust.
	Operation	Installation of 3-units bag house. Properly operational Air Pollution Control Device such as Bag house with Regular maintenance and monthly replacement of filter. Conduct stack sampling at least twice a year. Regular maintenance of equipment, standby genset	Lessen dust, avoid possible complaints

		and vehicles.	
Increase in Noise Level	Construction Operation	Regular maintenance of equipment such as change oil, and tune-up, etc. With properly installed noise barrier inside the machine	Minimize the vehicle sound Minimize health issues.
PEOPLE			
Health Issues			
Impact on Health due to Dust	Operation	Properly operational Air Pollution Control Device such as Bag house with Regular maintenance and monthly replacement of filter. Assistance to Medical Mission in coordination with the LGU. Provide mask when necessary.	Lessen dust emission thus prevents health issues
Positive impact on employment generation and livelihood	Construction Operation	Priority for local hirees Assistance to livelihood programs of the LGUs and implement Social Development Plan (SDP) in accordance to the LGU plan.	Improves the economic life of the community
Land	Abandonment	Removal of temporary facilities	Improves aesthetics

<u>Risks and uncertainties relating to the findings and implications for decision making</u>

Based on the assessment and findings relating to the findings and implications for decision making are as follows:

Table ES-10 Risks and uncertainties and implications for decision making

MODULE	RISK AND UNCERTAINTIES	IMPLICATION FOR DECISION MAKING
Land	Hazard Prone Area such as flooding, storm surge and tsunami	Increase in elevation to protect the property and the machineries.
Water	Possible siltation	Construction of settling pond and installation of silt traps
Air	Possible increase in PM_{10} due grinding activity.	Installation of Air Pollution Control Device such as Bag house with Regular maintenance and monthly replacement of filter.

1.0 PROJECT DESCRIPTION

1.1 Project Location and Area

The expansion of **Cement Finishing Plant Project** of Petra Cement Inc. will be located at Barangay Lower Irasan in the Municipality of Roxas, Zamboanga Del Norte. It is strategically lies at about 2 kilometres (km) from the town proper of President Manuel A. Roxas, Zamboanga Del Norte with geographic coordinates of 8°31'25.00"N latitude and 123°13'3.29"E longitude, *Table1-1shows the geographical coordinate boundaries of the project site and Table 1-2 shows the Directional Reference of the Project Site and Table 1-2A for the Surrounding Description and Distance from the Site*. The project site has a total land area of Fifty Two Thousand Seven Hundred Twenty Seven (52,727.00) square meters lot registered under TCT No. T-127-2018000058, ***refer to Annex C***.

Currently, the site has already started its land development such as earthmoving and construction of drainage system with temporary facilities and barrack. No operation yet in terms of production or finishing of cement in the area.

The raw materials such as clinker or pre-cooked cement shall be sourced outside of the country or imported while the gypsum and limestone shall be sourced out locally. The proponent shall acquire all raw materials to the legitimate and legal source only. All suppliers shall provide for the necessary permits and licenses in bringing in the materials to the site. The arrangement shall be considered supplier-buyer agreement. Once operational, the raw materials shall be transported thru the use of the port facility of Seaoil Philippines, Inc. covered already by an Environmental Compliance Certificate (ECC) with Reference No. ECC-09-180-0001 issued on April 26, 2018, ***see Annex D3*** and with pending Foreshore Lease Agreement (FLA) application, Memorandum of Agreement (MOA) executed between Seaoil Philippines and Petra Cement, Inc. as Joint Venture Partner as provided in Section 3 in the MOA dated February 8, 2018, ***presented in Annex D1*** and a Certification issued by Seaoil Philippines, Inc. that the port facility was constructed and designed to accommodate the operations of both parties, ***as presented in Annex D2***.

Table 1-1 Geographical Coordinates of the Project Site

Point	Longitude	Latitude
1	123° 13' 1.94"	8° 31' 15.62"
2	123° 12' 59.05"	8° 31' 17.28"
3	123° 12' 59.16"	8° 31' 17.82"
4	123° 12' 58.37"	8° 31' 18.41"
5	123° 12' 59.34"	8° 31' 18.73"
6	123° 13' 0.17"	8° 31' 21.92"
7	123° 13' 0.72"	8° 31' 22.21"
8	123° 13' 1.70"	8° 31' 21.91"
9	123° 13' 2.14"	8° 31' 30.19"
10	123° 13' 2.35"	8° 31' 31.23"
11	123° 13' 2.39"	8° 31' 32.76"
12	123° 13' 5.74"	8° 31' 31.43"
13	123° 13' 5.54"	8° 31' 30.54"
14	123° 13' 1.70"	8° 31' 14.77"

Table 1-2 Directional Reference of the Project Site

Directional Reference Adjacent To The Project Site	Notable Landmarks, Structures
North	Industrial Land
South	Industrial Land with few residential houses
West	Industrial Land with few residential houses
East	Industrial Land with few residential houses
GPS Reading	8°31'25.00"N; 123°13'3.29"E

The plant site is along Dipolog-Sinadangan-Liloy Road and is positioned strategically away from residential areas, it is approximately 10.3 kilometers from the town proper of Roxas, Zamboanga Del Norte and approximately 1.8 kilometres away from upper Irasan. It is bounded on the South by the ranges of Sergio Osmeña, Siayan and Sindangan in the East by Katipunan, the Municipality of Manukan on the West, and the Sulu Sea on the North West. It is bounded by the South by the mountain ranges of Sergio Osmeña and Jose Dalman by the Municipality of Katipunan on the East, the Municipality of Manukan on the West, and the Sulu Sea on the Northwest. The land features of Roxas are generally hilly. Only approximately one-third of the total land area is flat or level grounds. Most of the Barangays are located on high grounds except for six barangays e.g. Dohinob, Upper Irasan, Lower Irasan, Langatian, Piao and Nabilid, which are along the coastal area.

Table 1-3 Surrounding Description and Distance of the Impact Area at the Project Site

Description	Approximate Distance from the Site	Delineation
Asphalt Plant – Vicente Lao	East of the Project after Tanalan Creek	Direct Impact Area
Seaoil Vertical Storage Depot	West Boundary of the Project	Direct Impact Area
Tanalan Creek	East Boundary of the Project	Direct Impact Area
National Highway (Ipil-Dipolog Highway)	South Boundary	Direct Impact Area
Sulu Sea	North Boundary	Direct Impact Area
Dipolog Oil Mill	300 meters east	Direct Impact Area
Relocated Chapel-Lower Irasan	100 meters south west	Direct Impact Area
Lower Irasan Community	300 meters west	Direct Impact Area
Unpaved Portion access of Lower Irasan community	300 meters west	Direct Impact Area
Coco Sugar Production – Lower Irasan	500 meters west	Direct Impact Area
Barangay Lower Irasan Hall	500 meters west	Direct Impact Area
Multi-Purpose of Lower Irasan	500 meters west	Direct Impact Area
Regional Agro-Industrial Center of the Municipality of Pres. Manuel A. Roxas	400 meters west	Direct Impact Area
Public Market	1.3 km east	Indirect Impact Area
The Community Residences of Langatian	1.3 km east	Indirect Impact Area
Langatian Barangay Hall	1.3 km east	Indirect Impact Area
Langatian National High School	1.4 km east	Indirect Impact Area
Langatian Parish Chruch	1.4 km east	Indirect Impact Area
Langatian Health Center	1.5 km east	Indirect Impact Area
Langatian Police Station	1.5 km east	Indirect Impact Area
Roxas Municipal Hall	1.5 km east	Direct Impact Area
Roxas Fire Department	1.5 km east	Indirect Impact Area
Senior Citizen Center of Roxas	1.5 km east	Indirect Impact Area
DSWD Center of Roxas	1.5 km east	Indirect Impact Area
Langatian Plaza	1.5 km east	Indirect Impact Area
Langatian Farmers Information	1.5 km east	Indirect Impact Area
Langatian Health Center	1.5 km east	Indirect Impact Area

Figure 1-1 Vicinity Map

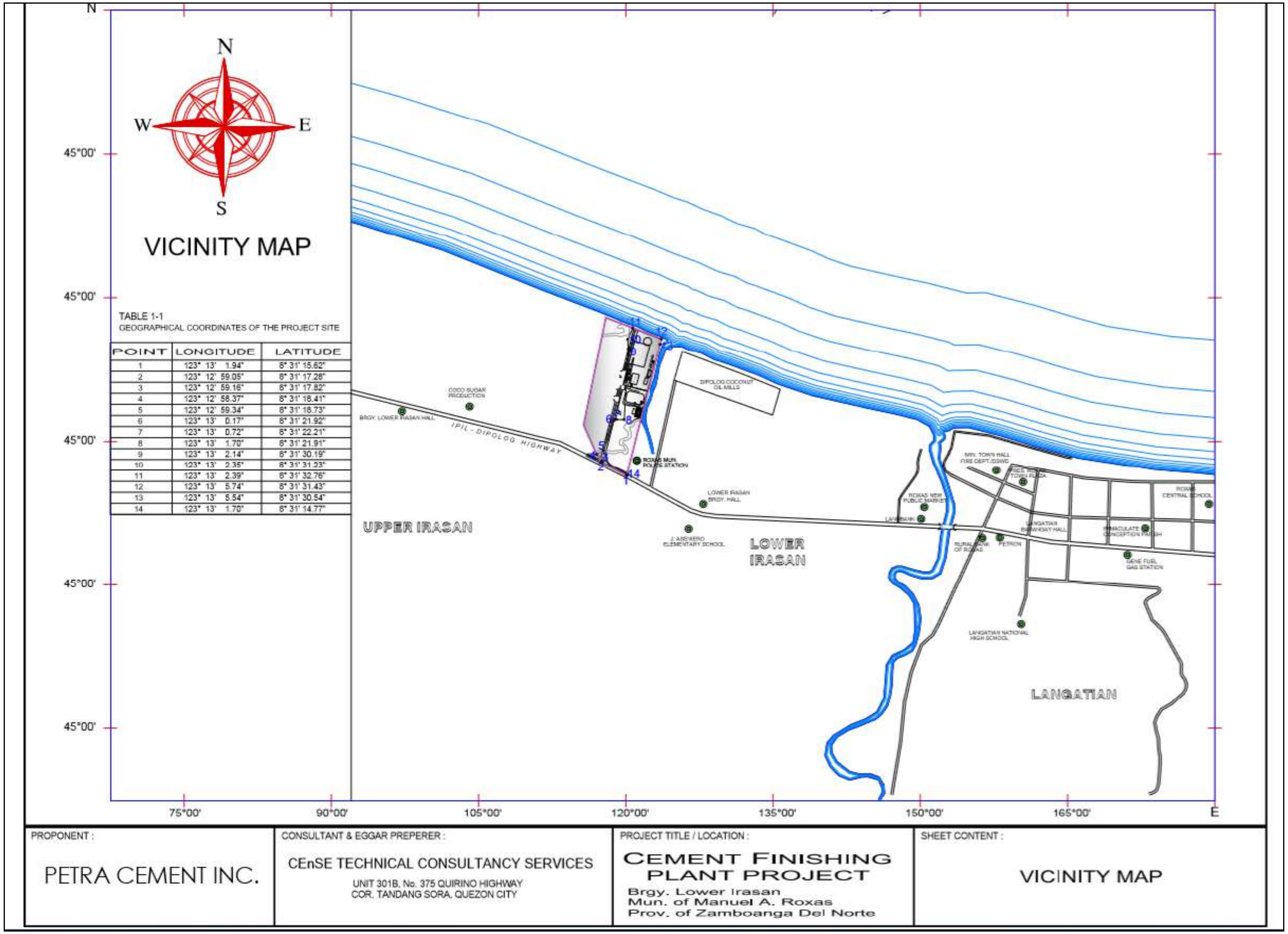

TABLE 1-1
GEOGRAPHICAL COORDINATES OF THE PROJECT SITE

POINT	LONGITUDE	LATITUDE
1	123° 13' 1.94"	8° 31' 15.62"
2	123° 12' 59.05"	8° 31' 17.28"
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13	123° 13' 5.54"	8° 31' 30.54"
14	123° 13' 1.70"	8° 31' 14.77"

Figure 1-1 Vicinity Map

Figure 1-2 Project Map

Figure 1-3 Impact Map

1.1.1 Delineation of Impact Area

- The EIA Study area on the proposed expansion of the capacity focused in the total land area of 52,727 square meters located in Barangay Lower Irasan, Municipality of Pres. Manuel A. Roxas, Province of Zamboanga Del Norte. The project identified Direct Impact Area (DIA) is considered the entire property and the host Barangay of Lower Irasan;

- Land Module, considering that there is a need to raise up the elevation to 4.0 meters, the identified Direct Impact Area (DIA) was due to backfilling activity thus stripping or removing of vegetation;

- Water Module, the Direct Impact Area (DIA) identified was the Tanalan Creek traversing the property possible impact of surface water quality due to construction of creek protection and stabilization or rip-rapping works and Sulu Sea for possible impact to marine water quality during operation phase specifically handling, loading and unloading of materials;

- Air Module, Barangay Lower Irasan as the host barangay was considered as the Direct Impact Area (DIA) though located about 1.3 kilometers west of the project site. The Air Modelling Dispersion findings and evaluation predicted concentrations area from 50 meters to 2500 meters WNW and ESE from the site. Accordingly, there are no residential areas within the 1-km from the site;

- People Module, Barangays Upper Irasan and Langatian are the two (2) barangays nearest to the project which was considered as Indirect Impact Area (IIA) which can be part as beneficiary to the Social Development Plan (SDP) as well as the company's Corporate Social Responsibility (CSR).

1.2 Project Rationale

Petra Cement, Inc., ***refer to Annex B for the SEC Registration***, is engaged in the business of finishing, distribute and sell cement and other cement products. The Department of Environment and Natural Resources – Environmental Management Bureau Region 9 (DENR-EMB R9) issued Environmental Compliance Certificate (ECC) with certificate number ECC-R09-1606-0008 to the proponent on June 7, 2016, ***refer to Annex D***. The certificate covers the construction and operation of the cement/non-metallic mineral processing plant project with a production rate of less than 50,000 metric tons/year within the 52,727.00 square meters, however, due to the increase in the demand, the proponent intends to increase the capacity into 1,200,000 Metric Tons per year based on the DTI's projection of 40 million metric tons per year demand.

The project will help in the development and expansion of industrial field in the Philippines. This will help minimize importation of similar product and promote local production. The project will therefore enhance the economic growth within the locality and nationally through generation of employment and government revenues i.e. individual taxes, real estate taxes and corporate taxes.

The project location is an idle grass and was used to be a coconut land located within the Municipality of Roxas and has been classified as Industrial Zone by the Municipality of Roxas.

1.3 Project Alternatives

Since the project is an expansion of the capacity, alternatives had already been considered and discussed during the issuance of the Regional Environmental Compliance Certificate (ECC). The project is an expansion of the production and is no longer considered new application, however for the purpose of discussion, the proponent considered the site based on the compatibility of land use plan of the Municipality and proximity to port facility and infrastructure development in Mindanao Region, therefore no alternative considered for the proposed expansion.

a. Cite Criteria

<u>Siting</u>: The existing and the proposed expansion capacity site is specifically for cement finishing plant use and is located in a private property. The location is within the Industrial Zone based on the land use map of the Municipality of Pres. Manuel A. Roxas and apparently away from the residential area, ***Annex E attached is the Zoning Certification issued by MPDO.***

Technology Option: Basically the project adopts the latest technology of compact machine to grind and mix the pre-cooked cement or clinker to produce a cement finishing materials. The technology eliminates emission of smoke or fumes during the process of cooking or heating rather than the conventional method of producing cement products. Machines shall be purchased outsourced and will only be assembled at the site. Dust is expected during the grinding process but will be mitigated thru its built-in dust collection system such as built-in three (3) units Filter Bag with 95% efficiency and capacity of 1 MT/hr. Since the technology involves dry process, water pollution is very minimal, and shall be mitigated thru its proposed retention or settling pond. The area has an existing water line served by Local Water District and will no longer extract water from underground. Since the project process helps prevents the quarry or major land disturbance, land contamination is unlikely to occur.

Resources: The power requirement of the cement finishing plant will be supplied by Zamboanga Electric Cooperative. The cement finishing plant will be having one (1) diesel fired generator set with a capacity of 750 kVA as standby unit. Water supply will be provided by existing local water distributor, however, in the event of water shortage, the retention/settling pond shall serve as back up for the project.

Liquefaction:

The project site is prone to liquefaction hazard since it is underlain by alluvial deposits characterized by thick layer of soft, compressible and unconsolidated sand, silt, clay and fine gravelly river deposits. Furthermore, the water table at the site is only about 2-3m from the ground surface.

Ground Shaking:

The site is prone to ground shaking hazard, PGA values of ***0.449337269g for soft soil, 0.281239874g for medium soil and 0.1939585g for rock*** should be applied in the engineering design of building structures to be erected at the site.

Ground Rupture:

No fault is shown passing directly through the project site. PHILVOLCS' certification also shows that the project site is approximately 24.00kms to the nearest segment of the active ***West Mindanao Fault*** or some author referred it as the ***Sindangan-Cotobato Fault System.***

Earthquake:

The area may experience ground vibration during earthquakes that might be generated by movement along major fault or trenches specifically at Sindangan-Cotobato Fault System or West Mindanao Fault. To mitigate any disastrous effected from this type of geohazard, the building structures to the erected at the proposed site should conform to the National Structural Code of the Philippines (1992). The plant should be able to withstand an earthquake with magnitude of at least intensity VI on the Rossi-Forrel intensity Scale. The structural design of the building and other structures to be built should conform to the existing government rules and regulation for building safety and stability in resisting an earthquake magnitude of 7.5 or more.

Tsunami

In case of Magnitude 8.0 earthquake from the Sulu Trench, a 3meter high tsunami will reached the western coasts of Zamboanga, and may result in a tremendous devastation could be expected particularly in Dipolog City. At the project site, such waves were predicted to force inland several kilometers from the shoreline. This natural hazard likewise reflects the damages it may inflict at the project site.

Strom Surge

Project Noah is a government program that seeks to assist the country in disaster risk reduction and management, climate change adaptation and mitigation efforts and related activities through research, development and extension services. The Program was launched in 2011 after the aftermath of TS Sendong in Central Mindanao. One of the important function attached therein was to provide a 6-hour lead-time warning to agencies involved in disaster prevention and mitigation. In their official website, Noah depicts a simulated presentation of various level of warnings/advisories and its impacts during storm surge event. Advisory No. 2 and 3 indicates a probable severe impact of raising sea water to the project site.

b. Comparison of Environmental Impacts

Table 1-4 Comparison of Environmental Impacts Due to the Expansion of Capacity

Alternative	*Comparison of Environmental Impacts*							
	Land		**Water**		**Air**		**People**	
	Existing	**Expansion**	**Existing**	**Expansion**	**Existing**	**Expansion**	**Existing**	**Expansion**
Siting	None Within Industrial Zone	None Within Industrial Zone	Hazard prone area such as liquefaction, tsunami, and storm surge and flooding	Same	None	None	Safety of People/workers due to hazard prone area	Same
Development Design	Loss of Vegetation	Same	None	None	None	None	Employment	Same
Process/ Technology Option	None	None	None	None	Dust Pollution during grinding and mixing of clinker, gypsum and limestone	PM_{10} (Uncontrolled)- 1hr=101.2 ug/Ncm -24hr=74.9 ug/Ncm $PM_{2.5}$ (Uncontrolled)- 1hr=17 ug/Ncm -24hr=23 ug/Ncm Located 141 NW from the grinding Machine	Employment	Same
Resource Utilization	Other local raw materials such as limestone and gypsum	Same	Competition of water sources	Increase in water use	Emission of PM and NO due to operation	Emission of PM and NO due to operation	Employment SDP	Same

c. Consequences of not proceeding the project

The expansion of the project if it will not push thru will be a lost in terms of investment to the proponent considering that they can only produce as much as 50,000 Metric Tons per year which is not sufficient to supply the growing needs of the national economy in providing cements products without having into quarry activity and cooking process. In addition, the cost of operation as against the production output capacity is high.

Based on the current land use plan of the municipality, the area is classified as industrial zone which shall take effect for the next 15 years. Climate change can happen anywhere, the location is prone to hydrologic hazards such as tsunami, storm surge and flood, and scenarios are anticipated even without the occurrence of the project. In this case, the entire coastal areas along Sulu Sea will be affected.

1.4 Project Components

The proposed expansion project basically involves the same process as initially planned, this includes grinding of already cooked imported clinker in horizontal ball mill, addition of additives such as gypsum and limestone material, conveying cement product into its allotted silo and packing the finished cement using the bagging machine. A total of two (2) units Vertical ball mill with capacity will be used, one (1) unit has a capacity of 120 MT/hr, all units are expected to run at 80-90%% efficiency based on supplier specifications.

The production floor will primarily be comprising the two (2) units of ball mill, standby material dryer, control room and repair workshop, continuous raw materials feeder, gypsum and limestone storage, clinker storage, dust collectors, cement silos, conveyors and bagging machines.

On the other hand, secondary facilities and support infrastructures will be built. Table 1-5 below shows the detailed comparison of project components covered by the ECC and the proposed expansion.

Table 1-5. Comparison of the Project Components (Covered by ECC and Proposed Expansion)

Facilities	Covered by existing ECC (ECC Ref. No. ECC-R09-1606-008 issued June 7, 2016)			Proposed Modification/Changes		
	No. of units	Area (sq.m)/ Capacity	Specification/ Description/ Remarks	No. of units	Area (sqm)/ Capacity	Specification/ Description/Remarks
Project Capacity	**50,000 MT/yr**			**1,200,000 MT/yr**		
Project Area	**5.2727 ha**			**5.2727 ha**		
MAJOR COMPONENTS						
Vertical Ball Mill	1	40 MT/hr	Equipment for clinker grinding	2	240 MT/hr	Two (2) with 120MT/hr capacity
Raw Material Storage Facility	1	1,500 sq.m	Includes storage of gypsum, pozzolana and clinker	2	4,500 sq.m	1,500 sq.m for gypsum and pozzolana; 3,000 sq.m for clinker
Cement Silo	4	1,000 tons/silo	Total of 4,000 tons capacity	5	500 tons/silo	Total of 2,500 tons capacity
Conveyor	None	None		1	344.40 meters	Conveyor from the port Facility to the Warehouse
Cement bagging machine	1	50 MT/hr		3	50 MT/hr	Additional machine due to increase in production
Generator Set	1	750 KV		1	750 KV	Standby- In case of power interruption
SUPPORT FACILITIES AND UTILITIES						
Admin Support (Canteen, Office, Clinic, quarters etc.)	1		One (1) Admin office Bldg., one (1) canteen, one (1) clinic, twenty-four (24) parking slots, workers barracks, security outpost etc.	1		One (1) Admin office Bldg., one (1) canteen, one (1) clinic, twenty-four (24) parking slots, workers barracks, security outpost etc.
Water Supply	-	6.5 cu.m/day	Water requirement provided by LWUA	-	12.5 cu.m/day	Water requirement provided by the LWUA
Drainage System	-	-	Engineered surface water drainage and management system			Engineered surface water drainage and management system
POLLUTION CONTROL FACILITIES						
Cooling Tower	1	3 cu.m/hr	Close loop system	1	6 cu.m/hr	Close loop system
Solid Waste Management Facility	1	9 sq.m		1	15 sq.m	Primarily intended for domestic solid waste
Toxic and Hazardous Waste	1	9 sq.m		1	15 sq.m	Intended for hazardous waste only

Facility						
Settling Pond	1	10 cum		1	50 cum	For wastewater treatment and reuse
Dust Collector	1	0.5 MT/hr	Filter bag type with about 95% efficiency	3	Up to 1 MT/hr	Same filter bag type
Port Operation	**Shared by Seaoil Philippines, Inc. and Petra Cement, Inc. under Memorandum of Agreement (MOA)**					

Site Development Plan for Existing and Proposed is presented in Figure 1-4 and 1-4A.

1.5 Process/Technology

The operation phase takes place wherein the clinker material is transported through shipping vessels from international vendors. The materials are received in material conveying system at the port into the main clinker open holding area.

From the holding area, the clinker are conveyed to the main clinker silos by a chain bucket. The storage capacity of five (5) units with capacity of 500 tons each.

The gypsum and admixture of less than 30mm lump size, are received from local market and are transported into the silos separately and a bucket elevator. The gypsum and a mixture are mixed in the appropriate proportions by an electronic belt weigher and transported to the cement mill on a belt conveyor.

The Milling/Grinding Operation involves a closed-circuit cement grinding system and a 2 meters cyclone separator. The mill load control system, including electric ear loading control unit and electric automatic-adjusted belt weigher, controls the quantity of clinker, gypsum and a mixture discharged. The waste gas from the cement mill is cleaned by a bag filter and emitted into the atmosphere.

The cement is either transported to the cement packing shop on an over-flow screw conveyor and air slide which is beneath the silos, or loaded by a bulk loader for shipping in bulk.

In the Packing Operation, the cement from the silo is transported into a stationary packer in the cement packing shop, on a bucket elevator, via a vibrating screen, screw conveyor and storage bin.

Plant Process Flow is presented in Diagram 1 and Process Flow and Waste Diagram in presented in Diagram 1A, Existing process Flow is shown in Diagram 1B and Proposed Expansion Process Flow in Diagram 1C.

The proposed expansion project is predicted to have both beneficial and potentially adverse socio-economic and cultural impacts on the environment, workers and the community.

The main environmental issues associated with cement finishing plant are consumption of raw materials and energy use, as well as emissions to air. Waste water discharge is usually limited to surface run off and cooling water only and causes no substantial contribution to water pollution. Additionally, the environment can be affected by the noise generated by usual machine operation.

Raw materials on the whole production processes includes clinker, gypsum and pozzolan materials also known as any material which is rich in alumina and silica. There is no known hazardous chemical or material being used on the operation.

1.5.1 Pollution Control Facilities

1.5.1.1 Air Pollution Control Device

The grinding machine has a built-in three (3) units Filter Bag with 95% efficiency and capacity of 1 MT/hr., collected dust can be sold or reused. Monthly replacement of filter shall be done to ensure the efficiency of dust collector.

Stand-by genset shall be provided with appropriate filter material.

Horizontal Ball Mills requires little service, and a few simple maintenances will keep it going strong for extended periods.

Preventive maintenance of process equipment should be regularly planned and performed. The focus should be on systematic observation and inspection of the equipment body, bearings and equipment drive, both when the equipment is running and stopped.

1.5.1.2 Water Pollution Control Device

The project has a provision for settling pond to allow the solid or fine particles to settle for reuse or recycling purposes. STP shall also be provided for the project.

1.6 Project Size

Table 1-6 Project Size

	Type	Capacity/Volume, MT per day
Raw Materials	Clinker Limestone Gypsum	80%=192.00 MT/hr 17%= 40.80 MT/hr 3%= 7.20 MT/hr 240 MT/hr
Total Land Area = 52,727 square meters		

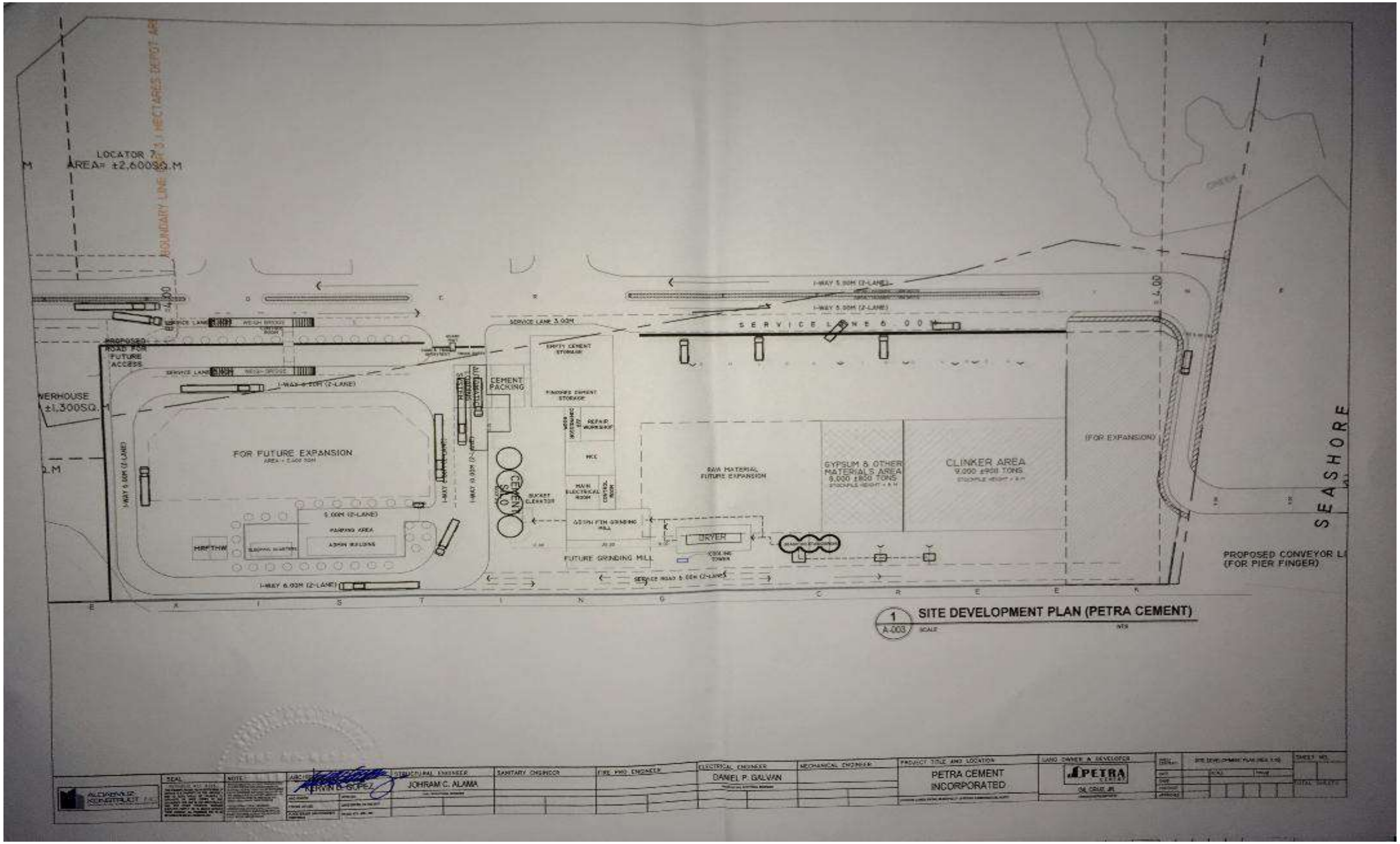


Figure 1-4 Site Development Plan – Existing ECC (Old)

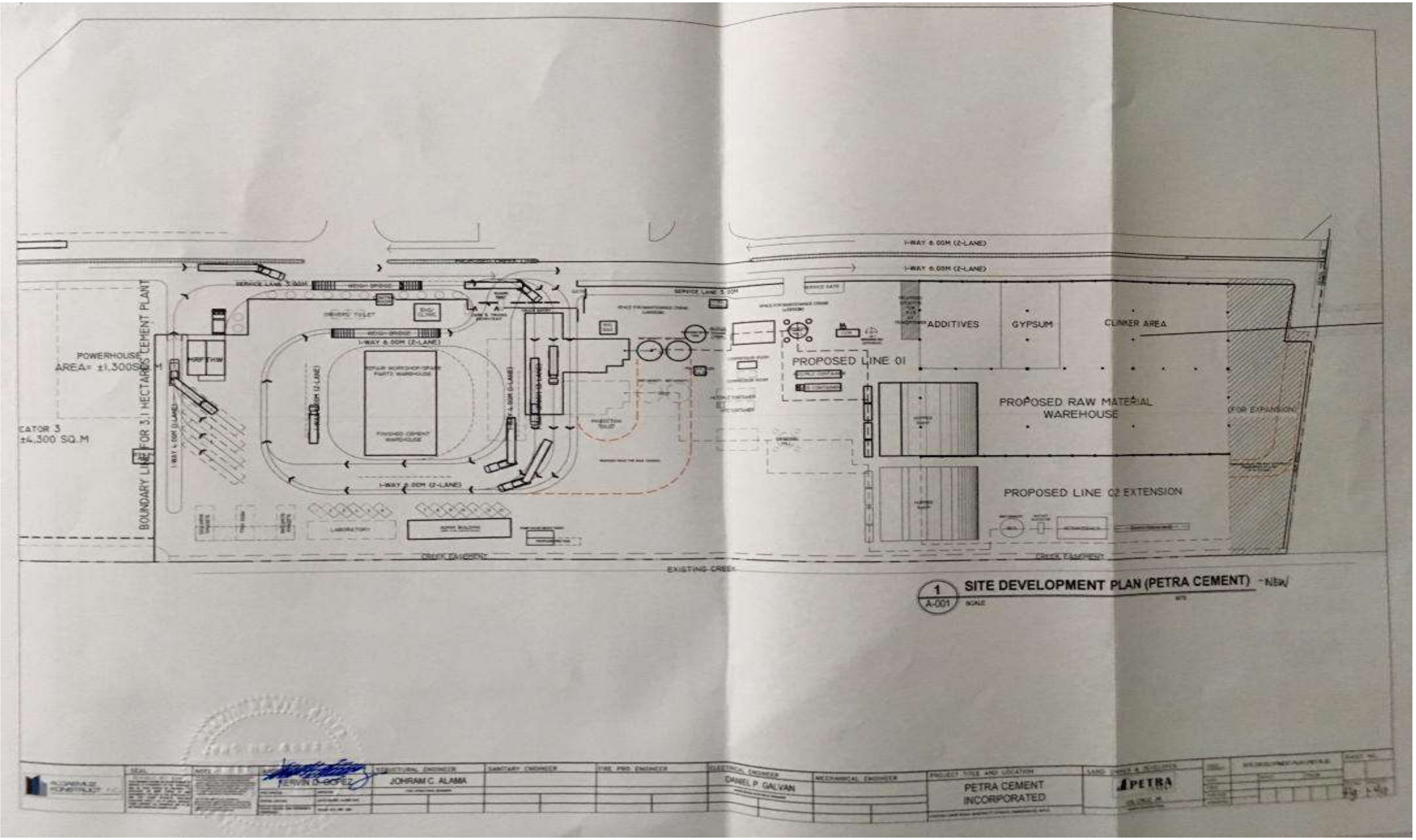


Figure 1-4A Site Development Plan – Proposed Expansion

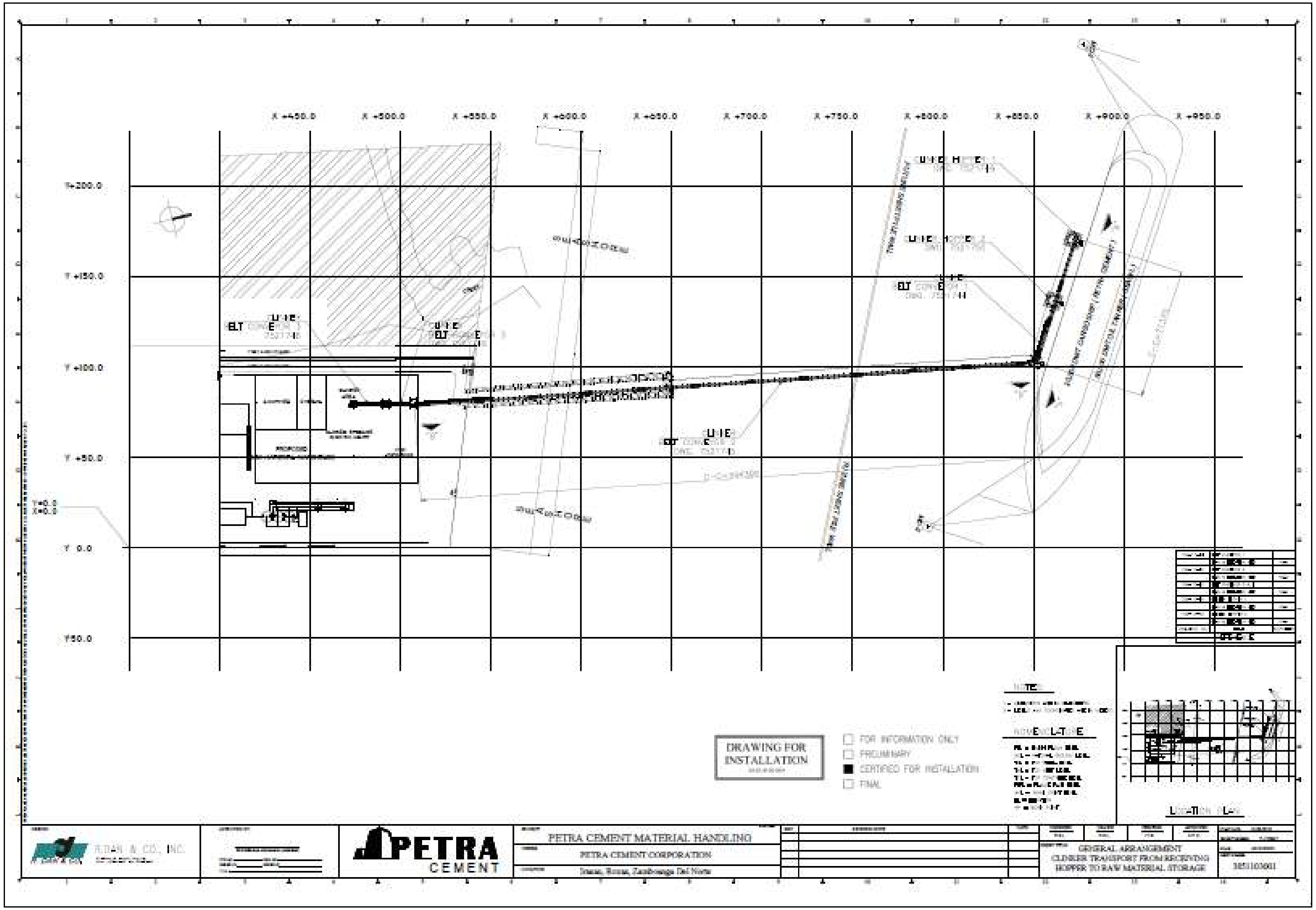


Figure 1-4B Overall Key Plan – Proposed Expansion

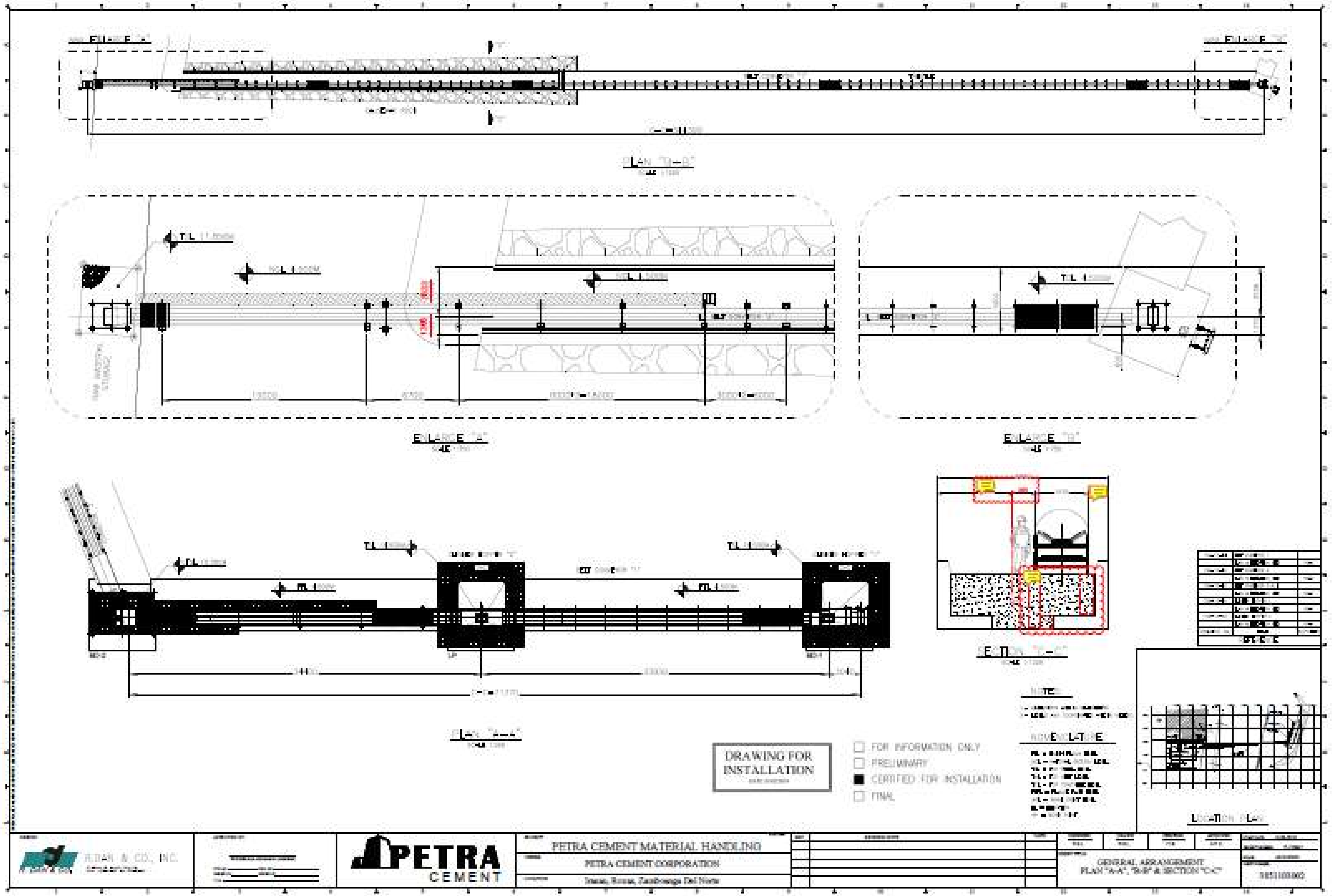


Figure 1-4C Conveyor Plan – Proposed Expansion

Figure 1-4D Conveyor Plan Perspective Rendering – Proposed Expansion

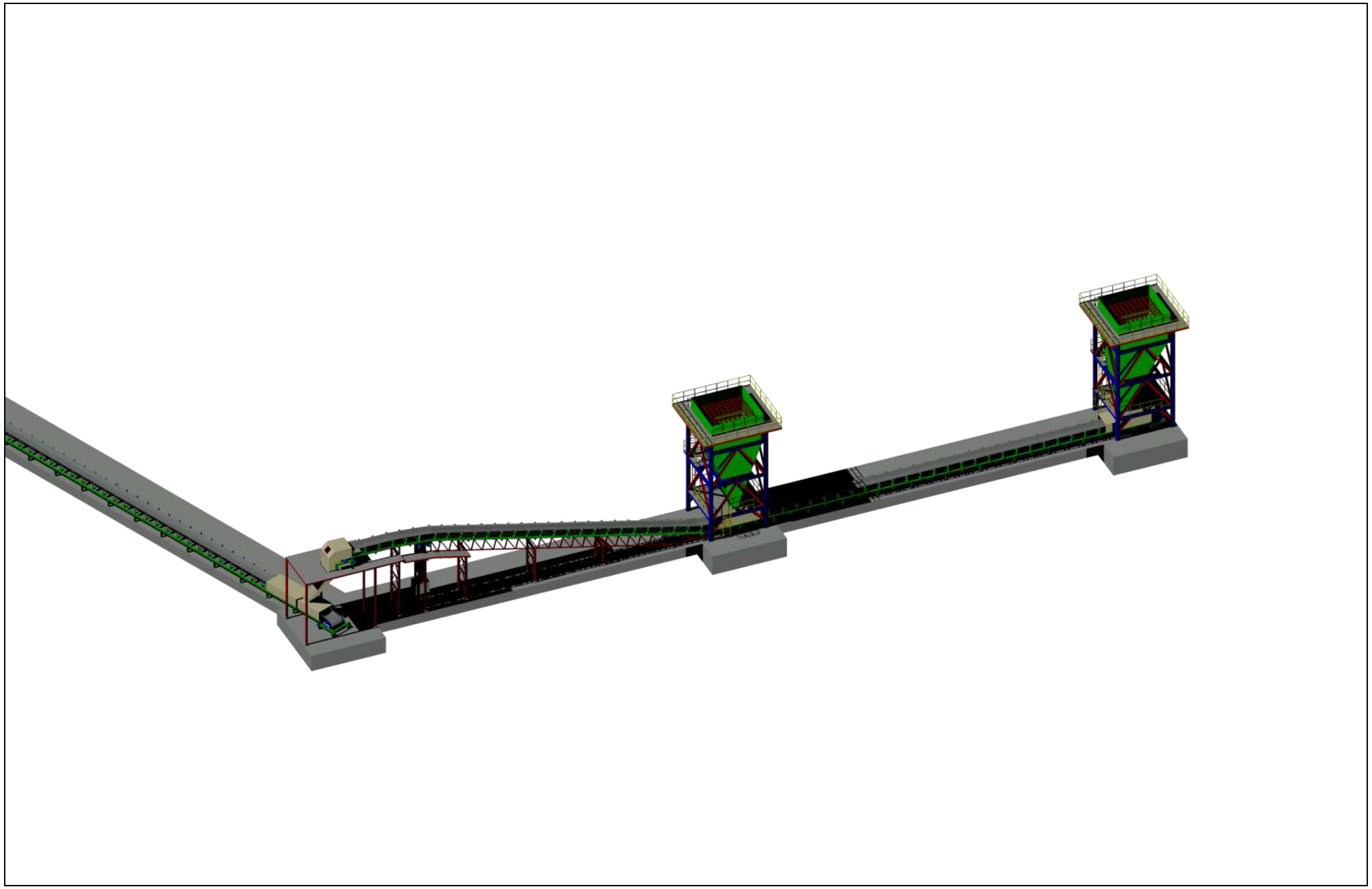
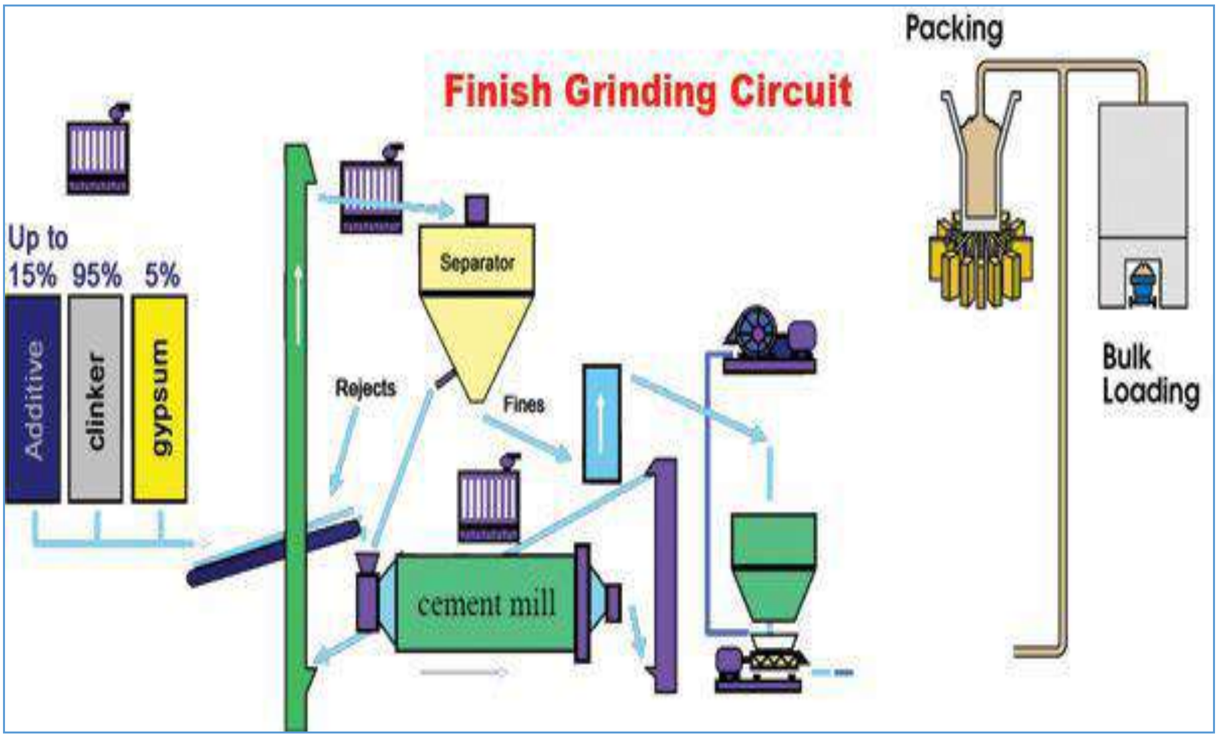
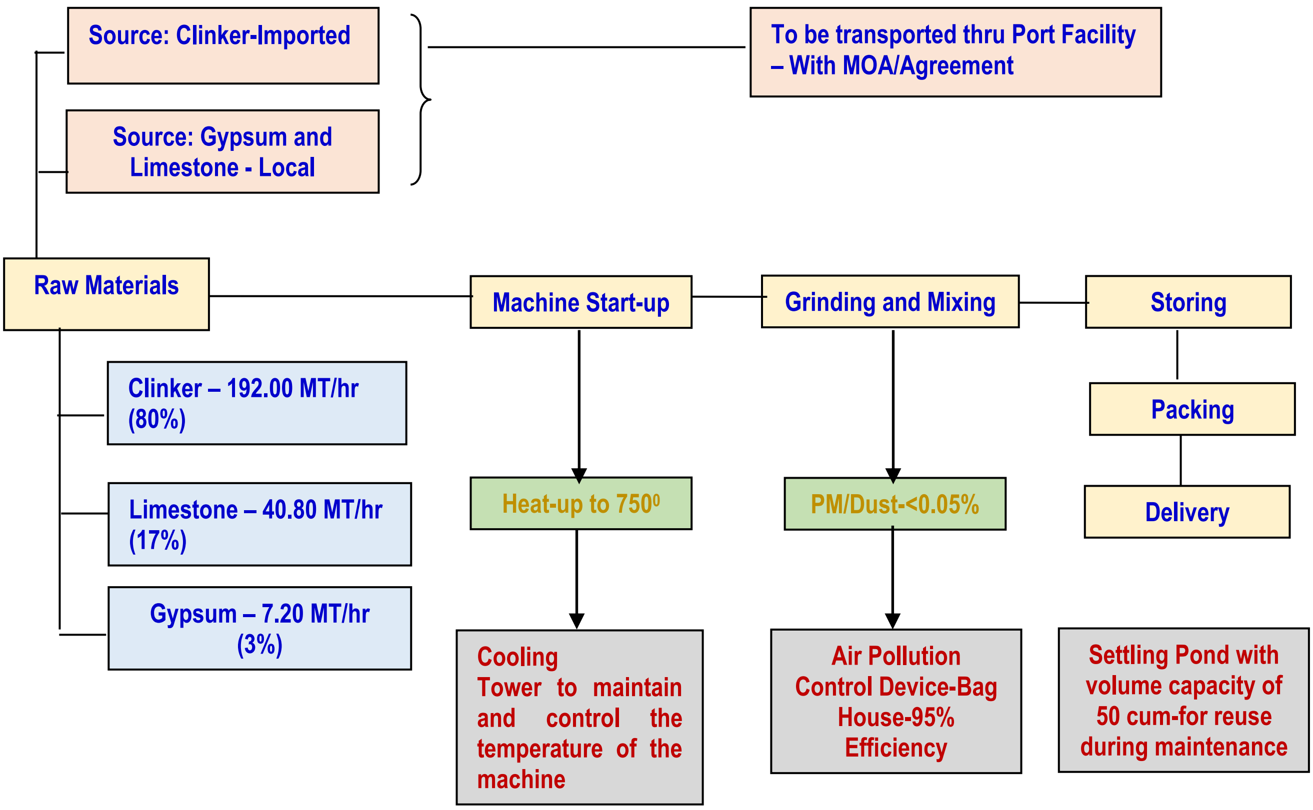


Figure 1-4E Conveyor Plan Enlarged – Proposed Expansion



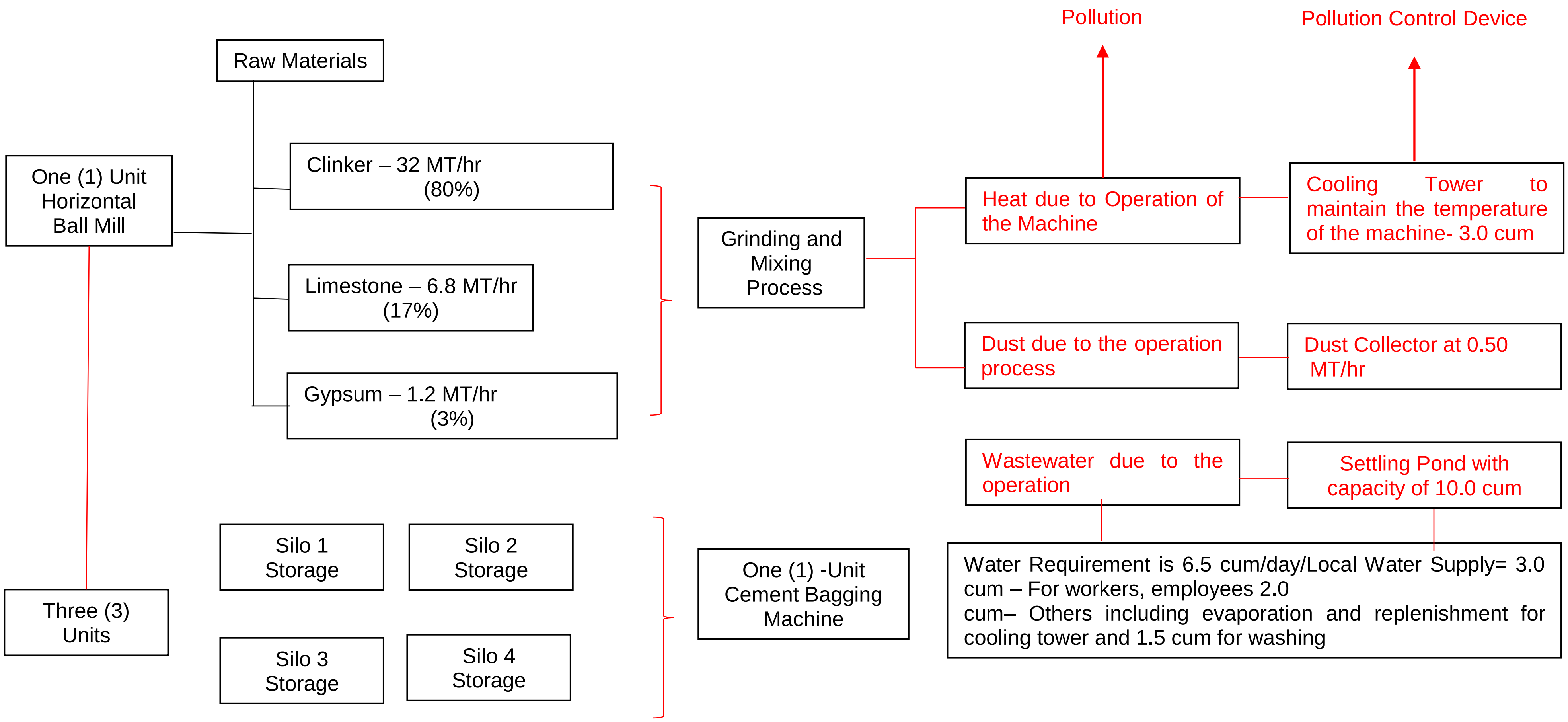
Plant Process Flow Diagram 1



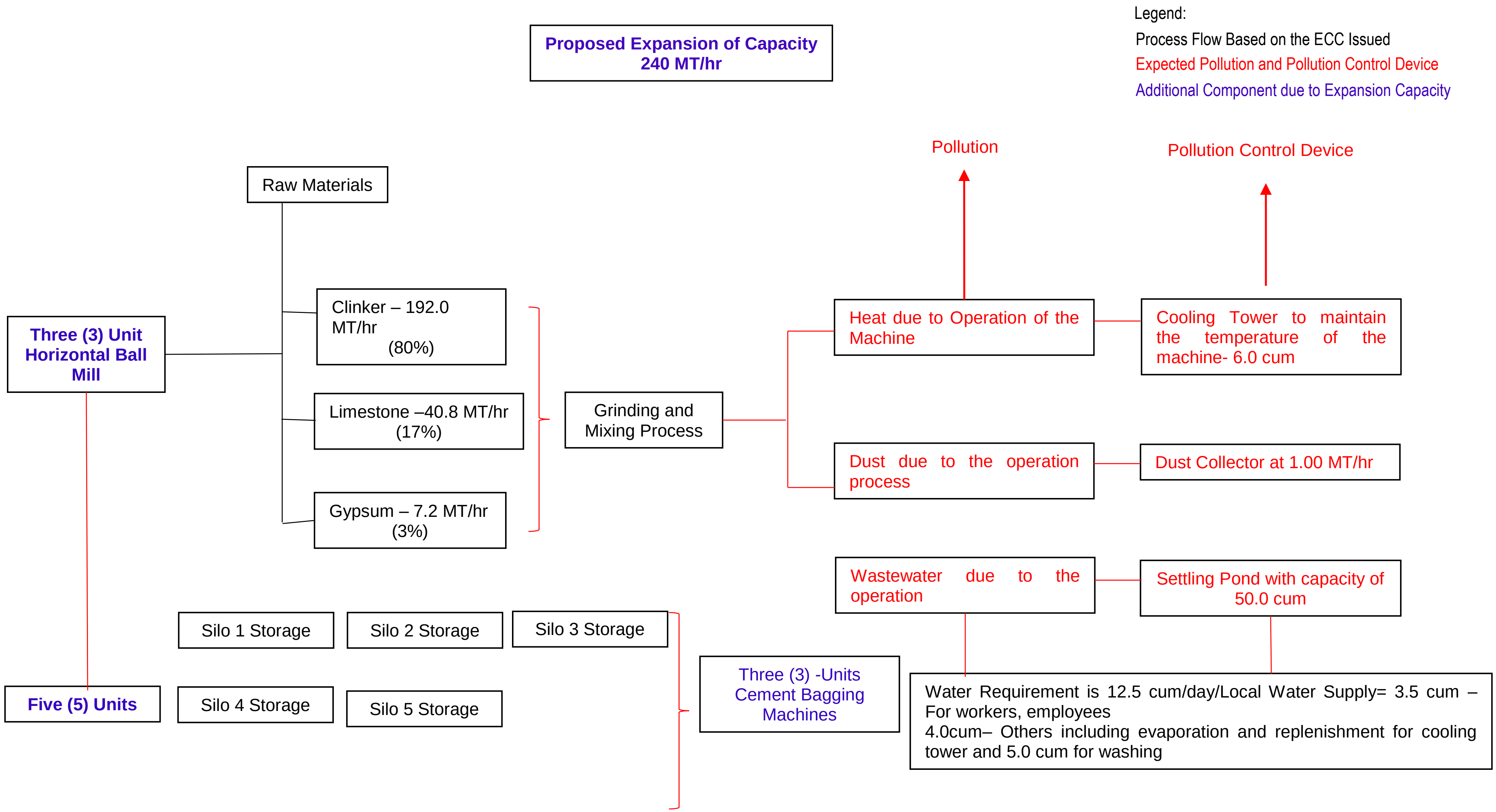
Process Flow and Waste Stream Diagram 1A

Existing based on ECC issued
40 MT/hr

Legend:
Process Flow Based on the ECC Issued
Expected Pollution and Pollution Control Device



Existing Process Flow and Waste Stream Diagram 1B



Expansion Process Flow and Waste Stream Diagram 1C

1.7 Development Plan, Description of Project Phases and Corresponding Timeframes

1.7.1 Pre-Construction Phase

The preconstruction/pre-development phase of the proposed project will include the following activities:

- Survey of the lot, including formal delineation of property boundaries;
- Design lay-out and detailed engineering plans for architectural, structural, electrical, mechanical, plumbing and environmental protection facilities; and
- Secure of permits such as Barangay Clearance, Business, Building and Zoning Permits from Local Government Unit (LGU) of Roxas, Zamboanga Del Norte, Environmental Compliance Certificate (ECC) from DENR-EMB-Region 9, and other government licenses prior to project implementation.

The impact at this stage of the project is completely beneficial. This phase of the project will give the proponent an interaction with the stakeholders by introducing the project to the host barangay and to the community.

1.7.2 During Construction Phase

The project is on its site development activities and construction of foundation for the machine and creek protection with total accomplishment of 36^. No operation yet in terms of production of cement, presented in Aerial Photos 1A and 1B taken last February 2019.

Land Development

Major activities include site clearing, land grading and leveling and subsequently compaction of soil. Site clearing activities include land grubbing or removal of some coconut trees, grasses and weeds which are the current vegetation in the area. It is expected during this phase that there will be an influx of construction equipment and workers at the site. As the construction progresses, more materials, wastes and minor disturbances i.e., solid wastes and siltation are expected to be noticed. The mitigating measures for such eventuality will be discussed in Environmental Management Plan (EMP).

For the duration of this project phase, the following activities are expected to be undertaken, such as:

- Establishment of temporary lodging (for construction personnel) and storage (for construction materials) facilities, and construction buffer zones;
- Leveling of terrain and clearing of unnecessary vegetation;
- Construction of concrete access road and perimeter/ security fence;
- Building of the production area, administration and staff offices, warehouse, parking spaces and delivery hubs, hazardous waste storage and solid waste storage; and
- Installation of equipment, piping and electrical/plumbing conduits, deep well and office fixtures.

Major Components

Installation of Machine

After the land development is finished, assembly, testing and commissioning of the grinding machines. This is composed of three (3) units Horizontal Ball (1-unit with 40 Metric Tons per house and 2-units with 100 Metric Tons per house capacity) and conveyor. The compact machine will be assembled on site with built in Three (3) units Filter Bag-Dust Collector with capacity of 1.0 Metric Ton per hour with 95% efficiency.

Construction of Warehouse for Clinker Area

The covered warehouse has an area of Four Thousand Five Hundred (4,500) square meters. One Thousand Five Hundred (1,500) square meters is allotted for storage of gypsum and limestone while the Three Thousand (3,000) square meters is for the storage of clinker materials.

Cement Silos

There are five (5) silos that will be built in the area for storage of finished cement products (portland cement). The capacity of each silo is 500 metric tons, which will have a total capacity of 2,500 Metric tons.

Other Supporting Facilities

Construction of Admin Office, Truck Parking Area, and Others

There will be One (1) Admin Office Building, One (1) canteen, One (1) Clinic, Twenty-four (24) parking slots, workers barracks, quarters, security outpost, etc.

Pollution Control Facilities

Construction of Settling Pond

Retention pond has a total volume storage of 50.0 cubic meters which collects and directs runoff from the drainage system. The water collected shall be reuse or recycle for other use in the project.

Cooling Tower

The cooling tower is a close loop system with capacity of 6.0 cum per hour. It is expected that replacement of the water is due to evaporation which is estimated at 5% or 0.30 cubic meters per hour.

Solid Waste Management Facility

In support to RA 9003, Otherwise known as 'Écological Solid Waste Management Act of 2000', the project shall put up a Material Recovery Facility (MRF) intended for the domestic solid waste temporary storage with a total area of Fifteen (15.0) square meters.

Toxic and Hazardous Waste Management Facility

In support to RA 6969 Otherwise known as 'Toxic and Hazardous Waste Management Act', the project shall put up a separate storage intended for the hazardous waste temporary storage with a total area of Fifteen (15.0) square meters.

Construction of Utilities

Construction of Drainage System

The project site has a shared or common drainage system with Seaoil Terminal Storage Facility project. This serves as a flood control measures in the area which directs the runoff to the Retention Pond.

Waterline Distribution System

The project site has an estimated water requirement of 12.50 cubic meters per day which shall be supplied by Roxas Water District. The distribution of the water requirement is allotted to 3.50 cum per day for the use of workers, employees and maintenance of the site, 5.0 cum per day for washing and 4.0 cum per day for others and evaporation loses replenishment for the cooling tower.

Electrical Distribution System

The project site has an estimated power requirement of 2.5 Megawatt per hour which shall be supplied by Zamboanga Electric Cooperative (ZANECO).

Significant environmental aspect, impact and mitigation measure for some of the above-mentioned activities are taken into consideration as follow:

Table 1-7 Description of the Pollution Control Device and Waste Management Measures During Construction Phase

Key Environmental Aspects	Environmental Impact	Waste Management System
Clearing of unnecessary vegetation	Reduced water quality in local waterways due to increased turbidity and sediment loading	Revegetation of area and provision of buffer zone
Bulk earthworks and continuous construction	Sediments laden runoff from disturbed areas, vibration and noise pollution	➢ Use appropriate design and tool for construction ➢ Regularly remove debris and other materials that may obstruct water flow ➢ Conduct water spraying to suppress dust sources and minimize discomfort to nearby residents
Electricity and Water use	Competition of water to the community	➢ Improve efficiency of supply and distribution system ➢ Observe water and electricity conservation measures

1.7.3 During Operation Phase

The operation phase takes place around sixteen (16) hours per day on an average and six (6) days a week. The operation phase includes the following:

- Raw materials are transported through shipping vessels
- Machine start-up heating at 750^{0}C using diesel and is estimated to consume about 39.05 gas per hour
- Mixing and Grinding Process
- Storing of admix materials (Portland cement)
- Packing Process
- Delivery to consumers and suppliers

Horizontal Ball Mills requires little service, and a few simple maintenances will keep it going strong for extended periods.

Preventive maintenance of process equipment should be regularly planned and performed. The focus should be on systematic observation and inspection of the equipment body, bearings and equipment drive, both when the equipment is running and stopped.

During the operational phase, the following aspects are also considered as beneficial impact:

- Potential of improvement for social and cultural values of local people's exchange of values and standards through positive social interactions.
- Possible to positive changes in lifestyles due to availability of income when the natives take up Company jobs.
- Provision of employment and stimulation of local economy

Table 1-8 Operational Phase – Environmental Risk Assessment

Key Environmental Aspects	Environmental Impact	Built-in Measure
Air emissions during the operation phase of cement plant, especially dusts	Air Pollution	Dust emitted during the operational phase is generally non-toxic, non- corrosive, not flammable, non- explosive, and not hazardous. Nevertheless, high efficiency dust collector will be installed
Usage and accumulation of storm water, sewage water and cooling water	Water Pollution	➢ Sewage shall be piped into septic tanks, which when filled up shall be evacuated using sewage trucks to be treated in a sewage treatment plant prior to discharge ➢ For the storm water, a network of internal drainage system have been designed to storm water into a sedimentation part, prior to discharge through and existing stream ➢ Cooling water shall be recycled as much as possible, but prior to recycling, it shall be cooled in a cooling tower before discharge into a drainage system
Use of raw materials and other resources	Waste generation	Wastes such as cement bags, wooden pallets, paper, etc., shall be reduced at source, reused or recycled via accredited scrapper

Continuous operation of process equipment	Noise and Vibration	➢ The proponent shall utilize the latest technology, which shall guarantee low noise levels. Noise will further be attenuated by encapsulating production area. ➢ Equipment, machinery and tools shall be serviced regularly to ensure low noise emission. ➢ The use of ear defenders shall be mandatory in high noise sections of the plant
Use of vehicle for the transportation of raw materials and finished product	Road traffic	➢ Implementation of traffic management that is appropriate for the area ➢ Road signs shall be placed at appropriate locations to alert motorist along the highway. ➢ Traffic warden shall be stationed at strategic locations to guide traffic.

1.7.4 Abandonment Phase

The proposed project is not expected to be abandoned within the next 25 to 50 years from its planned operations, for as long as the demand for cement can withstand the continuous operation of the plant. However, if abandonment is necessary due to urgent reasons, the proponent will perform an Abandonment Plan. The following scenarios may become reasons to abandon the project:

- Unsustainable business operations due to economic downturns;
- Changes in zoning, building, and other related ordinances of the Roxas, Zamboanga Del Norte;
- Transfer of business to other locations;
- Accidents and emergencies that could render the plant unfit for occupation; and
- Closure order from Government agencies.

As such, the proponent will allocate sufficient time and available resources for proper dismantling and removal of structures and equipment from the existing site to minimize possible or further threats to the surrounding environment. Other activities that will be done during this event are the following:

- Advice and properly compensate all affected personnel;
- Secure necessary government clearances related to abandoning existing projects (including Request to Relief the ECC conditions from the proponent);
- Removal of solid, liquid, and hazardous wastes within the site through a DENR-certified waste transporter/treater; and
- Clean-up and possible remediation of the site, if future evaluations and testing suggest such activity is necessary.

1.8 Manpower

The overall manpower requirement of the project will need Fifty Five (55) workers for the construction of cement plant including supporting facilities while During Operation, the plant needs about Fifty Six (56) total number of workers. The required manpower requirement shall be in close coordination with the Barangay Office for potential qualified available in host community.

Table 1-9 List of Manpower During Construction and Operation Phase

Position	Requirement	Number
During Construction Phase		
Non-skilled	Helpers, Laborers	31
Skilled	Carpenters, Masons, Plumbers, Electricians and Welders	16
Professionals	Engineers, Architects and Secretaries	8
	TOTAL	**55**
During Operation Phase		
Non-skilled	Helpers, Laborers	31
QA Manager	Direct Labor	1
Production Manager	Direct Labor	1
Logistics Manager	Direct Labor	1
Maintenance Manager	Direct Labor	1
Shift Supervisor	Direct Labor	3
Maintenance	Direct Labor	3
Electrical/Instrumentation	Direct Labor	3
Laboratory Supervisor	Direct Labor	3
Sampler	Direct Labor	3
Physical Analyst	Direct Labor	1
Chemical Analyst	Direct Labor	1

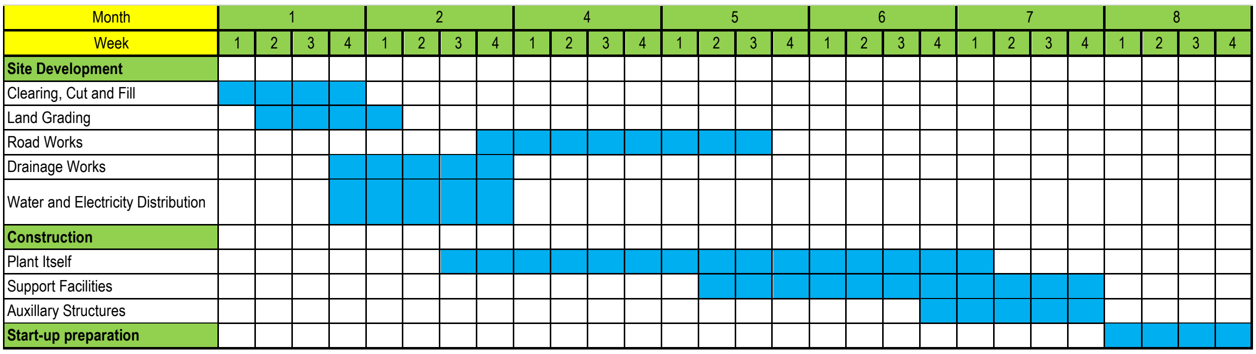
Operator (Pack House)	Direct Labor	3
Operator Finished Mill	Direct Labor	3
Dump Trucks Drivers	Direct Labor	3
Bulldozer Driver/ Payloader	Direct Labor	2
Safety & Environmental Office	Direct Labor	1
Plant Manager	Operating Labor	1
Admin Assistant	Operating Labor	1
HR Officer	Operating Labor	1
Marketing Manager	Operating Labor	1
Nurse	Operating Labor	2
Physician (Retainer)	Operating Labor	1
Security	Operating Labor	10
Supply Chain Manager	Operating Labor	1
Accounting Manager	Operating Labor	1
Accounting Staff	Operating Labor	3
Company Driver	Operating Labor	1
TOTAL		**56**

1.9 Project Cost

The project has a total capital allotment of PHP 150,000,000.00

1.10 Project Timetable

Table 1-10 Time table for the Project Establishment



Aerial Photo of the Site – February 2019

Aerial Photo – View from North

2.0 ASSESSMENT OF ENVIRONMENTAL IMPACTS

2.1 LAND

This section presents the key baseline conditions of the project's site in terms of land use and classification, geology, geomorphology, geologic hazards and pedology. Important considerations in land use are the conversion of the area into industrial zone, in geology are lithology and geohydrologic hazards, and in geomorphology are slope and alluvial processes.

The potential impacts of the project's activities during pre-construction, construction, operations, and abandonment stage on these environmental aspects and their corresponding options for prevention, mitigation or enhancement are also assessed and discussed in this section.

2.1.1 Land Use and Classification

This section describes the existing land classification and land uses within the project site, the key impacts of the project, and the corresponding control measures. Present land tenure within the project site is also discussed Environmentally Critical Areas (ECAs) within and surrounding the project are identified and located.

According to Act No. 2874, otherwise known as the Public Land Act, lands of the public domain are classified into three main classifications: (A) Forestland, (B) Alienable and Disposable, and (C) Mineral Lands.

Forestland, also known as permanent forest or forest reserves, refers to those lands of the public domain which have been the subject of the present system of classification and declared as needed for forest purposes. Alienable and Disposable lands refers to those lands which have been the subject of the present system of classification and declared as not needed for forest purposes or that are open to public disposition. They can be further classified according to the intended use or purpose such as agricultural, commercial, industrial, educational, charitable, reservations for town sites or public and quasi public uses. Mineral lands are lands in which minerals exists in abundance and there is enough justification to extract and utilize.

Though the project will imperceptibly impact and change the current land use, it is however, important to determine and understand the existing land use, and determine the legal classifications of the land by the local and national government.

Methodology

The following methodologies were used to determine the compatibility of the project with the existing land use and classification policies of the host municipality:

- Evaluated the compatibility of the proposed project vis-à-vis actual land use and approved land use plans, classification, and presence of environmentally critical areas;
- Investigated impact in terms of land tenure issues in relation to project implementation;
- Assessed impacts of project on visually significant landforms, terrestrial and marine areas; and
- Identified and assessed impacts of the estimated generation of solid wastes in terms of amount and characteristics and other related issues on existing management scheme.

The study was based mainly on review of published literature, reports, special studies and surveys, including maps from various sources primarily the Comprehensive Land Use Plan (CLUP) and available documents from the Office of the Municipal Planning and Development Coordinator (MPDO) of Pres. Manuel Roxas where all facilities are centrally located. Information from walkthrough confirmation surveys specific to the project site was included in the evaluation of observed actual land use for comparison with relevant laws and legally designated land use.

These data and maps were digitized, encoded and geo-referenced using Geographic Information Systems (GIS) with ArcGIS suite version 10.4 as the software. Slope maps were generated from SRTM data using Global Mapper version 18.2 and from the Mines and Geosciences Bureau (MGB) hazard maps to determine the coverage of existing features within the project site.

Additional information was obtained from the National Mapping Resources Information Agency (NAMRIA) maps for base referencing of key areas within the project site. Presence and proximity to ancestral domains, Environmentally Critical Areas (ECA), and those covered by Heritage Laws were also examined and included in the assessment using the Philippine Geoportal.

Assessment of key impacts and mitigating measures

The existing land classification and land use conditions at the host municipality were described by its areal distribution, land suitability and capability classification, and land use zoning.

2.1.1.1 Impact In Terms of Compatibility With Existing Land Use

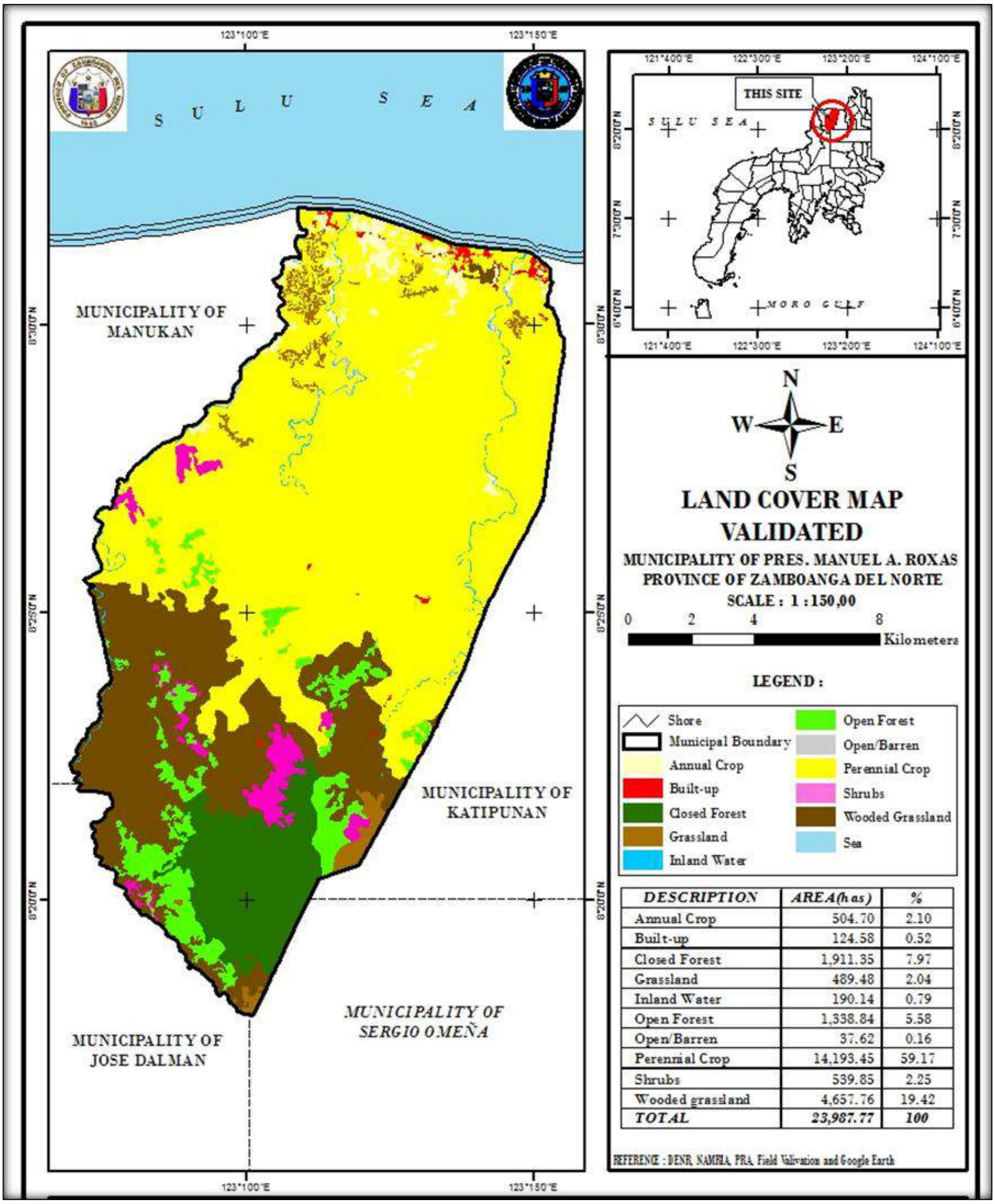
Existing conditions

The municipality of Pres. Manuel Roxas has a land area of 23,987.77 hectares comprising 4.71 percent of the total provincial land area of Zamboanga del Norte.

About 53 percent (12,732.04 hectares) that comprise the land area of Pres. Roxas are classified as forestland. The rest (11,255.73 hectares) is classified as alienable and disposable (A&D) lands, **Figure 2-1.**

With regards to land use, the host municipality is basically an agricultural town, with croplands comprising an area of 16,824 ha or 62% of the municipal land area. Aside from rice fields, these areas are planted with annual crops to include coconut, coffee, cacao, fruit trees, corn and other vegetables and root crops. In addition, agro-Industrial is 37 ha, **Figure 2-2.**

The project site lies within an area classified under industrial use as shown in **Figure 2-3** (Pres. Roxas CLUP 1998-2008). It is surrounded by agricultural, agro-industrial, and industrial lands. The built-up (and populated) areas are distant from the site, approximately 1.4 km away.



Source: Pres. Roxas MPDO 2015

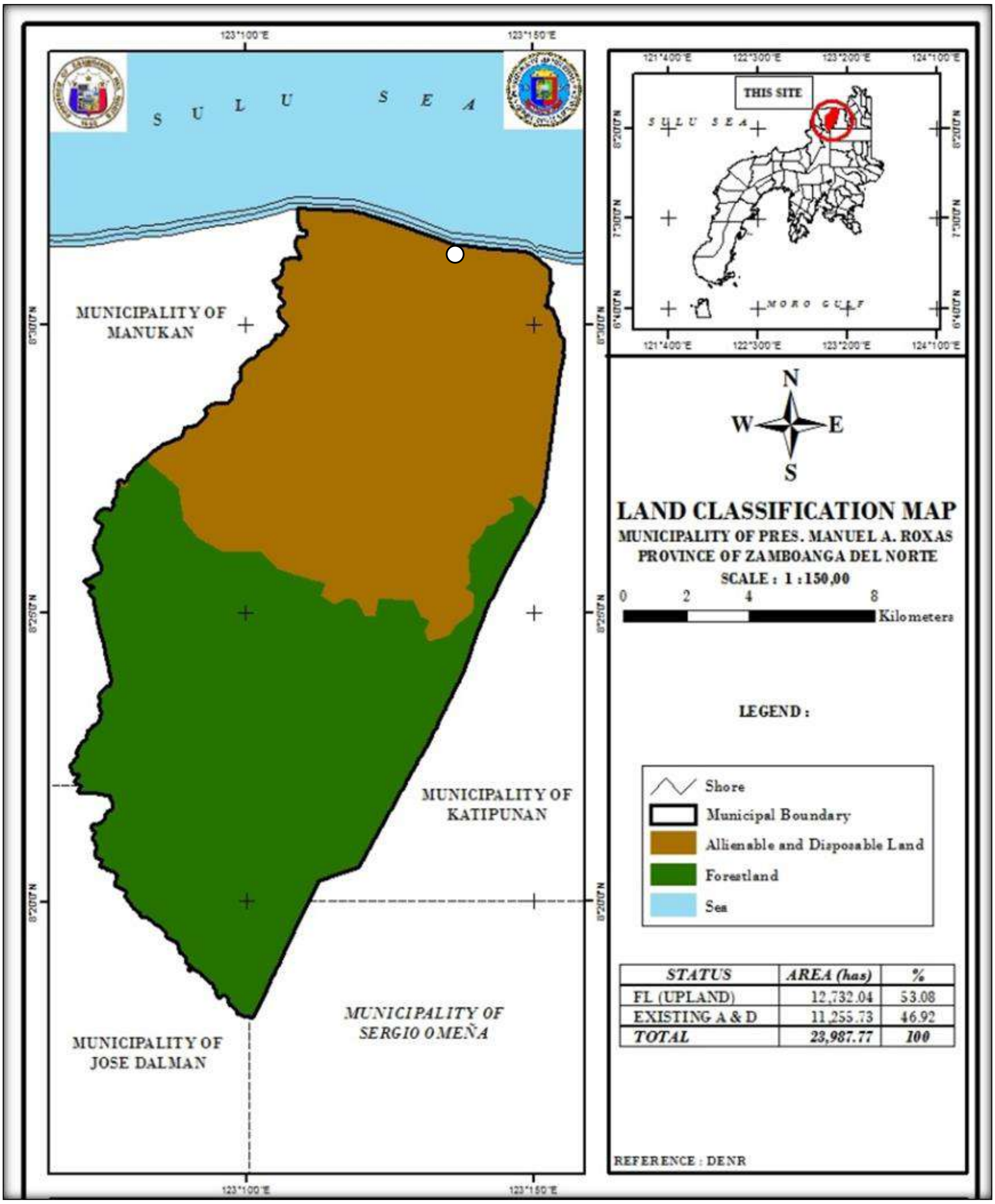
Figure 2-1 Validated Land Cover Map of the Municipality of Pres. Manuel Roxas

Impact assessment and options for mitigation and/or enhancement

There is no conflict between the project and the land use and classification of the host municipality because it is located inside an area classified for industrial use (Pres. Roxas CLUP 1998-2008). It is distant from built-up and populated areas. In addition, authority of proponent over is defined by its ownership of this land parcel covered by TCT No. T-27983.

Source: Pres. Roxas CLUP 1998-2008

Figure 2-2 Land Use Zoning Map of the Municipality of Pres. Manuel Roxas



STATUS	AREA (has)	%
FL (UPLAND)	12,732.04	53.08
EXISTING A & D	11,255.73	46.92
TOTAL	23,987.77	100

Source: Pres. Roxas MPDO 2015

Figure 2-3 Land Classification Map of the Municipality of Pres. Manuel Roxas

2.1.1.2 Impact On Compatibility With Classification As An Environmentally Critical Area (ECA)

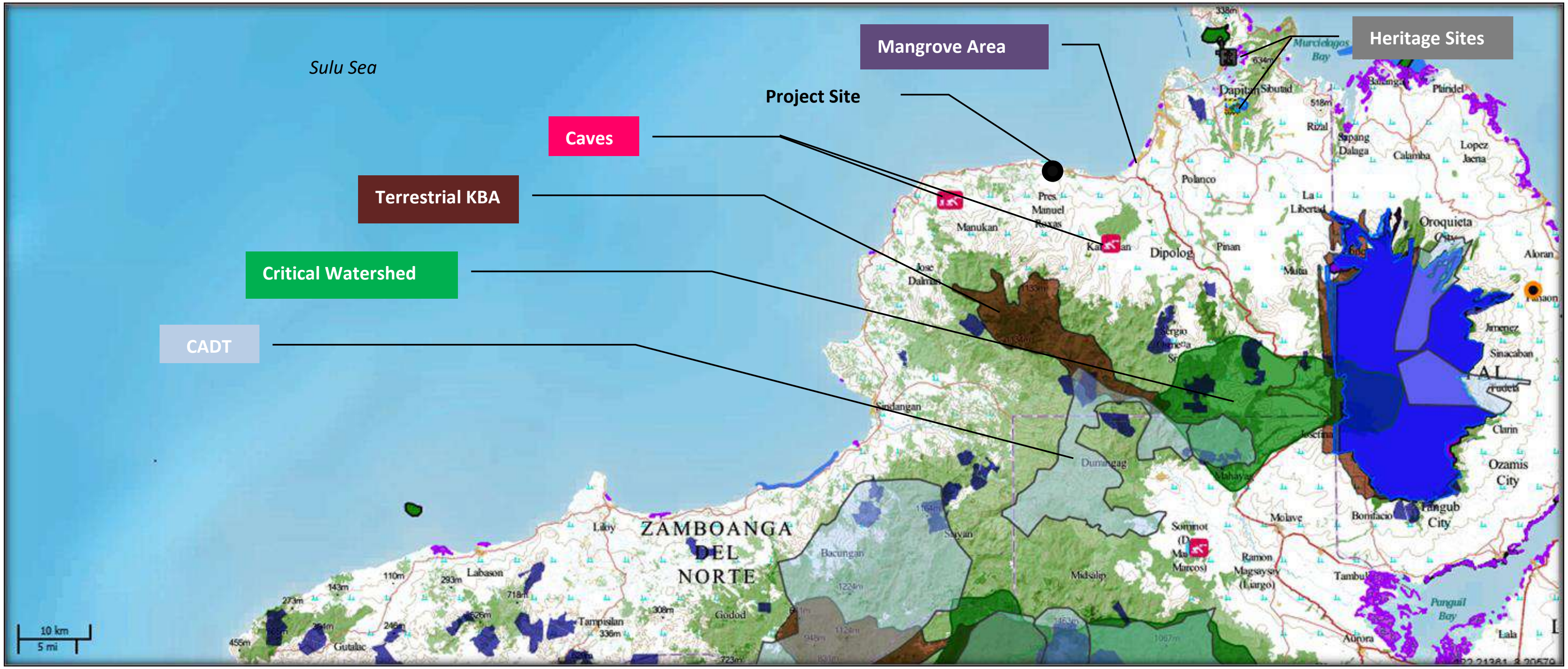
Existing conditions

The Revised Procedural Manual for DENR Administrative Order No. 30, Series of 2003 (DAO 03-30) defined Environmentally Critical Areas (ECA) in twelve categories. An ECA is an environmentally sensitive area declared through Proclamation 2146 of 1981 where significant environmental impacts are expected if certain thresholds of proposed projects are located, developed, or implemented in it. Assessment of project's encroachment in ECAs is presented in **Table 2-1**. **Figure 2-4** shows locations of ECAs within and surrounding the project.

The cement plant is located in two ECAs: areas frequently visited or hard-hit by natural calamities and areas close to waterbodies that support fishery activities. PHIVOLCS showed that the site were projected to be prone to a 7.17-meter high tsunami. **Figure 2-5**.

2.1.1.3 Encroachment in Protected Area (NIPAS) and Other ECA Categories

The current earthmoving area in preparation for land development and the proposed expansion of the capacity production are not located within any of the protected area.



Source: NAMRIA,BMB,NHCP,NCIP, NMP

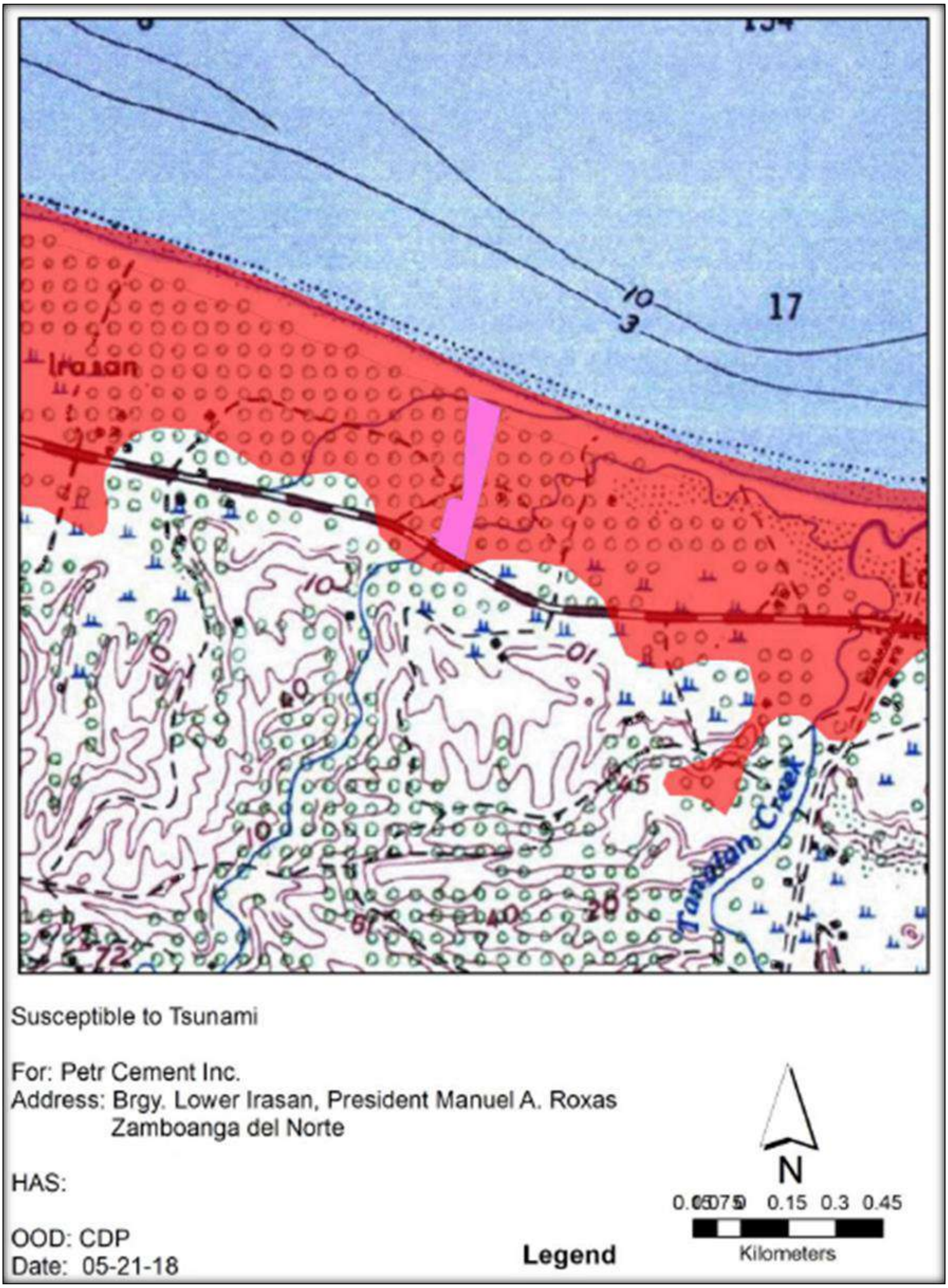
Figure 2-4 Environmentally Critical Areas (ECA) sorrounding the Project Area

Table 2-1 Assessment of project's encroachment in ECAs

No.	ECA Category	Technical Description of ECA Category based on DAO 2003-30	Presence within the Project Site	Description
1	Areas declared by law as national parks, watershed reserves, wildlife preserves, and sanctuaries	The laws referred to by this provision are Presidential Decree No. 705, as amended, otherwise called as the *Revised Forestry Code, Republic Act 7586* or the *NIPAS Act*, and other issuances including other proclamations, executive orders, local ordinances, and international commitments and declarations.	Not present within the project site.	Aliguay Is. Protected Landscape/Seascape under NIPAS Act (approx. 22 km distant) Jose Rizal Memorial Protected Landscape under NIPAS Act (approx. 25 km distant) Dipolog Critical Watershed under NIPAS Act (approx. 30 km distant)
2	Areas set aside as aesthetic, potential tourist spots	Aesthetic potential tourist spots declared and reserved by the DOT or other appropriate authorities for tourism development.	Not present within the project site.	Class 2: Ikogan Cave determined by BMB (approx. 12km away from site) Class 2: Libuton Caves I,II,III determined by BMB (approx. 14 km away) Filipino - Japanese Memorial Park determined by DOT (approx. 17 km away) Cogon Jungle Adventure determined by DOT (approx. 20 km away) Holy Rosary Cathedral determined by DOT (approx. 20 km away)
3	Areas that constitute the habitat of any endangered or threatened species of indigenous Philippine wildlife (flora and fauna)	This refers to areas considered as wilderness areas and areas identified by the PAWB/BMB to be natural habitats of endangered or threatened, rare, and indeterminate species of flora and fauna, as defined by PAWB/BMB.		Terrestrial Ecology Section 1.4
4	Areas of unique historic, archaeological, geological, or scientific interests	This refers to areas that are more than 100 years old (now superseded by new law RA10066, reduced to 50 years old) and declared by the National Historical Institute, National Museum, or National Commission for Culture and the Arts, through national or local laws or ordinances as areas of cultural, historical, and scientific significance to the nation, (e.g., declared national historical landmarks, geological monuments, and paleontological and anthropological reservations).	Not present within the project site.	Nearest recorded historical/ heritage site as per NHCP is located in the City of Dapitan: 1. Old Town of Dapitan (approx. 25 km) 2. St. James Church (approx. 26 km) 3. Rizal Shrine (approx. 26 km)
5	Areas that are traditionally occupied by cultural communities or tribes	This refers to all ancestral lands of the National Cultural Communities in Section 1 of P.D. No. 410 and settlements designed, implemented, and maintained by the PANAMIN for national minorities (non-Muslim hill tribes referred to in Presidential Decree No. 719) as may be amended by R.A. 8371 or the Indigenous Peoples Rights Act of 1997 and its Implementing Rules and Regulations.	The project site is not located in any ancestral domain based on NCIP and MPDO data.	Nearest approved CADT is located in the municipalities of Mahayag and Dumingag, Zamboanga del Sur (approx. 26 km away) and in the Municipality of Sindangan, Zamboanga del Norte (approx. 45 km).

No.	ECA Category	Technical Description of ECA Category based on DAO 2003-30	Presence within the Project Site	Description
6	Areas frequently visited and/or hardhit by natural calamities (geologic hazards, floods, typhoons, volcanic activity, etc.)	The area shall be so characterized if any of the following conditions exist: - Geologic hazard areas: This refers to all areas identified by the Mines Geosciences Bureau (MGB) as geologic hazard areas. - Flood-prone areas: This refers to low-lying areas usually adjacent to large active water bodies experiencing inundation of at least 2m, twice a year for the last five years prior to the year of reckoning. - Areas frequently visited or hard-hit by typhoons: This refers to all areas where typhoon signal No.4 was hoisted for at least twice a year during the last five years prior to the year of reckoning. - Areas prone to volcanic activities/ earthquakes: This refers to all areas identified as such by the Philippine Institute of Volcanology and Seismology (PHIVOLCS) (e.g., areas within permanent exclusion zones of active volcanoes or areas within the required minimum buffer zone of fault zones as determined by PHIVOLCS).	Present within the project site.	Within the tsunami innundation zone. Moderately susceptible to flooding. Very low risk to typhoon as determined by Joint Typhoon Warning Center. **Figure 2-6**. No risk from volcanic hazards; very low risk from earthquake and related hazards. Refer to Geology Section
7	Areas with critical slope	This refers to all lands with slopes of 50% or more classified as geohazard by MGB. Such slope conditions favor their natural susceptibility to geohazards such as landslides.	Not present within the project site.	Not applicable Refer to Geology Section
8	Areas classified as prime agricultural lands	Prime agricultural lands refer to lands that can be used for various or specific agricultural activities and can provide optimum sustainable yield with minimum inputs and development costs as determined by the Department of Agriculture	Not present within the project site.	Nearest area classified as SAFDZ: Agro-Industrial Zone approx. 500 m away
9	Recharge areas of aquifers	Refers to sources of water replenishment where rainwater or seepage actually enters the aquifers. Areas under this classification shall be limited to all local or non-national watersheds and geothermal reservations.	Not present within the project site.	The proposed project is not a recharge area of aquifers due to its location (near the shore).
10	Water bodies characterized by one or any combination of the following: tapped for domestic purposes; within the controlled and/or protected areas declared by appropriate authorities; which support wildlife and fishery activities	Water bodies shall refer to waters that are tapped for domestic purposes or those which support wildlife and fishery activities within declared protected areas, including the buffer zones.	Present within the project site.	The waterbodies near the site are Sulu Sea and Tanalan Creek. Only Sulu Sea is tapped for domestic purposes.
11	Mangrove areas characterized by one or any combination of the	Mangrove areas shall be characterized by one or any combination of the following	Not present within the	Nearest mangrove area is approx. 9.8 km.

No.	ECA Category	Technical Description of ECA Category based on DAO 2003-30	Presence within the Project Site	Description
	following conditions: with primary pristine and dense young growth; adjoining mouth of major river systems; near or adjacent to traditional productive fry or fishing grounds; areas which act as natural buffers against shore erosion, strong winds and storm floods; areas on which people are dependent for their livelihood.	conditions: - With primary pristine and dense young growth - Adjoining mouth of major river systems; - Near or adjacent to traditional productive fry or fishing grounds; - Areas that act as natural buffers against shore erosion, strong winds and storm floods; and - Areas on which people are dependent for their livelihood, pursuant to and taking into consideration *Republic Act 7161*, which prohibits the cutting of mangrove species.	project site.	
12	Coral reefs characterized by one or any combination of the following conditions: - With 50% and above live coralline cover; - Spawning and nursery grounds for fish; - Act as natural breakwater of coastlines	Characterized by one or any combination of the following conditions: - With 50% and above live coralline cover; spawning nursery grounds for fish; and act as natural breakwater of coastlines.	Not present within the project site.	Refer to Hydrology Section



Source: PHIVOLCS

Figure 2-5 Tsunami Hazard Map of the Municipality of Pres. Manuel Roxas

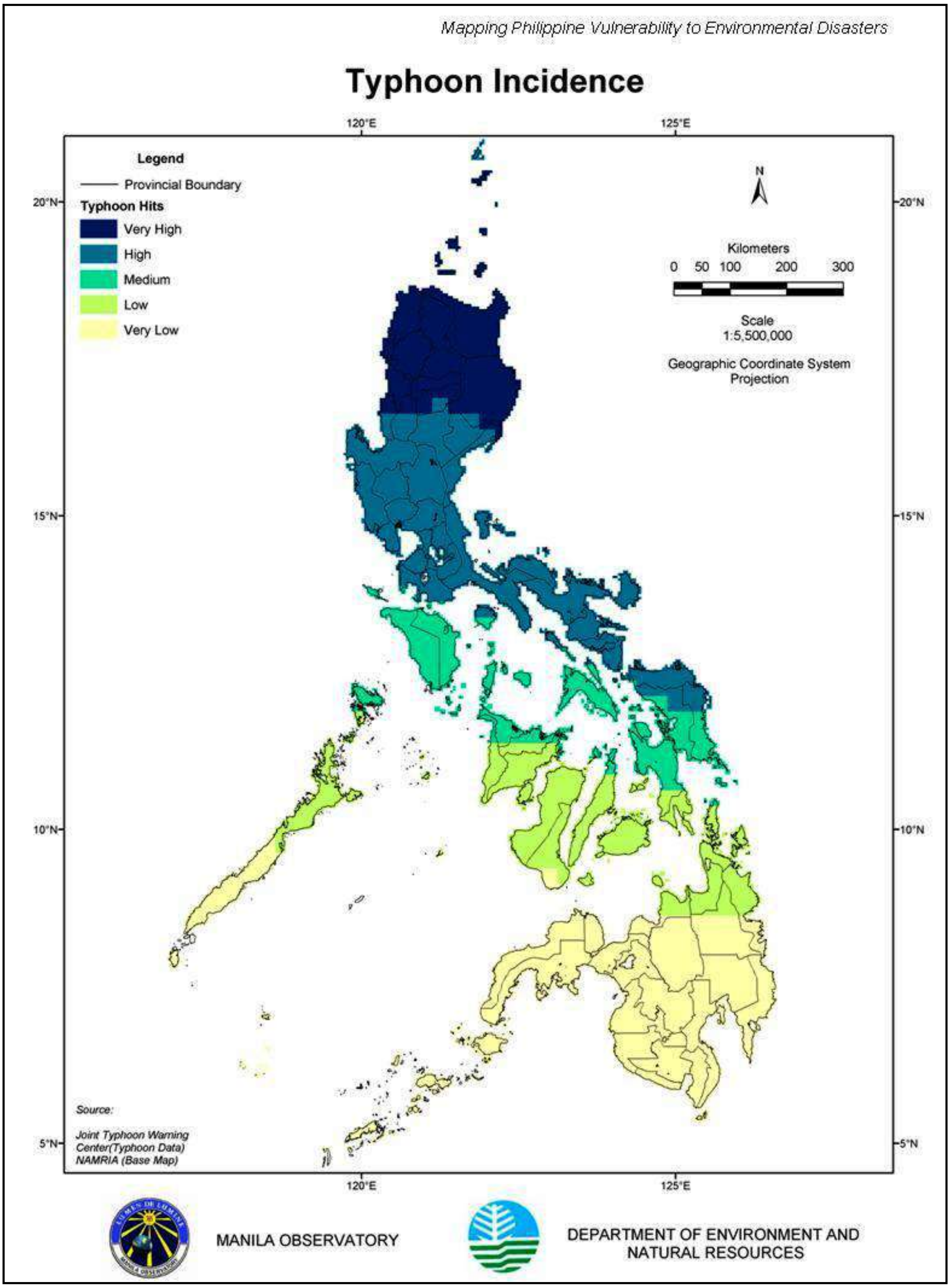


Figure 2-6 Typhoon Incidence Map of the Philippines

The project site is not within a protected area but is nearby two waterbodies, the Sulu Sea and the Tanalan Creek.

The character of the creek varies considerably within 650-700 meters within the project site, it ranges from about 2-3 meters wide in its upper stem closer to the national road to about 12-15 meters wide at its widest point near the coast. In most locations, it is about 3 to 5 meters wide. Depth is generally range from 0.2 meters to over 1.5 meters. Silt and sand to large cobbles form the stream bottom, depending on location and water velocity. Grasses, weeds, Ipil trees and other plants are moderately dense along the stream banks and overhang much of the creek near the company temporary lodging and storage/warehouse. In other areas, abundant algae grow on the stream bottom.

The remainder of the stream appears to have a silt or sand bottom, although the depths of the pools and debris restricts the ability to visually determine the composition of the substrate.

Nevertheless, any entity can build a structure or discharge to the bay or near the creek but should comply with all DENR/PAMB requirements.

Impact assessment and options for mitigation and/or enhancement

The structures and operations of the cement plant may be potentially affected by tsunamis. Projections along other geohydrological hazards will be considered during the detailed engineering design stage.

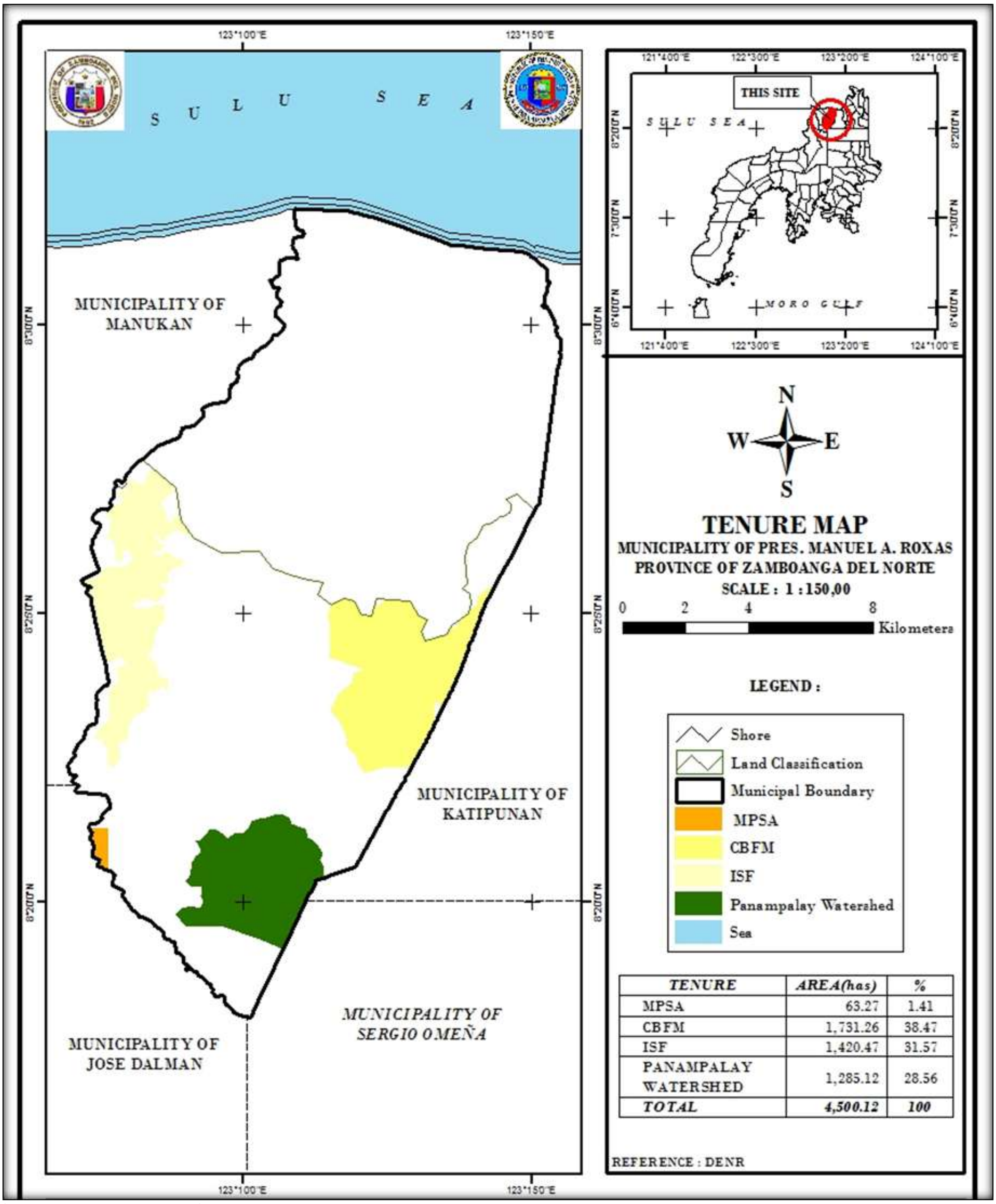
2.1.1.4 Impact In Existing Land Tenure Issue/s

Existing conditions

According to the municipality's CLUP (1998-2008), approximately 38 percent of Pres. Roxas' forest cover is within Community Based-Forest Management Agreement (CBFMA) area. Integrated Social Forestry (ISF) Program also reserves 1,420.47 hectares (31.57%) and the Panampalay Watershed covers 1,285.12 hectares (28.56%). A Mineral Production Sharing Agreement (MPSA) identified as Seq 83, No. MPSA 083-97-IX and owned by Solid North Mineral Corp. (assignment from Kenell Mining Corp.) makes up the remaining 1.41 percent (63.27 hectares). **(Figure 2-7)**

Impact assessment and options for mitigation and/or enhancement

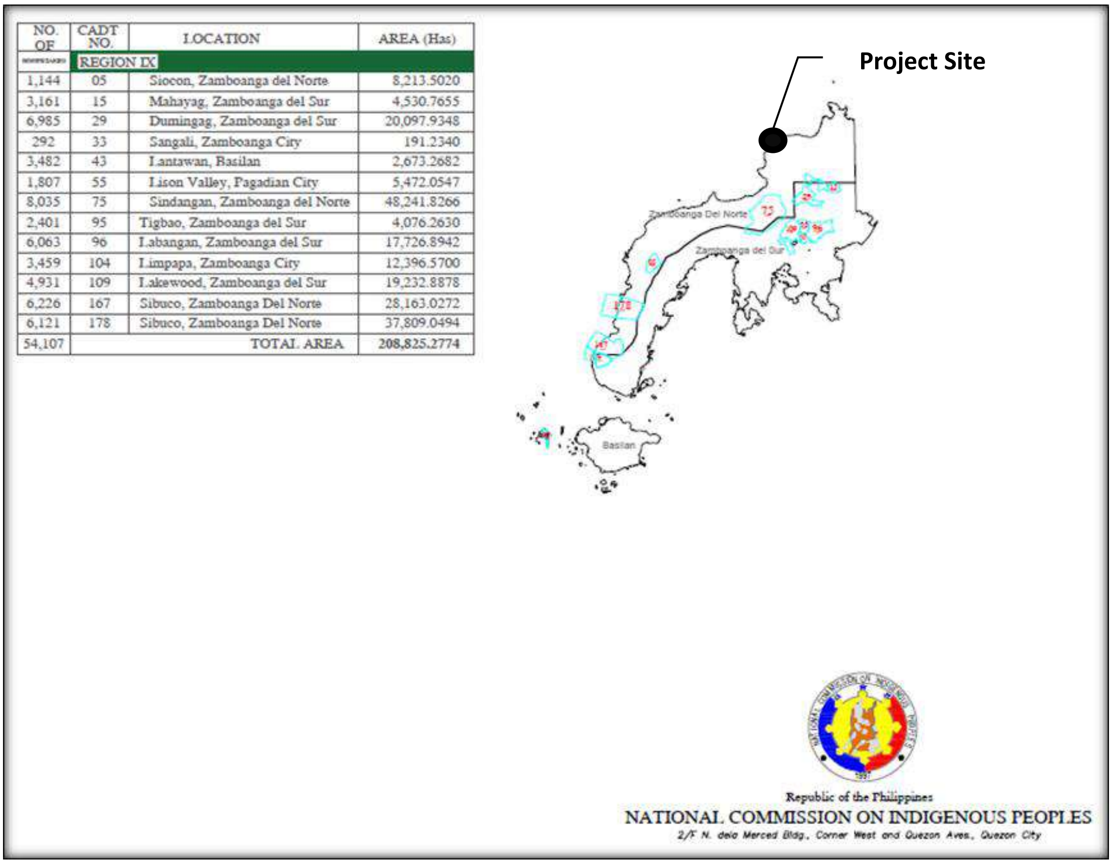
There are no land tenurial issues regarding the cement plant because it is located inside an area classified for industrial use. In addition, data from the National Commission on Indigenous Peoples (NCIP) showed that the site is not covered by Certificate of Ancestral Domain Titles (CADT) or Certificate of Ancestral Land Titles (CALT). Similarly, there are no Comprehensive Agrarian Reform Program (CARP) communities, Certificate of Ancestral Domain Claim (CADC) or Certificate of Ancestral Land Claim (CALC) within or surrounding the project site as per DENR and MPDO records. **(Figure 2-8)**



TENURE	AREA(has)	%
MPSA	63.27	1.41
CBFM	1,731.26	38.47
ISF	1,420.47	31.57
PANAMPALAY WATERSHED	1,285.12	28.56
TOTAL	*4,500.12*	*100*

Source: Pres. Roxas MPDO

Figure 2-7 Tenure Map of the Municipality of Pres. Manuel Roxas



NO. OF	CADT NO.	LOCATION	AREA (Has)
	REGION IX		
1,144	05	Siocon, Zamboanga del Norte	8,213.5020
3,161	15	Mahayag, Zamboanga del Sur	4,530.7655
6,985	29	Dumingag, Zamboanga del Sur	20,097.9348
292	33	Sangali, Zamboanga City	191.2340
3,482	43	Lantawan, Basilan	2,673.2682
1,807	55	Lison Valley, Pagadian City	5,472.0547
8,035	75	Sindangan, Zamboanga del Norte	48,241.8266
2,401	95	Tigbao, Zamboanga del Sur	4,076.2630
6,063	96	Labangan, Zamboanga del Sur	17,726.8942
3,459	104	Limpapa, Zamboanga City	12,396.5700
4,931	109	Lakewood, Zamboanga del Sur	19,232.8878
6,226	167	Sibuco, Zamboanga Del Norte	28,163.0272
6,121	178	Sibuco, Zamboanga Del Norte	37,809.0494
54,107		TOTAL AREA	208,825.2774

Source: NCIP

Figure 2-8 CADT Map covering the Zamboanga Peninsula

2.1.1.5 Impairment Of Visual Aesthetics

Existing conditions

The project site is located along the coastal area of Barangay Lower Irasan, Pres. Manuel Roxas, Province of Zamboanga del Norte. The northern part of the site is fronting the coastal area of Sulu Sea, where the proposed port under the joint venture of the proponent and Sea Oil Petroleum will be established.

Facing east is the asphalt processing plant owned by Vic Lao Construction and the Tanalan Creek. The southern part is occupied by Ipil-Dipolog Highway and few residential houses. The succeeding area looking south is occupied by vast plantations of coconut trees and several agricultural parcels covering terrain which ranges from flat to moderately sloping. The east side offers a view of several tank farms owned by SEAOIL Phils., Inc.

Actual Photos of Areas Surrounding the Project Site

Photo 2A. North of Project site--- mostly occupied by the Sulu Sea and proposed port facility

Photo 2B. Perspective facing east of Project —Tanalan Creek and Vic Lao Construction (Asphalt Processing Plant)

Photo 2C. South of Project--- Dipolog-Ipil Highway, coconut trees, parcel of rice farms, few residential houses

Photo 2D. Perspective facing west of Project—SEAOIL Depot (ongoing construction)

Impact assessment and options for mitigation and/or enhancement

The proposed expansion of the project will cause a change in visual aesthetics, but the impact is not necessarily adverse. Since the establishment of Petra Cement, Inc., areas to be covered by the plant facilities have been subjected to clearing, land grading and levelling, and subsequently soil compaction.

There will be establishment of temporary lodging and storage facilities and construction of structures that may require modification of land surrounding the project site. During operation, there will only be minimal visual impact such as presence of emissions from towers. To ensure that there will be no adverse impact on visual aesthetics, the proponent will conduct regular maintenance of its machines and equipment to ensure the efficiency of plant operations and that emissions will be in accordance with DENR standards.

2.1.1.6 Devaluation Of Land Value As A Result Of Improper Solid Waste Management And Other Related Impacts

Existing conditions

There is no solid waste management system in place in the area as the major anthropogenic activities consists of agricultural activities consisting of coconut farming, kaingin, and grazing.

Petra Cement, Inc. Will be responsible for the management of the solid wastes during the construction and operation of the cement plant. The proponent will implement the following waste management measures to comply with Republic Act No. 6969 and avoid contamination of land and water due to improper waste disposal:

- Strict implementation of rules and regulations on sanitation and waste disposal
- Provision of storage area for solid wastes and construction of a temporary MRF

Further to the compliance with Republic Act No. 6969, Petra Cement, Inc. has applied a hazardous waste generator.

Impact assessment and options for mitigation and/or enhancement

The construction of the project will involve land clearing and construction of several structures. During operation, the plant is expected to generate both hazardous and non-hazardous wastes. If not managed properly, this may cause land and water contamination. To mitigate potential adverse impacts, Petra Cement, Inc. will strengthen its implementation of waste management measures, which shall include but will not be limited to:

- Practice waste segregation at source and waste reduction through reuse and recycling;
- Conduct of IEC on solid waste management to all employees including posting of signages and provision of properly-labelled waste bins;
- Segregation of non-hazardous and hazardous materials;
- Non-hazardous wastes will be disposed in the local government disposal area; and Hazardous wastes such as used oil, used batteries, busted bulbs, expired chemicals and laboratory wastes will be stored onsite and hauled and treated offsite by a 3rd party DENR-registered waste treater

2.1.2 Geology/Geomorphology

This section described the existing geology, geomorphology and potential geohazards that may affect Petra Cement, Inc. cement finishing plant expansion project. It aims to present a characterization of the existing geophysical conditions within the project's impact area, and describe possible implications to the suitability of the site for project development. Conversely, potential impacts of the project to the natural or current state of geomorphology and geology shall also be discussed. Prevention, mitigation and enhancement measures for the management of the project's induced effects and exposure to geophysical risks shall be enumerated lastly for every section.

Background

Given the importance of the geophysical environment to project feasibility, implementation and environmental compliance, geologic and geohazard risk assessment became embedded in the Philippine's environmental permitting process through Presidential Decree No. 1586 which set up the framework for the Philippine Environmental Impact Statement (PEIS) System. The standard form for Environmental Performance Report and Management Plan (EPRMP) submissions under the PEIS acknowledges the influence of geophysical conditions to projects, and conversely, consequential impacts to geomorphology, geology and geohazard exposure by project developments. The ultimate objective of the geophysical assessment is the emplacement of monitors, controls and guarantees across different phases of a project, in accordance with the intention of the PEIS in safeguarding the country's natural resources while promoting sustainability of projects.

To secure an Environmental Clearance Certificate (ECC) amendment for the Petra Cement Inc. cement finishing plant expansion project as required under the PEIS System, PCI has tasked CENSE Technical Consultancy Services to conduct an EIA for the project. Part of this study is to assess the geomorphologic, geologic and geohazard vulnerability within the proposed project site and surrounding areas.

Methodology

Study Area

The proposed Petra Cement Inc. cement finishing plant will be located at Barangay Lower Irasan in the Municipality of Roxas. It is strategically lies at about 6 kilometres (km) from the town proper of President Manuel A. Roxas, situated in the province of Zamboanga del Norte, located in the north-central region of the Zamboanga Peninsula in the island of Mindanao, Philippines. Geomorphologic, geologic and geohazard field observations were conducted around proposed location of key project components such as the storage facilities, administration offices, laboratory and control room buildings, and electric substation building. Exposures encountered during the conduct of the study were observed and noted.

Secondary Information

Secondary information for literature review and subsequent data interpretation are gathered from various sources. Discussions on the geology of the area are based on publications, technical reports and studies from the Mines and Geosciences Bureau Central Office.

Additional geologic information were obtained from academic publications of UP NIGS Rush urgent Working Group. Internal field geology reports from Adamson University Geology & Mining and Mapua University Geology are likewise used as data sources. Base maps for geomorphologic analysis were taken from the National Mapping Resource Information Administration (NAMRIA). Historical seismicity data were retrieved from the online catalogue of University of the Philippines Nationwide Operational Assessment of Hazards (UP-NOAH) and the National Earthquake Information Center of the United States Geological Survey (USGS-NEIC). Seismic hazard maps were adapted from PHIVOLCS, USGS and other academic sources.

Fieldwork

Geologic field surveys were conducted on May 19 & 20 to validate secondary information, document the existing geomorphology and geology, trace and identify geomorphologic and structural features, and conduct rapid geohazard assessment within the study area. Observations made during the fieldwork were supported with photo documentation and georeferencing

Data Processing and Analysis

Map Generation

Maps adopted from various sources, such as MPDO,PHIVOLCS and MGB geohazard maps, were imported into the ArcMap (v.10.5) software of the ArcGIS suite by ESRI.

Historical Earthquake Distribution

A database of historical earthquakes (from 1902 to present equal to or exceeding magnitude (M) 5.0 within a radius of 200 km around the project area, was generated from the PHIVOLCS-SOEPD as a shape file, imported into the Google Earth Pro (v.7.1.1.1.888) software, and plotted on a base satellite image from Landsat. To preserve the style elements provided in the PHIVOLCS shape file, a screenshot of the generated map was taken and exported to ArcMap.

Ground Shaking Computation

To assess potential ground shaking intensities from identified earthquake generators (i,e. active faults) within the study area, Peak Ground Acceleration (PGA) values are computed for each identified fault structure. PGA values describe the amount of acceleration that a particle or object on the surface of the earth experiences as it moves irregularly during an earthquake. PGA values are calculated using the formula for ground attenuation devised by Fukushima and Tanaka (1990), as below:

log10A = 0.41M - log10(R + 0.032x100.41M) – 0.0034R + 1.30

where:

A = mean of the peak acceleration from two horizontal components at each site (in cm/sec2)
R = shortest distance between the project site and fault rupture or earthquake generator (in km)
M = surface wave magnitude (or mean credible earthquake value as prescribed by PHIVOLCS)

Relative Ground Acceleration is represented by the unit less function ***g***. The average ***g*** is calculated from the resulting mean of peak acceleration represented by A, divided by the acceleration due to gravity constant. The mean of peak acceleration generally decreases for a particular area as its distance increases from the potential epicentre of an earthquake. This decrease also translates to a gradual reduction in ***g*** values as a particular area increases its distance from the same epicentre. Variations in the mean value of ***g*** are calculated based on the type of subsurface material underlying the study area, as different materials have different responses to the transmission of earthquake energy. Four general categories, namely Rock, Hard Soil, Medium Soil and Soft Soil are used to determine different response ranges in the study area. energy. Four general categories, namely Rock, Hard Soil, Medium Soil and Soft Soil are used to determine different response ranges in the study area.

2.1.2.1 Topography/Terrain/Slope

Slope Gradient Analysis

Slope gradient analysis is performed on the Philippine Geoportal -NAMRIA topographic base map with a contour interval of 2 m, using the ArcMap (v.10.5) software. A slope gradient rating system is adopted from the Mines and Geosciences Bureau and Bureau of Soils and Water Management (BSWM) slope classification system.

Existing Conditions

Zamboanga is observed to be bounded by irregular coastlines with generally rocky terrain and occasional stretches of sandy and gravely beaches to its eastern and southwest side. Its coastal profile generally declines abruptly towards the sea. Embayment is also noted to occur in areas where rivers are present, hence filling up these areas with alluvial materials. As a result, small tracts of coastal plains and sometimes-broad plains are produced.

Located at the northern portion of Zamboanga del Norte is the municipality of Pres. Manuel A. Roxas with a total land area of 27, 082.2847 hectares. Currently, the municipality hosts a total of thirty-one (31) barangays roughly representing 4.71 percent of the total provincial land area.

In addition, it is a coastal municipality with ten (10) kilometres of shoreline stretching from the boundary of Katipunan to the boundary of Manukan. To its advantage, the natural depths within the municipality waters can be used and developed for the construction of port and wharf.

Also, shallow waters along the municipality's shoreline provide food or livelihood to the people as bangus and prawn fries usually thrives on these areas.

With regards to its topography, the municipality's land features are generally hilly with only one-third of the total land area being on level grounds.

Most of the Barangays are found on highly elevated areas. Only six barangays were noted to be located along the coastal areas, such as the Lower Irasan, Dohinob, Langatian, Piao, and Nabilid.

Moreover, the municipality is typified as having a gentle to moderate topography predominantly on its northern portion where beach fronts, alluvial plains and coastal plains are present. On the contrary, its southern portion is typified by moderate to steep slopes where mountain ridges, karsts and hills are found. Scattered peaks can be seen throughout the southern front with the highest peak at 3359 feet (or 1,024 meters). However, the highest peak in the region which rises to 7,956 feet (or 2,425 meters) can be found farther southeast. This 'highest peak' is known as Mt. Malindang and is reported to occupy parts of Zamboanga del Norte, Zamboanga del Sur and Misamis Occidental province.

Four wide rivers and three prominent creeks were found to be traversing the municipality. The four wide rivers are: (1) Dohinob Daku, (2) Dohinob Diut, (3) Tangian and (4) Piao Rivers, while the three prominent creeks are: (1) Irasan creek, (2) Langatian Creek and (3) Minang Creek. The existence of rivers and creeks within the land area serves as a means for the farmers to cultivate various crops and as a natural drainage. Noted on the side of the river banks are strips of cultivated level grounds.

The drainage pattern in the municipality is characterized by its parallel to dendritic feature. Namely the drainage systems in the area are Dohinob, Daku, Dohinob Gamay, Tangian and Piao Rivers. These are all observed to drain towards Sulu Sea

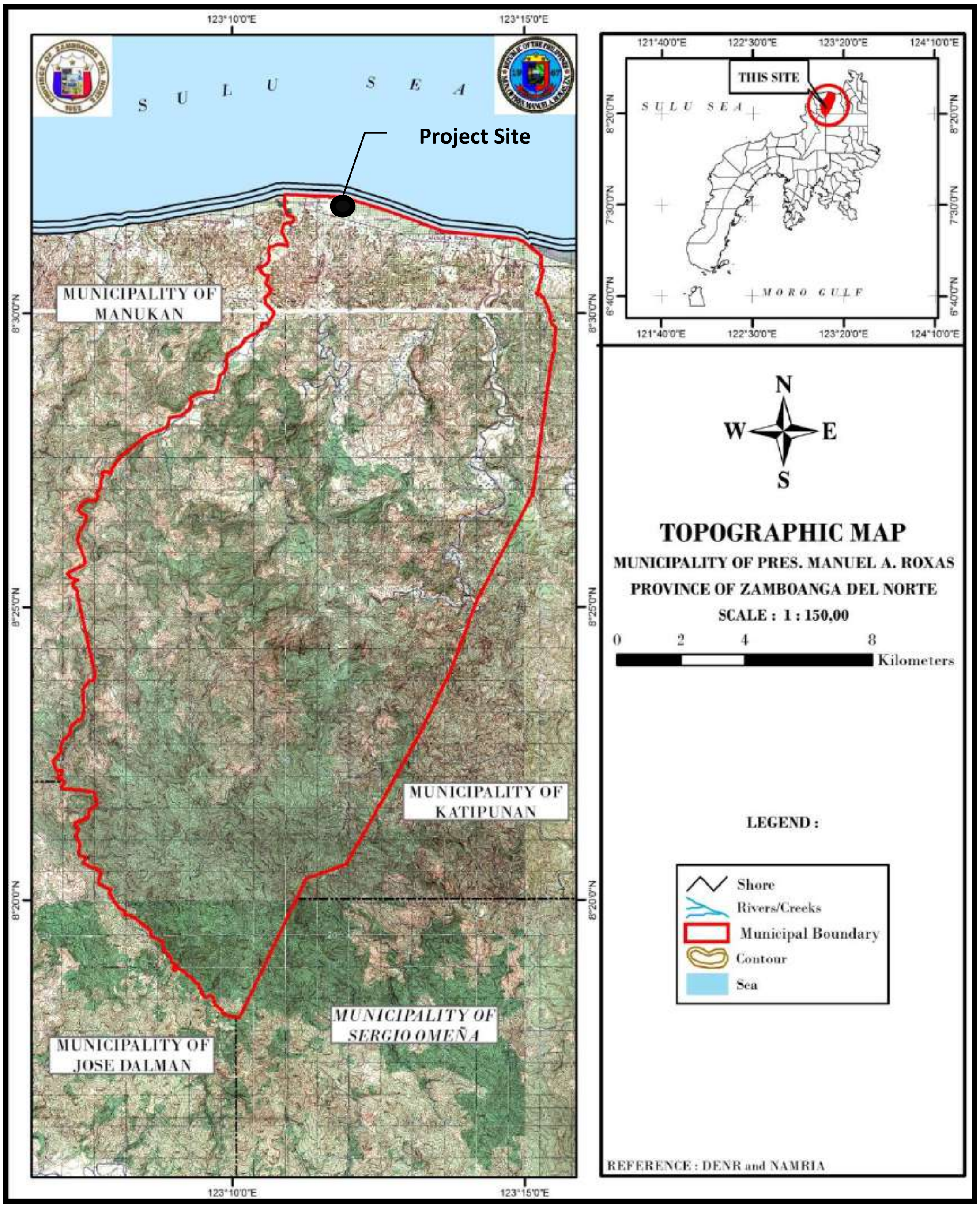
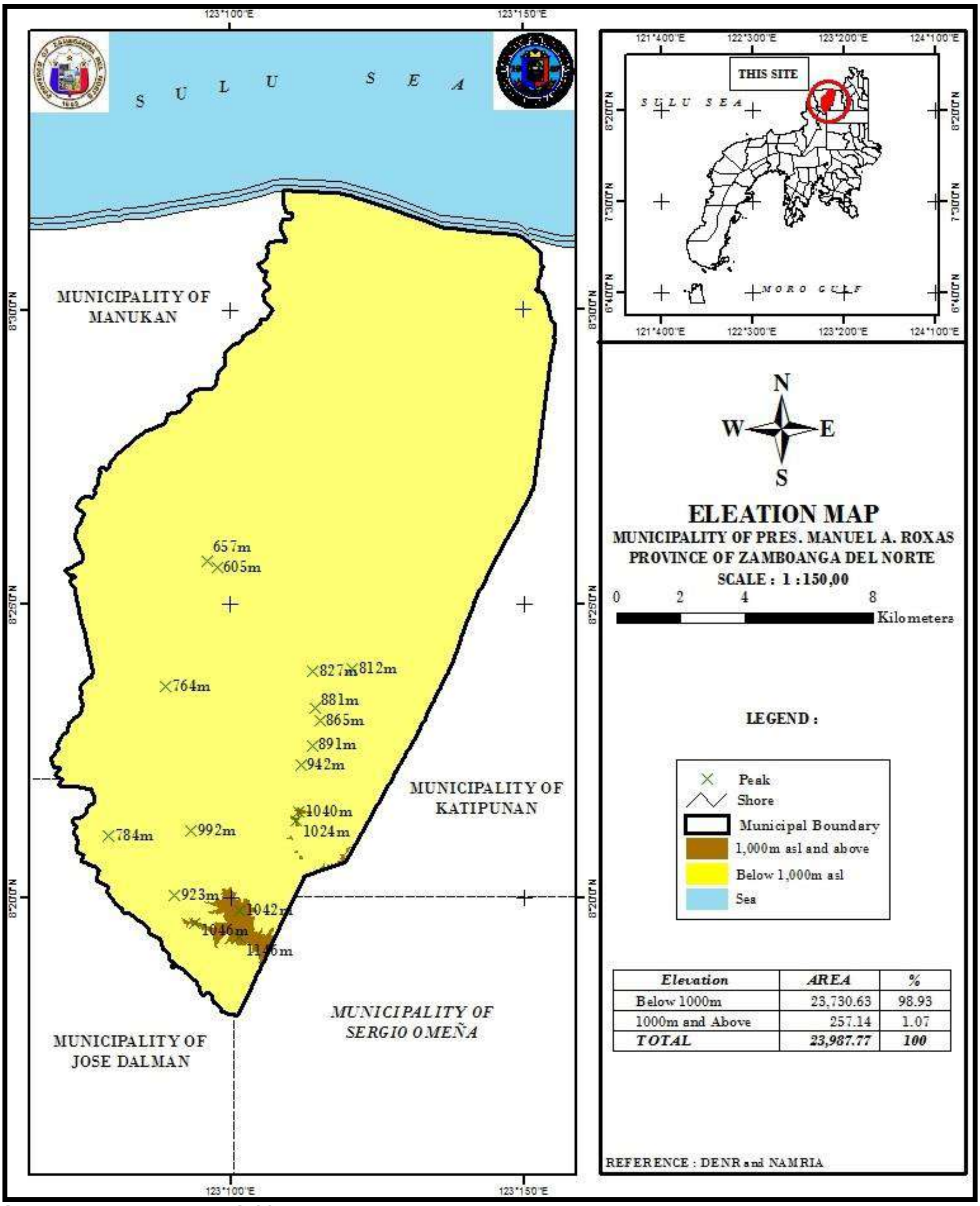


Figure 2-9 Topographic Map of Manuel A. Roxas, Zamboanga del Norte.



Source: Pres. Roxas MPDO 2015

Figure 2-10 Elevation Map of Pres. Manuel A. Roxas, Zamboanga del Norte

2.1.2.2 Change In Sub-Surface Geology/Underground Conditions

Existing Conditions

Geodynamic Setting

Zamboanga del Norte is situated at the northwestern portion of the Zamboanga Peninsula. Although the Peninsula was originally thought to be a part of the tectonically active Philippine Mobile Belt (PMB), recently published data has suggested otherwise. According to Yumul, et al 2015, the peninsula is possibly the southernmost part of a rifted segment of the southeastern continental margin of China. This idea was first conceived when previous researchers found out that the peninsula is made up of continental fragments which could have come from the Palawan microcontinental Block or the Borneo Block (Faure et al. 1989; Rangin et al 1990; Tamayo et al. 2000).

Regional correlations with Palawan and Mindoro (Faure et al. 1989) and geochemical analyses of metamorphic rocks in the Peninsula (Tamayo et al. 2000) have also confirmed its continental affinity. In particular, the peninsula is said to be similar to Palawan in terms of stratigraphy, structure and metamorphic rock suites. Thus, its continental character has allowed geoscientists to distinguish the peninsula from the rest of the Mindanao Island. Presently, it is acknowledged that the Mindanao Island is no longer divided into Pacific cordillera (or the eastern Mindanao-Halmahera block) and Central cordillera (or the western Mindanao-Sangihe block).

Current models show that Mindanao Island is divided according to their affinity: (1) Zamboanga Peninsula (with continental affinity) and (2) eastern-central Mindanao block (with island arc affinity). These two are separated by the northwest-southeast trending Siayan Sindangan suture zone. The Palawan microcontinental block, which has the same continental affinity as Zamboanga Peninsula, and the PMB makes up the Philippine archipelago. The archipelago's ongoing tectonic activity is largely influenced by its complex geodynamic framework. To site, it is flanked on the west by the following trenches: (1) Manila trench: an expression of the subduction of the South China Sea under the Luzon Arc (Karig, 1973; Cardwell et al 1980), (2) Negros trench: an expression of the subduction of Sulu Sea Basin under the Negros and Panay Islands and (3) Cotabato trench: an expression of the subduction of the Celebes Sea basin under Mindanao Island (Hayes & Taylor, 1978). Conversely, it is flanked on the east by the following features: (1) Philippine Trench: an expression of the oblique convergence of the Philippine Sea Plate under the eastern Philippine Arc (Cardwell et al 1980; Fitch, 1970; Hamburger et al 1983) and (2) East Luzon Trough: a nascent subduction zone propagating northwards (Lewis and Hayes, 1983). The present (or past) activities along these subduction zones are indicated by the presence of active, potentially active and inactive volcanoes in the archipelago **(Figure 2-12)**.

East Luzon Trough – Another theory
** Nascent Subduction (Lewis and Hayes, 1983)*
The ***Nascent Subduction Theory*** by Stephen Lewis and Dennis Hayes, 1983 suggests that the North Luzon Ridge, a volcano-capped bathymetric ridge system that extends between Luzon and Taiwan, is presently undergoing deformation in response to the relative motion between the Asian and Philippine Sea plates. Plate motion models predict convergence along the western side of the Philippine Sea plate, from Japan in the north to Indonesia in the south, and most of this plate margin is defined by active subduction zones. However, the western boundary of the Philippine Sea plate adjacent to the North Luzon Ridge shows no evidence of an active WNW-dipping subduction zone; this is in marked contrast to the presence of both the Philippine Trench/East Luzon Trough subduction zones to the south and the Ryukyu Trench subduction zone to the north. The hypothesis was concluded based on extensive marine geophysical and earthquake seismology data collated.
**Lewis and Hayes, "The Tectonics of Northward Propagating Subduction Along Eastern Luzon, Philippine Islands", First published: 19830101*

Compelled Collision (Lagmay, Tejada, Pena & Aurelio, 2009)

Aurelio et al hypothesized that the Philippine Trench propagates northward to a still poorly-understood feature which appears in most maps as a transform fault. Further to the north however, east of Luzon Island, a new subduction zone is being born (***Karig, 1973; Lewis and Hayes, 1983)*** thus the name: East Luzon Trough. Compressive structures that would correspond to the subduction zone are still generally absent on the eastern flank of the island, and in very isolated cases where they exist, the degree of deformation decreases from 16°N to 18°N latitude, and seems to completely disappear to the north. The corresponding volcanic arc does not exist (yet). Basing from seismic and bathymetric data, Lewis and Hayes (1983) have proposed that this nascent subduction zone is propagating northwards. ***Barrier and others (1990)*** however present later a kinematic explanation to the trough's disappearance to the north. The trough is flanked to the east by the Benham Rise. At this point, it is important to note the existence of an inactive accretionary prism to the west of the present location of the trough that would indicate the existence of an ancient subduction zone, a hypothesis that has always been maintained by Balce and others (1979).
**Aurelio, M. A & Pena R. E., Mineral Resources of the Philippines, Vol. 1, Mines and geosciences Bureau (MGB), 2004, pages 28-29*

Related studies, theories done by local scientist

- Karlo L. Queano, Jason R. Ali, John Milsom, Jonathan C. Aitchison and Manuel Pubellier, North Luzon and the Philippine Sea Plate motion model: Insights following paleomagnetic, structural, and age-dating investigations, *Journal of Geophysical Research: Solid Earth*, **112**, B5, (2007).
- Emmanuel Ramos, John Beavan, David Silcock, Michael Hamburger, , Catherine Thibault and Renato Feir, Geodetic constraints on postseismic deformation following the 1990 M 7.8 Luzon earthquake and implications for Luzon tectonics and Philippine Sea plate motion, *"Geochemistry, Geophysics, Geosystems"*, **2**, 9, (2001).
- Bartolome C. Bautista, Maria Leonila P. Bautista, Kazuo Oike, Francis T. Wu and Raymundo S. Punongbayan, A new insight on the geometry of subducting slabs in northern Luzon, Philippines, *Tectonophysics*, **339**, 3-4, (279), (2001).
- Federico F. Florendo, Tertiary arc rifting in northern Luzon, Philippines, *Tectonics*, **13**, 3, (623-640), (2010).

As of 2012, PHIVOLCS lists 23 volcanoes as active in the Philippines, 21 of which have historical eruption which indicates extreme volcanic activities had been felt for the last 600years or so (Phivolcs[1], 2012). Apparently, local volcanologist admitted that there been actually an ambiguity in the exact number of either active or potentially active volcano based on their definition of terms. ***Figure No. 2-12*** presented herewith is a replica of the previous shown map which in this map vividly indicates the location of said active volcanoes. It should be noted that Mt. Isarog does not included in the list being classified as active. Recently, Phivolcs releases a new list which include Mt. Isarog as active thus increases the number of active volcanoes in the country (Phivolcs[2], 2019). However, closer review on the list and its volcanic activity indicates there benn no volcanic eruption ever recorded in the past. Source; 1- *List of Active Volcanoes". Philippine Institute of Volcanology and Seismology (PHIVOLCS). 30 July 2008. Archived from the original on 4 March 2016; 2 - Philippine Institute of Volcanology and Seismology – Lava (Local active Volcano Archive), 2019*

Also, collision zones can be found at its northern, western and southern extremities, namely the Taiwan (continent-arc collision), Mindoro-Panay (arc-continent collision) and Moluccas (arc-arc collision) respectively. On a side note, the Manila Trench-Luzon Arc system connects with the Taiwan collision zone on the north and the Mindoro-Panay collision zone on the south, ultimately forming the Taiwan-Luzon-Mindoro Belt (Pelletier, 1985; Stephan and others, 1986; Dario, 1987; Maleterre, 1989; Pinet, 1990).

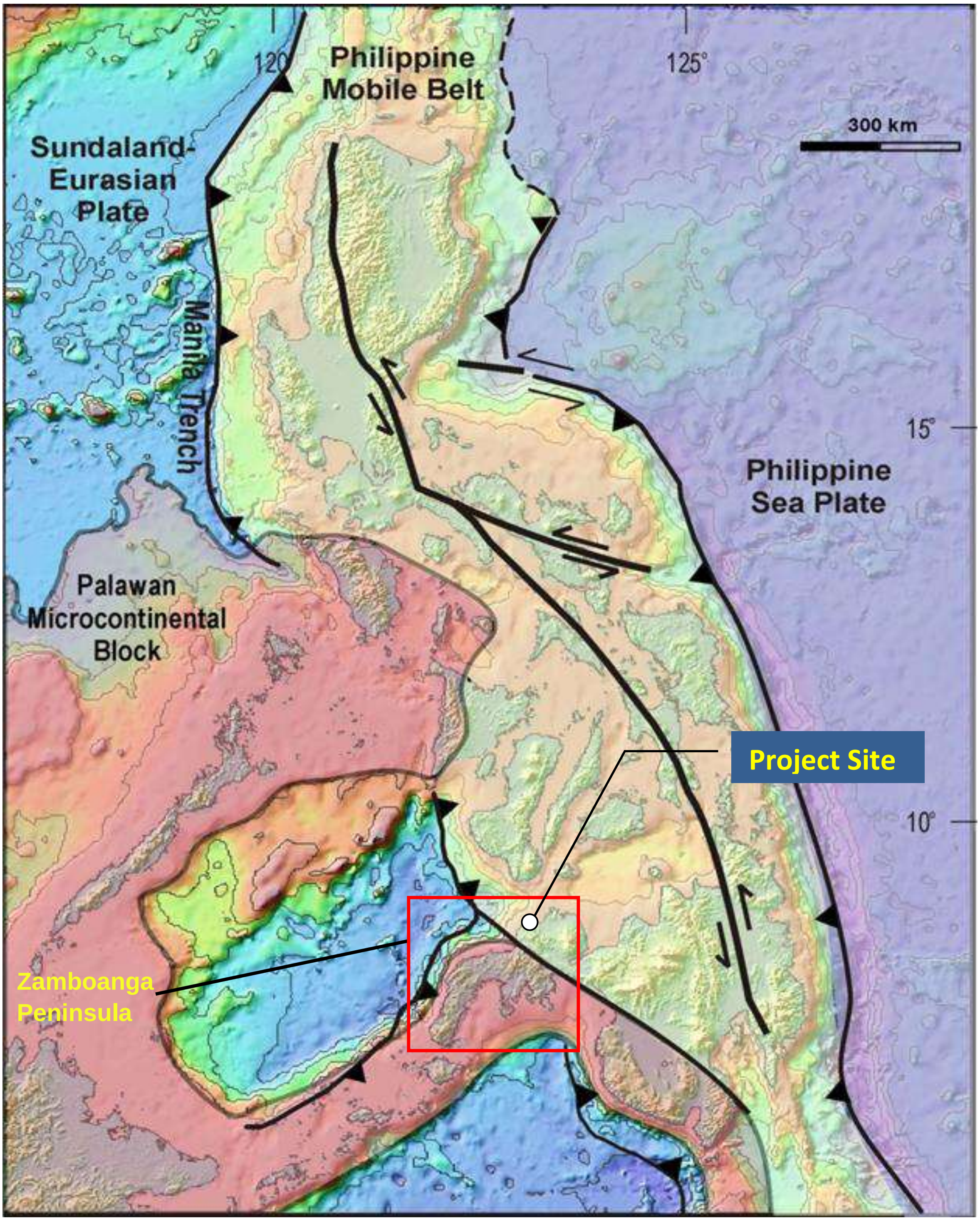
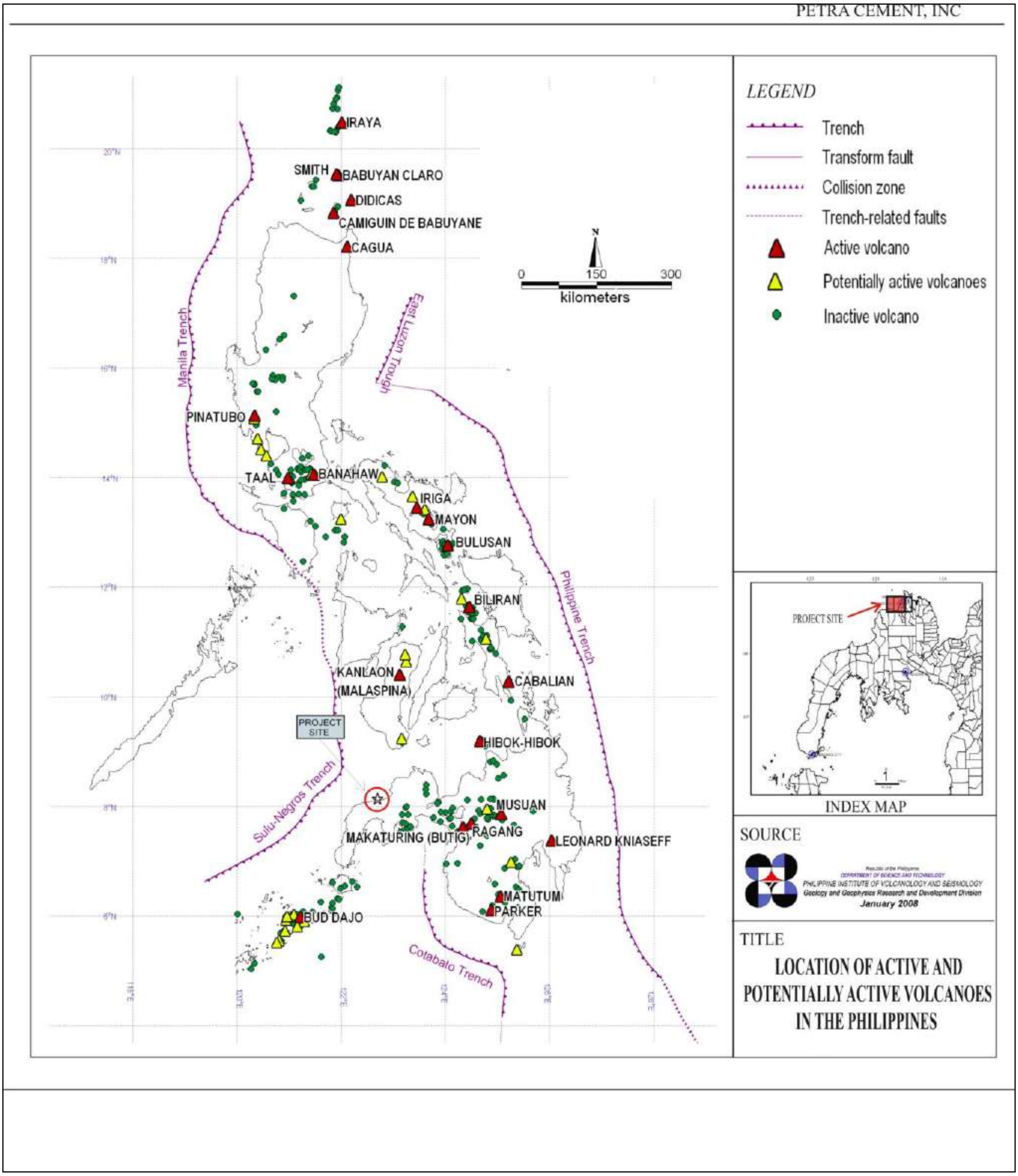


Figure 2-11 Generalized tectonic map of the Philippines. Modified after Yumul et al 2015, Geology of the Zamboanga Peninsula, Mindanao, Philippines: and enigmatic South China continental fragment



Source: PHIVOLCS, 2008

Figure 2-12 Map of volcanoes and major tectonic features in the Philippines

Regional Geology

The illustrated map presented tin the report was derived from the study conducted by Dr. G. Yumul Jr et al entitled ***"Geology of Zamboanga Peninsula, Mindanao, Philippines; An Enigmatic South China Continental Fragment,*** release in 2004. The study preclude the likelihood that the western block of Zamboanga Peninsula could be part of Palawan micrcontinental block mainly because of its distinct similarity of these island arcs in terms of stratigraphy, geologic structure and metamorphic rock suite ***(Figure No. 2-14 and Figure 2-15).*** The query raised by the reviewer focused particularly on the discussions on major stratigraphic formations which are not included in the map and must be construed to the other side of the crustal block which is the Southwest Zamboanga Block instead. In response to the query hereunder are the discussion related to the regional geology of the northeastern Zamboanga Penisula which includes the project site.

Regional Geology: Mindanao Island in the southern Philippines is made up of two blocks: the island arc related eastern-central Mindanao block and the continental Zamboanga Peninsula, which consists of several ophiolites bodies and melanges. The Middle Miocene Siayan – Sindangan Suture Zone represents the tectonic boundary between the island arc and continental block. The northeastern block comprises of Dapitan to Sindangan and Sergio Osmeña to the southwest. The NE crustal block margin has Polanco Ophiolite as its basement. It consists of a complete crust-mantle suite that includes residual peridotite, cumulate peridotites and gabbro, sheeted dike complex and basalts (Yumul, 2000). The thickness of the dikes ranges from a few centimeters to half meter. The Sindangan Volcanics of Antonio (1972) apparently constitute the volcanic carapace of the ophiolite. The Polanco is assigned a probable Cretaceous age.

The Gunyan Melange was named by Yumul and others (2000) for the chaotic megablocks of igneous and sedimentary rocks set in serpentinized and clayey matrix. The Melange is a combination of tectonic and sedimentary melange distributed in a linear manner near the center of the so-called Siayan-Sindangan Suture Zone (also known as Sindangan-Cotabato Fault) in Gunyan, Siayan. The tectonic melange consists mainly of ophiolite-derived blocks of harzburgite, gabbro, basalt and chert in a serpentinite matrix. The blocks range in size from tens of meters to kilometer-sized hills. The ophiolite-derived blocks even include chromite's enveloped in dunite at Gunyan and its vicinity. The sedimentary melange, on the other hand, consists of sandstones, andesites, schists, as well as limestone ranging in size from boulders to kilometer sized blocks set in a clayey matrix. An Oligocene age determined for one of the limestone blocks suggests an Early Miocene age for the Suture Zone as well as for the Melange. An Oligocene age determined for one of the limestone blocks suggests an Early Miocene age for the Suture Zone as well as for the Melange.

The Sindangan Basalt was previously named Sindangan Volcanics by Antonio (1972) for the hydrothermally altered, intricately folded and faulted volcanic rocks near Sindangan. It is well-represented by a northeast trending elongated body that starts from Timonan River in the north and extends farther south of Ingin River. The southern contact probably extends towards the central part of the Peninsula (Antonio, 1972). The Sindangan probably represents the volcanic carapace of the Polanco Ophiolite. Along Ingin River, faulted and altered porphyritic basalt flows are associated with thin lenses of agglomerate. These rocks vary from greenish grey to light brownish grey when fresh, and purplish to reddish brown and spotty when weathered. Outcrops are commonly characterized by poorly developed pillow structures. Individual pillow surfaces are epidotized and chloritized. The age of the Sindangan is presumed to be Middle Miocene.

The Sirawai Formation was named by Santos-Yñigo (953) after the thermally metamorphosed green clastic rocks exposed at the Siocon-Sirawai area in western Zamboanga. This formation also outcrops along the east coast of Vitali Island, near the headwaters of Vitali River, and at Panubigan Island along the southern projection of the Linguisan-Vitali ridgeline. At its type locality, the formation attains a maximum thickness of about 2,000 meters. It seems to lie unconformably over the Tungawan Schist, and is presumed to be of Eocene age, for lack of any fossils by which to date the unit. The formation consists mainly of conglomerates and minor shales and sandstones. These clastic rocks seem to have been derived chiefly from schist terrain. The conglomerates are poorly sorted and contain angular to sub angular, pebble- to boulder-sized clasts of schists and numerous quartz fragments. On the other hand, the shales and sandstones exhibit cross bedding features. Both the fine-grained clastics and the conglomerates are typically epidotized in the vicinity of diorite intrusive bodies.

Motibot formation which marks the onset of a common history for the northeastern and southwestern Zamboanga blocks, has three (3) members; a lower limestone member, a middle basaltic flow to tuffaceous sedimentary unit and a clastic sequence (conglomerate, limestone and tuffaceous sediments. Cherts interbeds are also noted. The whole sequence generally dips to the northeast. Unconformably overlying the Matibot Formation are the Plio-Pleistocene Malindag Volcanics, which are made up of thick, massive lava flows, volcaniclastic sediments and tuff deposits. Good exposure of the tuff deposits can be observed along the coast from Dipole to Dapitan. Near Dapitan, the tuff deposits are particularly coarse and grade into massive volcaniclastic deposits with poorly sorted, boulder-sized andesite and basalt blocks. Andesitic to basaltic lave flows with monomictic agglomerate belonging to this formation are hydrothermally altered and associated with gold mineralization (Jimenez et al, 2002).

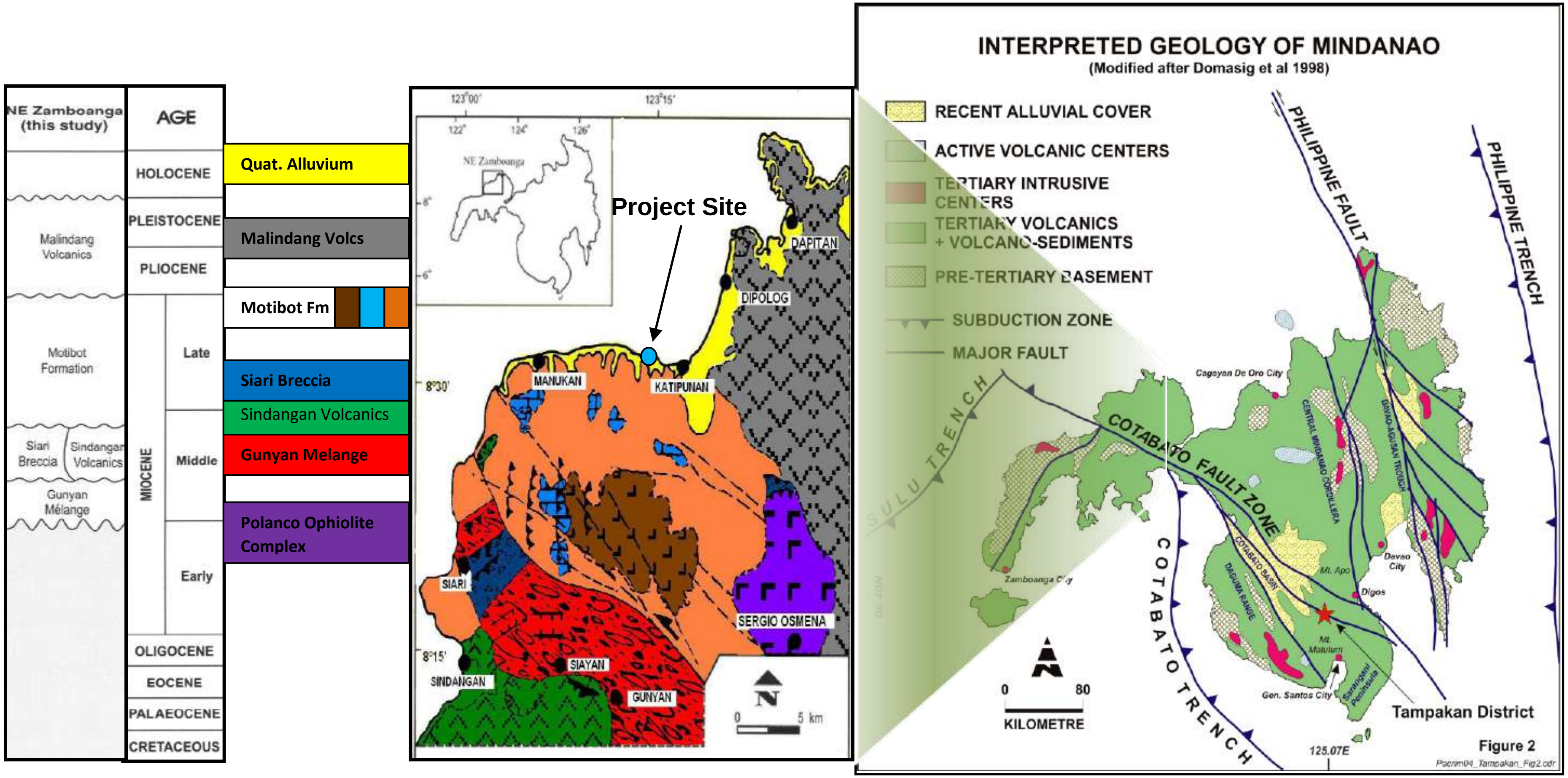


Figure 2-13 Interpreted Geology of Mindanao and Northwestern Zamboanga Peninsula including associated Stratigraphic column for selected area. Modified after Domasig et al, 1998; Yumul et al, 2015; Adamson University Field Geology Class of 2011.

Local Geology

Seven (7) chronostratigraphic units were identified in the municipality of President Manuel A. Roxas, Province of Zamboanga del Norte, namely these are: (1) Cretaceous-Paleogene, (2) Oligocene-Miocene, (3) Oligocene-Miocene (sedimentary and metamorphic rocks), (4) Pliocene-Pleistocene, (5) Recent, (6) Upper Miocene-Pliocene (igneous rocks), and (7) Upper Miocene-Pliocene (sedimentary rocks).

The Oligocene-Miocene (sedimentary and metamorphic rocks) unit is widely distributed at the central part and is also found at the southernmost tip of the municipality. Also found at the southern portion is the Upper Miocene-Pliocene (igneous rocks). The recent deposits, on the other hand, are located at the northern part engulfing some parts of the Pliocene-Pleistocene unit. Lastly, the Oligocene-Miocene, Upper Miocene-Pliocene and Cretaceous-Paleogene are sparsely distributed throughout the municipality.

Upon researched, the quadrangle maps covered the project site belongs to the Manucan and Dipolog Quadrangles. Unfortunately, the only existing geologic map available upon conducting our research is the Dipolog Quad. The Manucan Quad Map on which the project site is covered are nowhere to be found in MGB archives and files. Using the Namria topo map aided by its contour lines and other available tools at its possession such as; satellite photo imagery interpretation, lithologic projection from adjacent known geologic map (Dipolog Geologic Map) and field mapping, a projected geologic map of Manucan Qaudrangle was created.

Site Geology

The project area is generally blanketed by Quaternary Alluvial deposits consisting of loosely consolidated clastics mainly sand, silt, gravel and clay materials with thicknesses ranging from 0.5 to 3 meters from the surface. Beneath the alluvial deposits lies sandstone to pebbly sandstone units with thick pyroclastic beds. Outcrops of pyroclastics are well exposed south of the project site.

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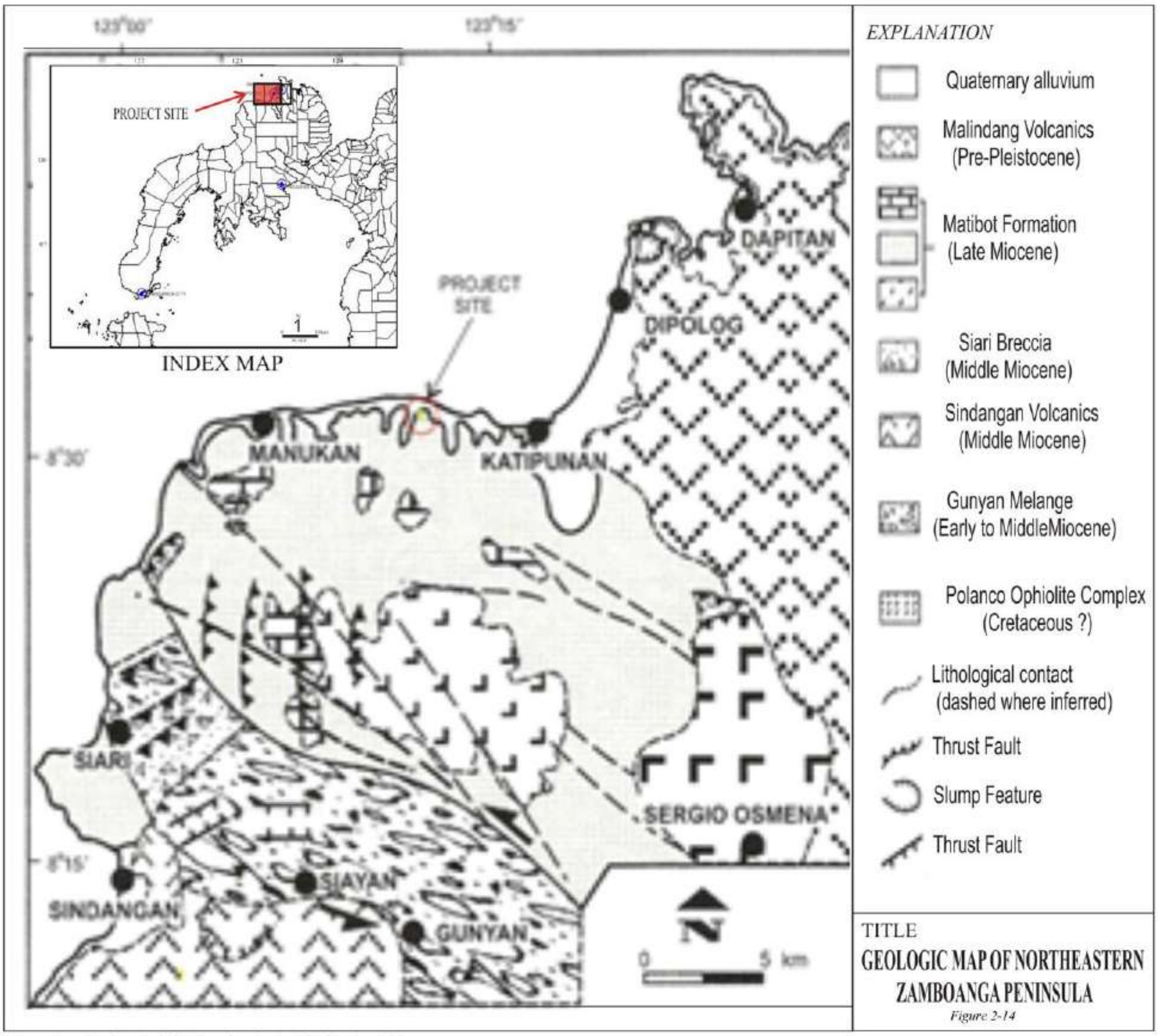

Source : Yumul et al., Geological Society of London Special Publication, 2004

Figure 2-14 Geologic Map of Northeastern Zamboanga Peninsula

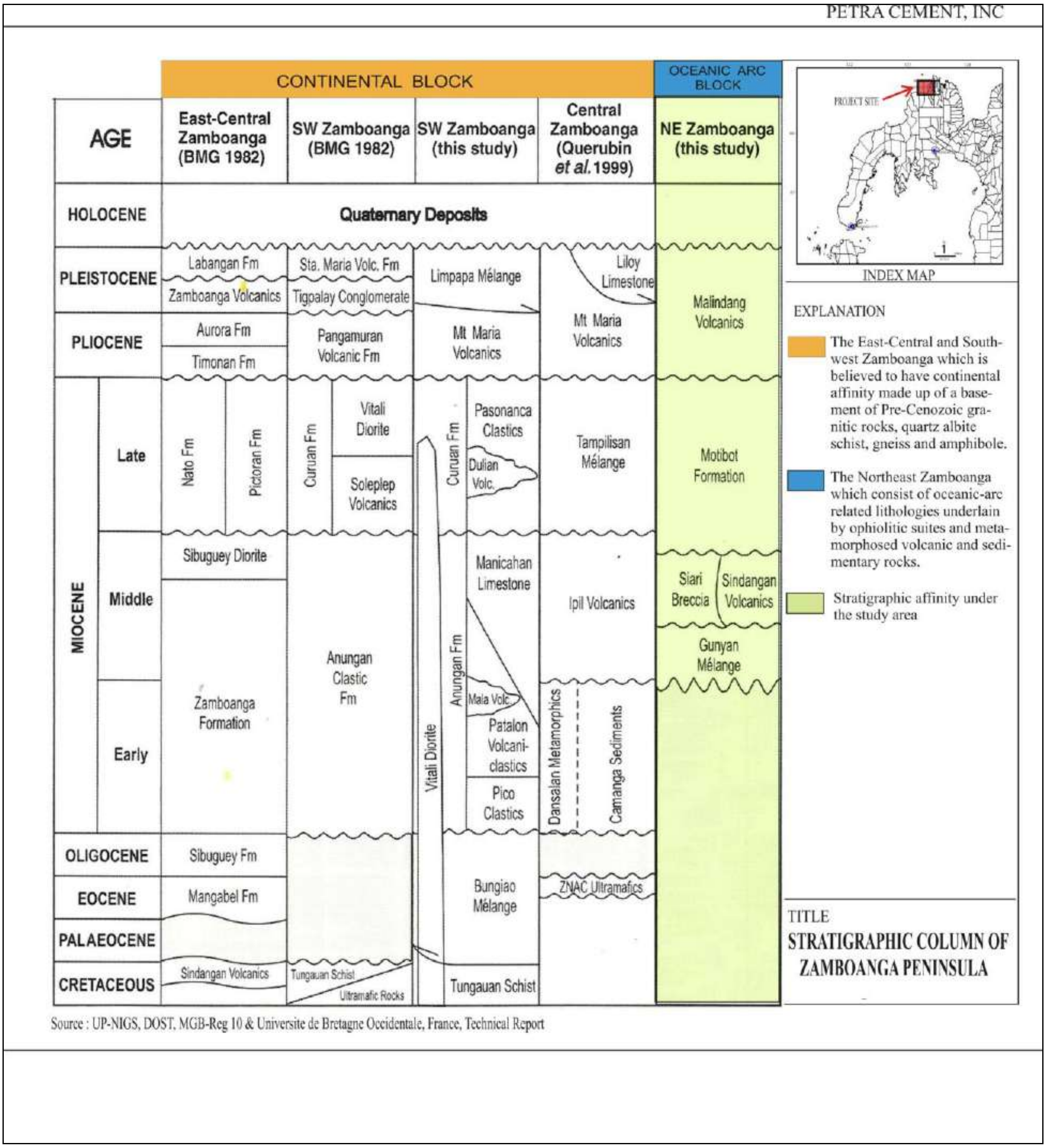

Figure 2-15 Stratripgraphic Column of Zamboanga Peninsula

Tectonic Structures: The Philippine trench east of Mindanao island marks the Philippine Sea Plate subduction zone. The Sulu Trench to the northwest accommodates the south-southeast directed subduction of the SE Sulu Sea Basin, whereas the eastward consumption of the Celebes Basin occurs along the Cotobato Trench ***(Figure No. 2-16).*** Ancient to present day volcanism can be attributed to the different modern day trenches or their ancient counter-part (e.g. the pro-Philippine Trench, Sajona et al., 1997). The two major sinistral fault zone, the north-south trending Philippine Fault Zone and the northwest-southeast Sindangan-Cotobato-Daguma Lineament (Pubellier et al., 1991), traverse Mindanao. The Sindangan-Cotobato-Daguma Lineament is postulated to be a product of the "soft" collision between Sundaland and the Philippine Mobile Belt during the Late Miocene to Miocene (Pubellier et. al., 1996). The Sindangan-Cotobato-Daguma Lineament just like the Philippine Fault Zone, is classified as active (e.g. Quebral et al., 1996), and divides Mindanao into Zamboanga Peninsula with postulated continental affinity and eastern-central Mindanao island arc affinity (e.g. Sajona et al., 1997)

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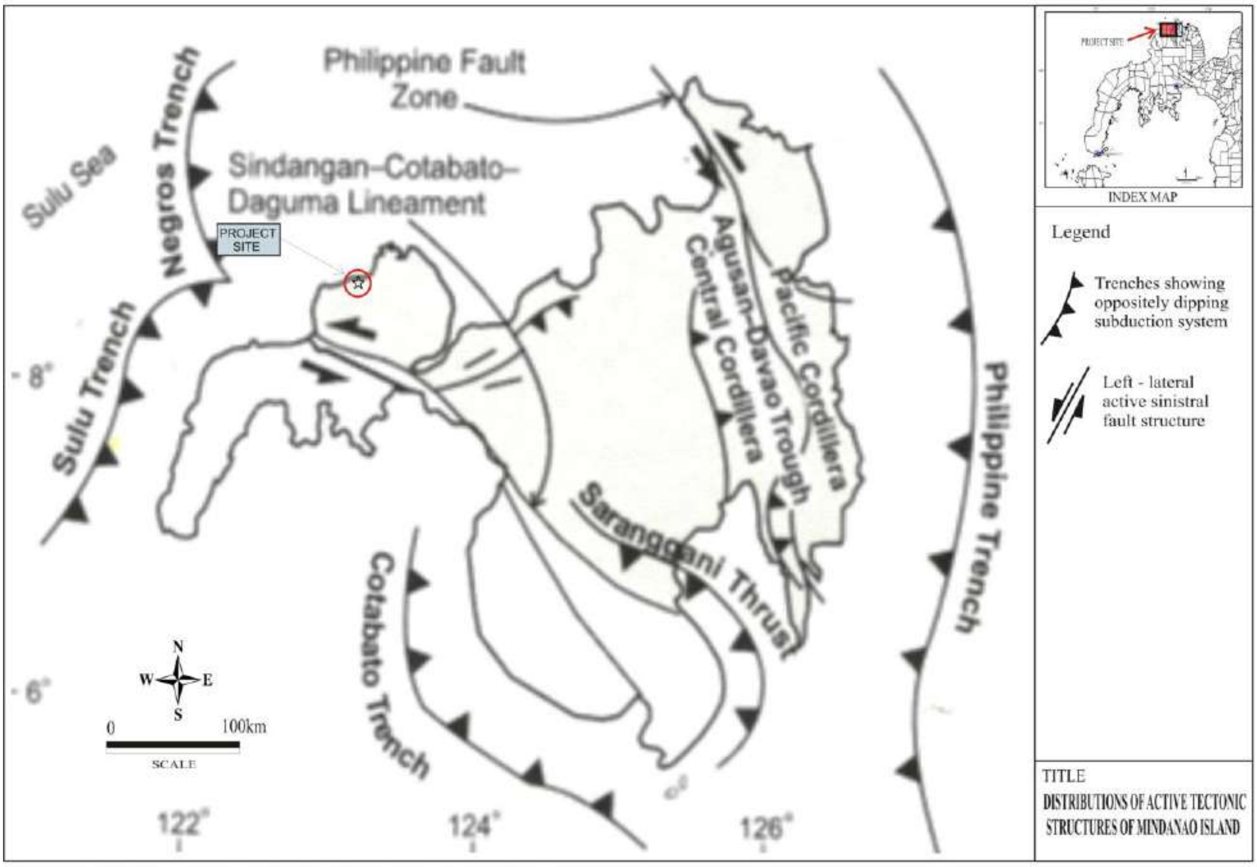


Source: Yumul et al, Geological Society of London Special Publication, 2004

Figure 2-16. The Tectonic and Structural Map of Mindanao Island.

IMPACT ASSESSMENT AND MITIGATION

During Construction and Operation Phase

Potential Impacts

Aside from the noticeable changes the project will bring to existing surface conditions of the geophysical environment of the project site, subsurface conditions will also be impacted by the construction and development of the different plant components:

- Solid and hazardous wastes generation
- Flood and Erosion.

Options for Prevention, Mitigation or Enhancement

The disturbance of original soil and rock materials during construction works and land development exposes these materials, excavation and filling would minimize exposure of the soil or rock to the elements.

- Implement Soli and hazardous waste mangement plan thru proper segregation
- Increased the elevation of the property to minimum of 4.0 meters

2.1.2.3 Inducement Of Subsidence, Liquefaction, Landslides, Mud/Debris Flow, Etc.

Geohazards

The project is exposed to several geohazards risks due to its topographic and geologic character, and proximity to an open body of water. A summary of the different geohazards, past occurrence, probability of future occurrence, and potential risks to the project is presented in **Table 2-2**.

Table 2-2 Summary of Geohazards in the project site

Geohazards		Previous Occurrence Near the Site	Likelihood of Future Occurrence	Potential Areas to be Affected	Potential Risks to Project
Seismic and related Hazards	Ground Rupture and Ground Shaking	2016 April 13 Baliguian, Zamboanga del Norte (M 6.0, epicentre 17 km) 2015 August 2 Aurora, Zamboanga del Sur (M 5.0, epicentre 2 km)	Likely Likely	Areas close to fault zones (Mindanao Fault: Western Mindanao Extension; Zamboanga Fault System) Areas on ruggy terrains (>45° slope angles) ; areas with poorly consolidated rocks and loose	Partial to total destruction of facilities by strong ground shaking ***(See attachment for PHIVOLCS' earthquake hazard assessment)***
	Earthquake-Induced Landslide	Unknown	Possible	Steep areas with >45° slope angles	No damage
	Liquefaction	Unknown	Possible	Areas near creeks and rivers Areas underlain with poorly consolidated soils and fine clastics	No damage
	Tsunami	Unknown	Possible	Area fronting the Sulu Sea	Partial to total destruction of facilities

	Seiche	Common occurrence, but unnoticeable	Possible	Coastal area of Sulu Sea	Inundation of facilities
Weather Hazards	Rain-Induced Landslide	Unknown	Possible	Steep areas with >45° slope angles Areas underlain with poorly consolidated soils and fine clastics	Not Applicable
	Flooding	2017 January (Flashflood, Barangay Situbo, Pres. Roxas)	Possible	Areas near creeks and rivers	Inundation of facilities Loss of road access
	Storm Surge	Unknown	Possible	Coastal areas of Sulu Sea	Partial to total destruction of facilities
Volcanic Hazards		Unknown	Unlikely	None	Not Applicable
Subsidence		Unknown	Possible	Areas underlain with poorly consolidated soils and fine clastics Areas near creeks and rivers	Partial to total destruction of facilities
Climate Change Effects		Not applicable	Likely	All areas	Increased flooding of area Encroachment of bodies of water Increased occurrence of storm surges

Seismic Hazards

Figure No. 2-17 shows the Seismicity Map of Mindanao Island and Zambaonaga Peninsula as depicted by Phivolcs and have been suggested by the reviewer. Since the 1600s, there have been 106 earthquakes in the Philippines with a magnitude of more than 6.0. Of the many islands in the country, only Palawan Island has not been visited by destructive earthquakes, according to a seismic map produced by the Philippine Institute of Volcanology and Seismology (PHIVOLCS). The strongest recorded earthquakes that hit the Philippine Archipelago occurred on Sept 20 and 21, 1897, in the Celebes Sea area, between the islands of Sulu and Basilan. While no succeeding earthquakes so far matched the intensity of the July 1990 quake, it was not the strongest in Philippine history. In fact, the 7.8-magnitude record that year comes only as 7th among the strongest that have hit the country. The Sept 20, 1897, earthquake registered a magnitude of 8.6 on the Richter scale, while the second quake, which occurred on the very same location the next day, registered a magnitude of 8.7. Next in terms of magnitude were 3 earthquakes with a magnitude of 8.3 (Aklan in 1948; near Davao Oriental in 1924; Celebes Sea in 1918). There were 3 with a magnitude of 8.1 (west of Sultan Kudarat in 1976; east of Davao Oriental in 1943; east of Samar in 1897). Two earthquakes with a magnitude of 8 occurred in Las Piñas in 1645 and in Cagayan in 1627. Four occurred with a magnitude of 7.9: west of Ilocos Sur in 1934; Masbate in 1897; west of Ilocos Norte in 1897; east of Samar in 1897

Most recently, in the year 2016, Zamboanga del Norte was hit by a magnitude 6.0 earthquake. The epicentre was located at 17 kilometers northwest of Baliguian, Zamboanga del Norte with a depth of 16 kilometers. **(Figure 2-19)**.

Table 2-3 Earthquake Magnitude Class

Class	Magnitude
Great	8 or more
Major	7-7.9
Strong	6-6.9
Moderate	5-5.9
Light	4-4.9

Numerous areas around the epicentre felt the following intensities:

- Intensity V (strong) – Zamboanga City
- Intensity IV (moderately strong) – Baliguian, Gutalac, Ipil, Labason, Siocon, Sibuco, and Titay, Zamboanga Del Norte; Isabela Cioty, Basilan
- Intensity III – Sirawai and Liloy, Zamboanga Del Norte
- Intensity II – Dipolog City; Oroquieta City, Misamis Occidental

Three houses were also reported to be damaged during the earthquake. It is highly likely that the province will once again face this kind of event.

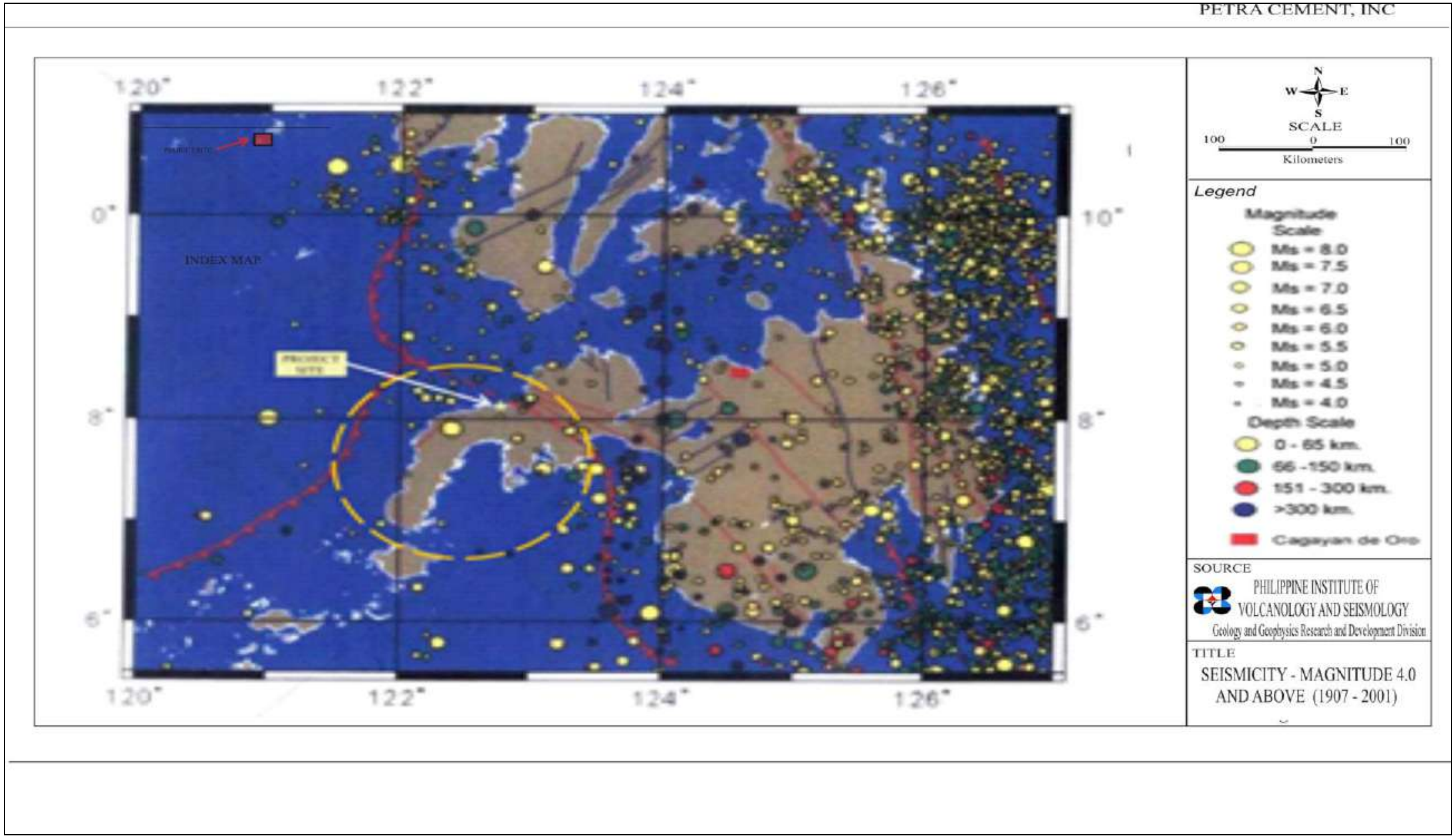
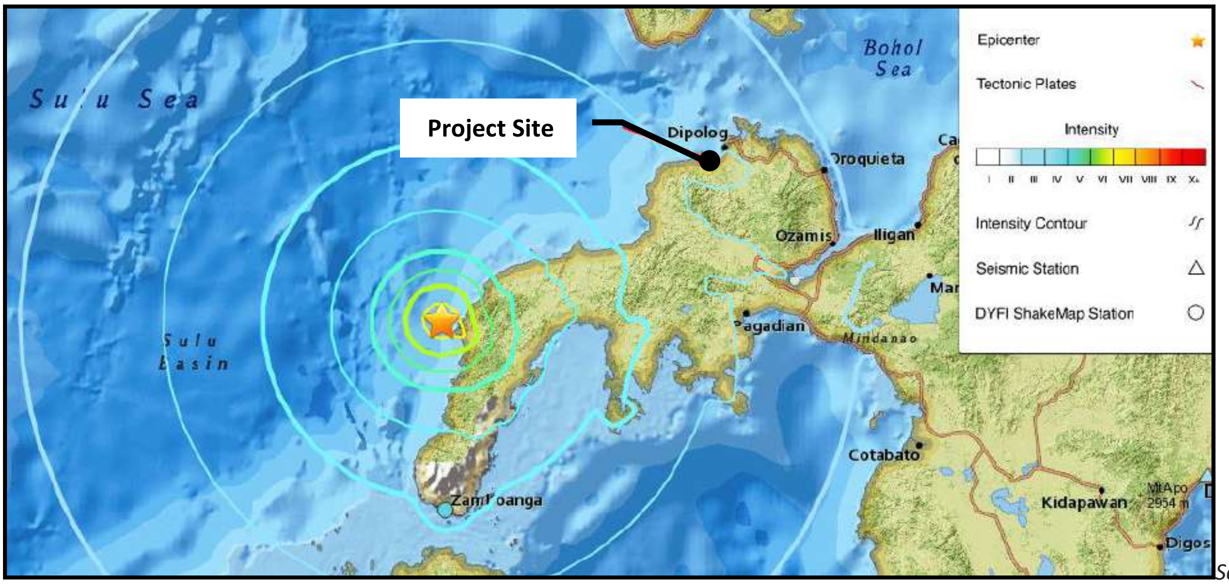


Figure 2-17 Locations of Historical Recorded Earthquakes in Zambonga Peninsula after USGS and PHIVOLCS



Source: USGS 2017, PHIVOLCS 2016

Figure 2-18 Shaker Map of March 14, 2016 M 6.0 - Baliguian, Zamboanga del Norte earthquake

Several precautionary measures are given by the PHIVOLCS to the public to avoid future casualties and seismic hazards. Namely, the common hazards related to earthquake are ground shaking, ground rupture, landslides and rockfalls, subsidence and lateral spreading, liquefaction and tsunami. PHIVOLCS has also released seismic-related (e.g. tsunami and liquefaction) susceptibility maps to each region.

Table 2-4 PHIVOLCS Earthquake Intensity Scale

Intensity Scale	Description
I	**Scarcely Perceptible** - Perceptible to people under favorable circumstances. Delicately balanced objects are disturbed slightly. Still Water in containers oscillates slowly.
II	**Slightly Felt** - Felt by few individuals at rest indoors. Hanging objects swing slightly. Still Water in containers oscillates noticeably.
III	**Weak** - Felt by many people indoors especially in upper floors of buildings. Vibration is felt like one passing of a light truck. Dizziness and nausea are experienced by some people. Hanging objects swing moderately. Still water in containers oscillates moderately.
IV	**Moderately Strong** - Felt generally by people indoors and by some people outdoors. Light sleepers are awakened. Vibration is felt like a passing of heavy truck. Hanging objectsswing considerably. Dinner, plates, glasses, windows and doors rattle. Floors and walls of wood framed buildings creak. Standing motor cars may rock slightly. Liquids in containers are slightly disturbed. Water in containers oscillate strongly. Rumbling sound may sometimes be heard.
V	**Strong** - Generally felt by most people indoors and outdoors. Many sleeping people are awakened. Some are frightened, some run outdoors. Strong shaking and rocking felt throughout building. Hanging objects swing violently. Dining utensils clatter and clink; some are broken. Small, light and unstable objects may fall or overturn. Liquids spill from filled open containers. Standing vehicles rock noticeably. Shaking of leaves and twigs of trees are noticeable.
VI	**Very Strong** - Many people are frightened; many run outdoors. Some people lose their balance. motorists feel like driving in flat tires. Heavy objects or furniture move or may be shifted. Small church bells may ring. Wall plaster may crack. Very old or poorly built houses and man-made structures are slightly damaged though well-built structures are not affected. Limited rockfalls and rolling boulders occur in hilly to mountainous areas and escarpments. Trees are noticeably shaken.
VII	**Destructive** - Most people are frightened and run outdoors. People find it difficult to stand in upper floors. Heavy objects and furniture overturn or topple. Big church bells may ring. Old or poorly-built structures suffer considerably damage. Some well-built structures are slightly damaged. Some cracks may appear on dikes, fish ponds, road surface, or concrete hollow block walls. Limited liquefaction, lateral spreading and landslides are observed. Trees are shaken strongly. (Liquefaction is a process by which loose saturated sand lose strength during an earthquake and behave like liquid).
VIII	**Very Destructive** - People panicky. People find it difficult to stand even outdoors. Many well-built buildings are considerably damaged. Concrete dikes and foundation of bridges are destroyed by ground settling or toppling. Railway tracks are bent or broken. Tombstones may be displaced, twisted or overturned. Utility posts, towers and monuments mat tilt or topple. Water and sewer pipes may be bent, twisted or broken. Liquefaction and lateral spreading cause man- made structure to sink, tilt or topple. Numerous landslides and rockfalls occur in mountainous and hilly areas. Boulders are thrown out from their positions particularly near the epicenter. Fissures and faults rapture may be observed. Trees are violently shaken. Water splash or stop over dikes or banks of rivers.
IX	**Devastating** - People are forcibly thrown to ground. Many cry and shake with fear. Most buildings are totally damaged. bridges and elevated concrete structures are toppled or destroyed. Numerous utility posts, towers and monument are tilted, toppled or broken. Water sewer pipes are bent, twisted or broken. Landslides and liquefaction with lateral spreadings and sandboils are widespread. the ground is distorted into undulations. Trees are shaken very violently with some toppled or broken. Boulders are commonly thrown out. River water splashes violently on slops over dikes and banks.
X	**Completely Devastating** - Practically all man-made structures are destroyed. Massive landslides and liquefaction, large scale subsidence and uplifting of land forms and many ground fissures are observed. Changes in river courses and destructive seiches in large lakes occur. Many trees are toppled, broken and uprooted.

According to the map of active faults and trenches by PHIVOLCS **(Figure 2-19)**, Zamboanga del Norte is transected by several active faults and is situated approximately 100 kilometers from the Sulu-Negros Trench. Two major faults which are in close proximity to the province are the Western Mindanao Extension of the Mindanao Fault and the Zamboanga Fault System. Several apparent fault traces are also found within and near the area.

Zooming in to the municipality of Pres. Manuel A. Roxas in Zamboanga Del Norte, several local faults and tension cracks were also mapped in the area **(Figure 2-20)**. The length of the fault traces and tension cracks ranges from approximately 5 to 18 kilometers.

Two prominent northeast-southwest trending faults are noted. The fault line map below designates the areas which are highly, moderately and not susceptible to the associate seismic hazards (e.g. ground rupture and shaking).

Ground shaking

The most serious direct effect of an earthquake in terms of buildings and structures is ground shaking (F.G. Bell, 2002). In this aspect, the ground conditions, such as the surface and bedrock geology, of the foundation of the buildings must be investigated. Previous studies have found out that earthquake intensities vary in areas which have different geology. The intensity decreases in areas where harder rocks, such as granite and basalt, are prevalent. Conversely, the intensity increases in areas where loose and wet sediments are common.

Table 2-5 Average Changes in Intensity Associated with Different Types of Surface Geology (from Degg, 1992)

Subsoil	Average change in intensity
Rock (e.g granite, gneiss, basalt)	-1
Firm sediments	0
Loose sediments	+1
Wet sediments, artificially filled ground	**+1.5**

In addition to ground conditions, the method and materials in which the structures were built from must also be taken into consideration. Buildings which are not earthquake-proof and stand on generally non-cohesive soils will be damaged greatly and may even be reduced to rubbles when the ground shaking comes into play.

Table 2-6 Earthquake Loss-Susceptibility Data for Different Construction Types (MM=modified mercalli scale) (from Degg, 1992).

Construction Type	Average damage (%) at intensity (MM):				
	VI	VII	VIII	IX	X
Adobe	8	22	50	100	100
Unreinforced masonry, non-seismic design	3.5	14	40	80	100
Reinforced concrete frames, non-seismic design	2.5	11	33	70	100
Steel frames, non-seismic design	1.8	6	18	40	60
Reinforced masonry, medium quality, non-seismic design	1.5	5.5	16	38	66
Reinforced concrete frames, seismic design	0.9	4	13	33	58
Shear wall structures, seismic design	0.6	2.3	7	17	30
Wooden structures, seismic design	0.5	2.8	8	15	23
Steel frames, seismic design	0.4	2	7	20	40
Reinforced masonry, high-quality seismic design	0.3	1.5	5	13	25

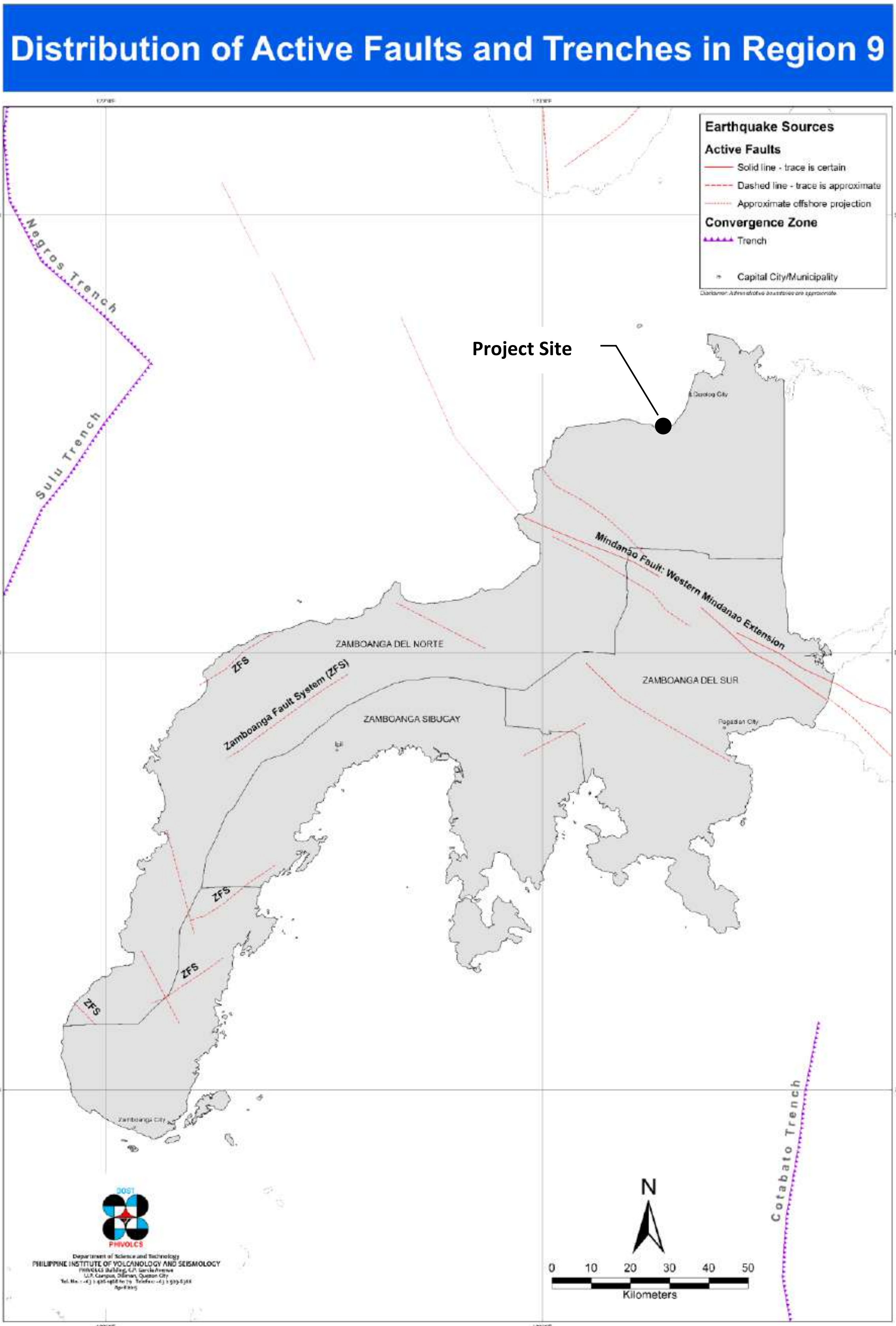


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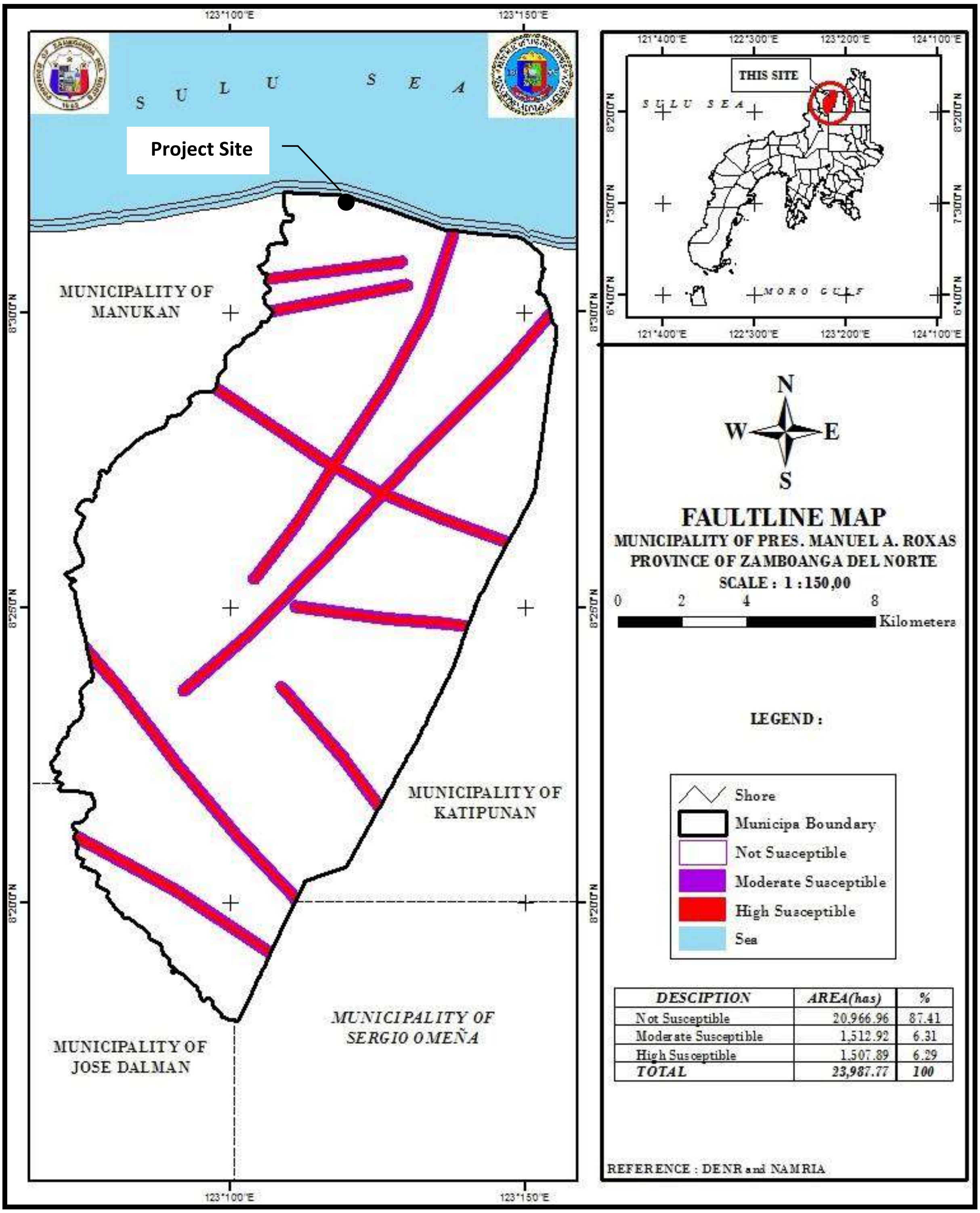
Figure 2-19 Distibution of Active Faults and Trenches in Region IX



DESCIPTION	AREA(has)	%
Not Susceptible	20,966.96	87.41
Moderate Susceptible	1,512.92	6.31
High Susceptible	1,507.89	6.29
TOTAL	23,987.77	100

Source: Pres. Roxas MPDO 2015

Figure 2-20 Ground Rupture and Ground Shaking Susceptibility Map of Pres. Manuel A. Roxas, Zamboanga Del Norte

Earthquake-triggered landslide

Ground shaking generally destabilizes slope by the inertial loading it imposes or by causing a loss of strength in the slope materials. As a result, mass wasting happens, particularly in the topographically high land features (e.g. mountains), during earthquakes. According to a study conducted by Keffer (1984), the weakest ground shaking can initiate four types of internally disrupted landslides: (1) rock falls, (2) rock slides, (3) soil falls and (4) disrupted soil slides, while strong ground shaking can initiate (1) coherent, deeper-seated slides, (2) lateral spreads and flows, and (3) highly disrupted rock avalances and soil avalanches. Furthermore, in the research, he stated that the materials which are most susceptible to earthquake-induced landslides include weakly cemented rocks, more indurated rocks with prominent or pervasive discontinuities, residual and colluvial sand, volcanic soils containing sensitive clay, loess, cemented soils, granular alluvium, granular deltaic deposits and granular man-made fill.

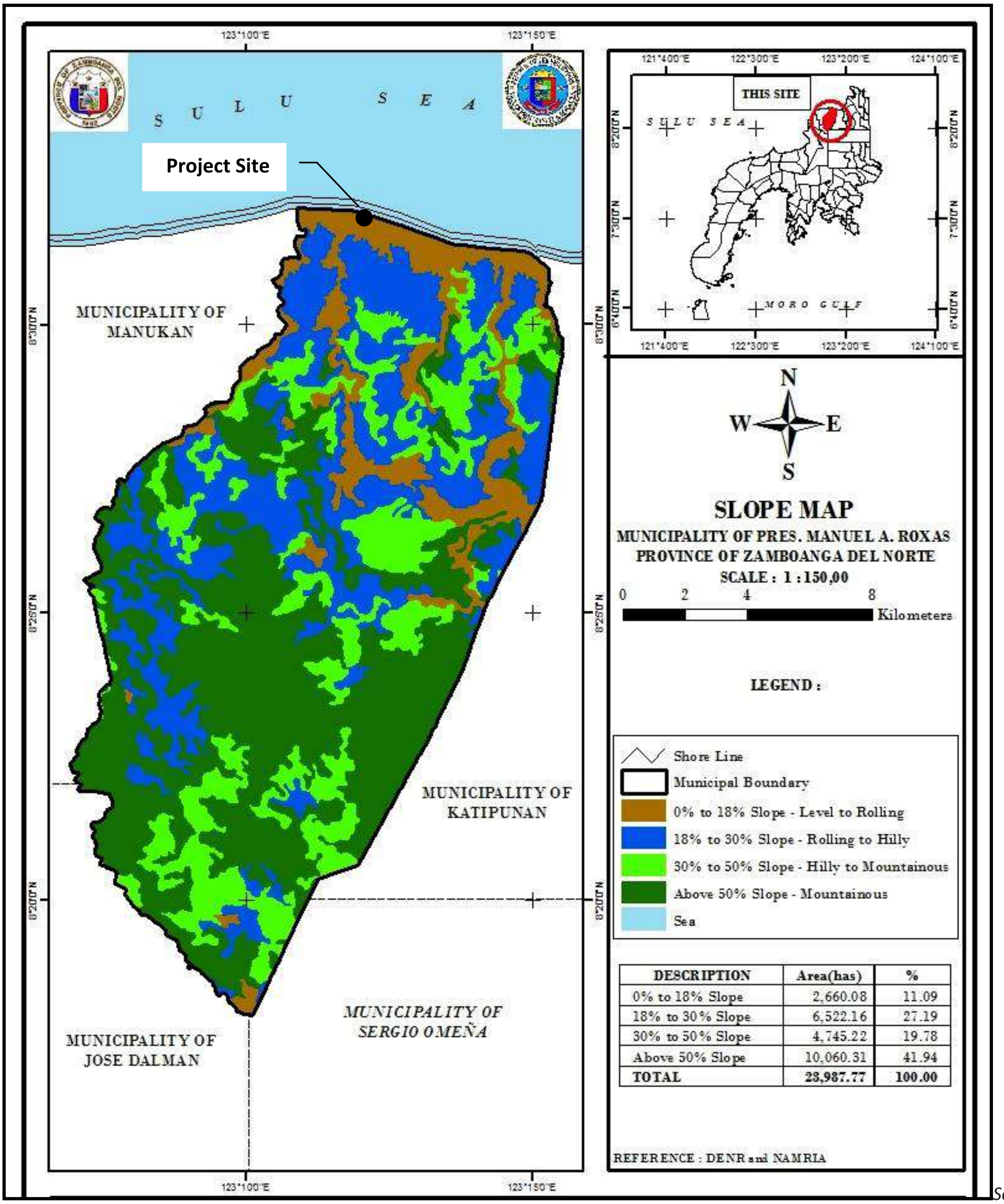
Present data on slope range, slope characteristics of the areas in the municipality of Pres. Manuel A. Roxas can help assess its landslide susceptibility. Slope map of the municipality is presented in **Figure 2-21**. In addition, **Figure 2-22** shows selected areas of the municipality that are likey to collapse during strong earthquake.

Table 2-7. Slope range and characteristics in the municipality of Pres. Manuel A. Roxas, Zamboanga Del Norte

Slope Range	Characteristics	Location
6-8 %	This land is on moderate slopes. This is poorly drained and it is subject to slight erosion. Can be cultivated through the use of special conservation practice.	Part of Dohinob, Upper Irasan, **Lower Irasan**, Poblacion, Piao and Nabilid.
9-15%	This land has greater slopes but is still suited for cultivation. To obtain high yields, special conservation practice must be employed.	Part of Poblacion, Lower Irasan, Piao and Nabilid.
16-25%	Best Suited for pasture but can be cultivated to crops in good rotation. Needs intensive soil conservation measures.	Pangologon, Denoman, Tanayan, parts of Villahermoso, Lipakan and Piñamar
26-35%	This land is too stepped, too eroded or too shallow for cultivation. Production of forage or woodland production on this land withoutSpecial restriction will be profitable.	Part or Villahermoso, Lipakan, Piñamar, Piñalan, Sebod, Capase and Marupay
36-60%	This type of land would be better preferred as woodland. This is more rugged.	Moliton, Balubo, Canibongan, part of Capase, and Marupay.

The site generally occupies a broad coastal beach and relict mixed flat environment stretching over the entire shoreline and its landward margins. To the south, an elevated denudational hill-and-slope to rugged terrain developed roughly 1-2kms of the project site with local relief ranges from 10m to 40masl dominates this area. Coastal and relicted mixed flat terrain is characterized by low to nearly flat accumulation zone, where deposition of relatively thick soil and weathered materials predominates. Diagnostic features includes presence of ponded water (usually utilized as rice fields), old tidal creeks, over bank flow and undulating ground surface that varies between 1.0m and 3.0meters above ground surface *(Javelosa, 1997).*

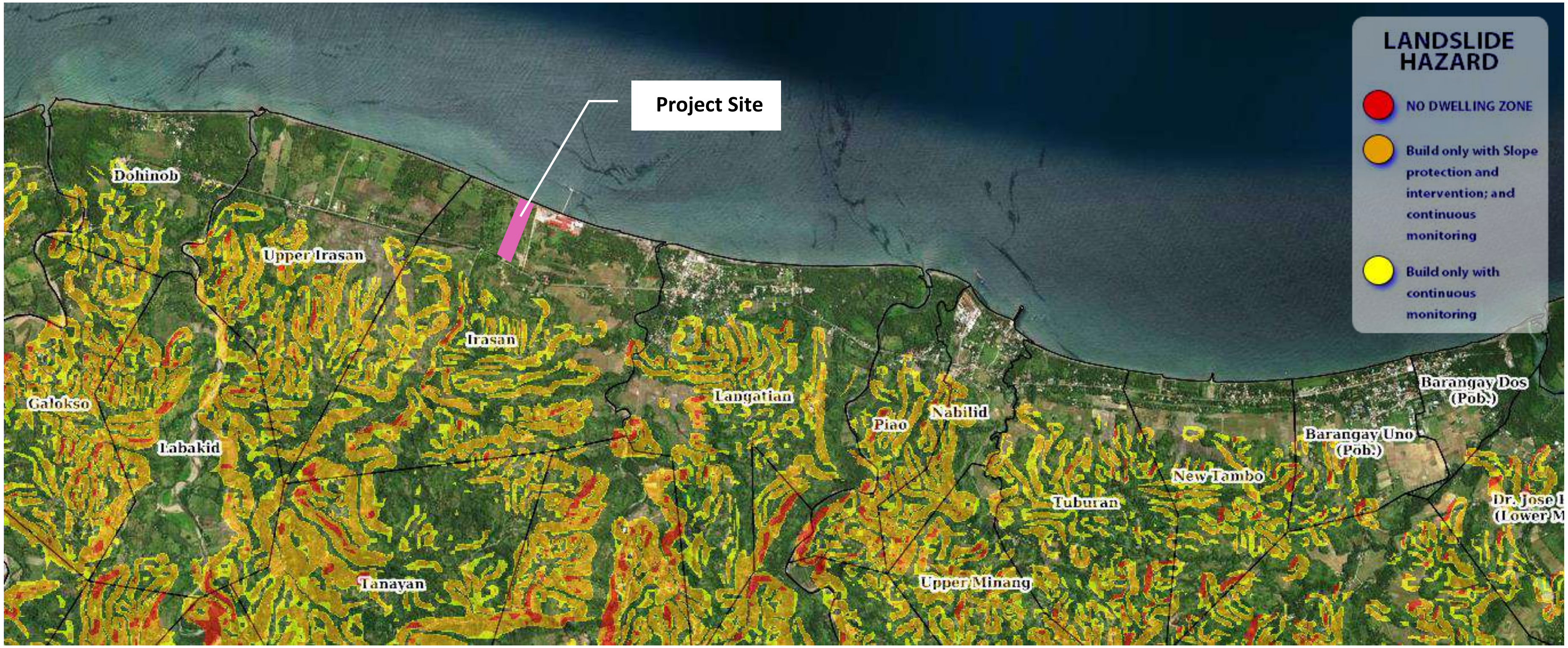
Landslide by definition is a movement of a mass of rock, debris, or earth down a slope over an upland area with steep slopes. Slope gradient exceeding 20º to 50º have caused severe landslide occurrences on most large scale incidences (*Wu et al, 2010).* Slope movement occurs when forces acting down-slope (mainly due to gravity) exceed the strength of the earth materials causing an increase in its movement over a relatively reduced shear strength of the material. Although there are other major factors that contribute to landslide, discussion would be confined on gradient and elevation as this appears to be the main issue. Thus, on the basis of its existing morphologic attributes, proximal distance from potential landslide and in-deep government assessment (MGB flooding and landslide susceptibility map which classified the site as low moderate landslide susceptibility) implies that any landslide incidents are unlikely to occur. *Source: Wu, C. et al."Correlation between landslides and gradient in the Three Gorges Reservoir area based on GIS and information value model", **published in:** 2010, 18th International Conference on Geoinformatics; Javelosa R. S., Geology and site environmental investigation of proposed sanitary landfill, Bauan, Batangas, MGB Report Investigation, 1997*



DESCRIPTION	Area(has)	%
0% to 18% Slope	2,660.08	11.09
18% to 30% Slope	6,522.16	27.19
30% to 50% Slope	4,745.22	19.78
Above 50% Slope	10,060.31	41.94
TOTAL	23,987.77	100.00

Source: Pres. Roxas MPDO 2015

Figure 2-21 Slope Map of the Municipality of Pres. Manuel A. Roxas



Source: NOAH 2018

Figure 2-22 Unstable Slope Map of selected areas in the Municipality of Pres. Manuel Roxas

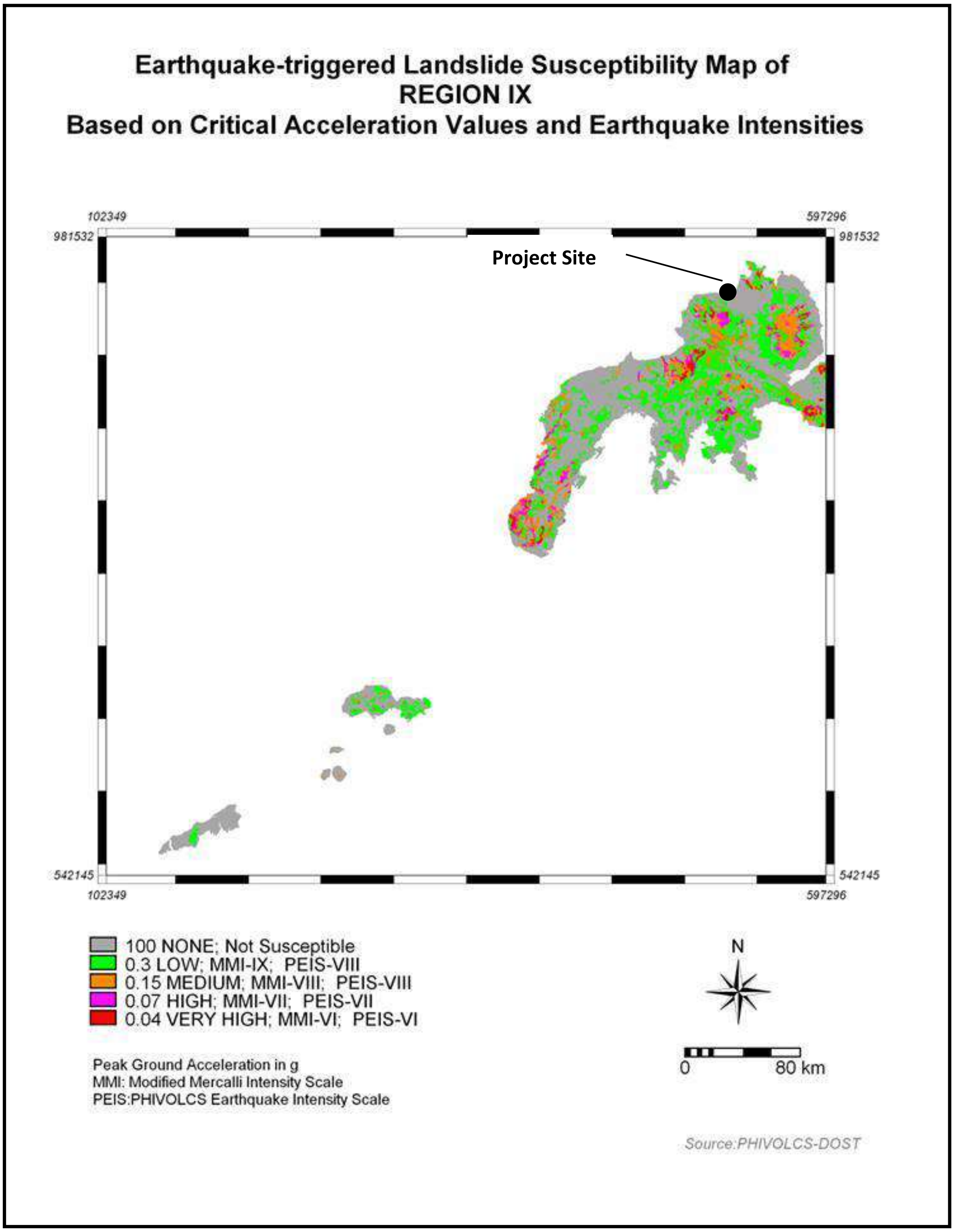
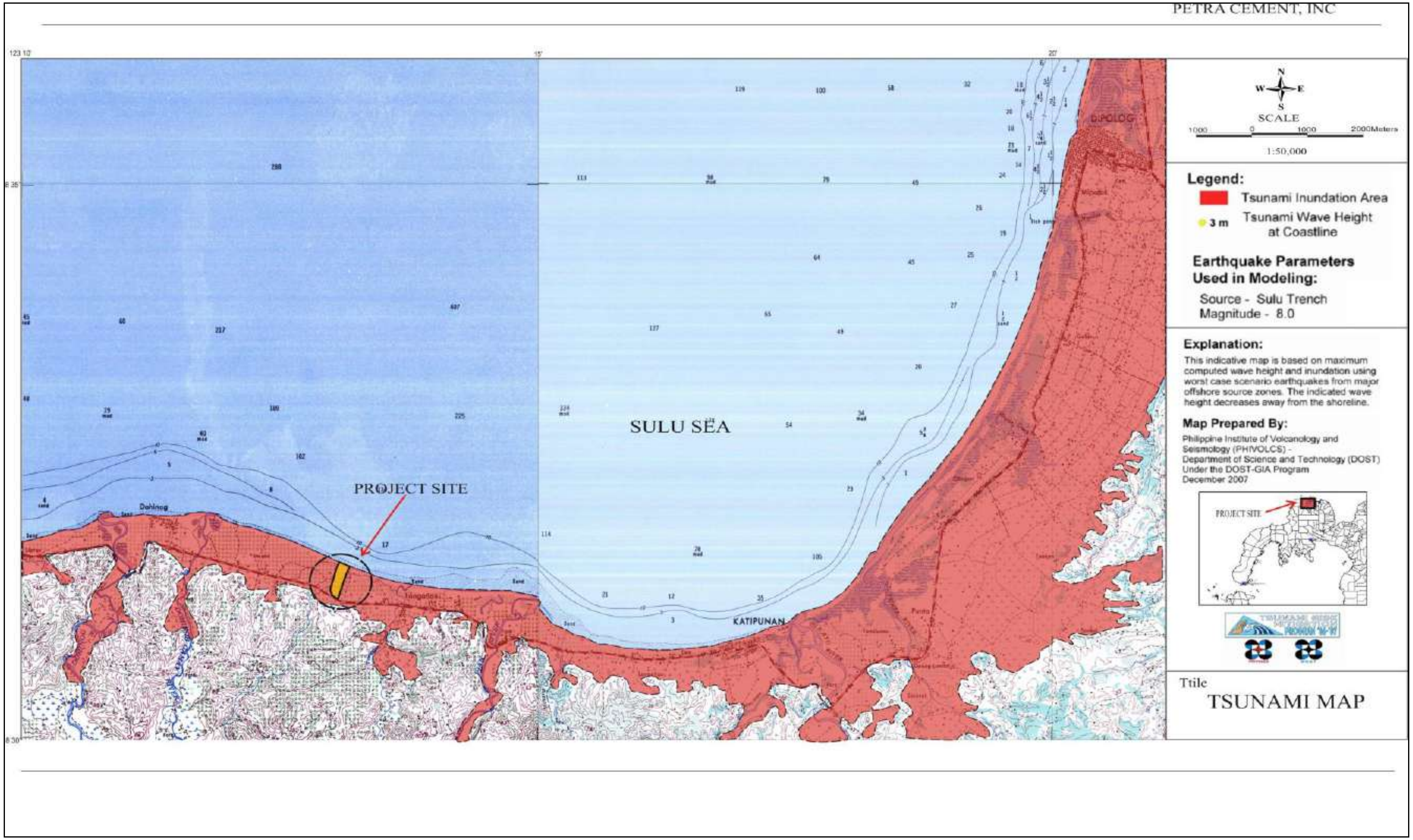


Figure 2-23 Earthquake-triggered Landslide Susceptibility Map of Region IX.

Tsunami

A natural phenomenon such as earthquakes, volcanic eruptions, underwater landslides or meteorite impacts cause a series of giant waves due to the sudden displacement of a large volume of water. The waves can travel across open waters at vast distances and great speeds, building into shorter period but higher amplitude waves as they approach shallow bathymetries near the coast. The speed of tsunami waves generally depends on ocean depth and not on the distance from the source of the wave. The waves travel as fast as jet planes in great depths of the waters and only slow down as they approach the shallow bathymetries near the coast. Once tsunamis get on land, the waves can damage and engulf buildings and structures. It can incorporate the resulting debris eventually forming destructive slurries that can travel several kilometres inland.

Shown in **Figure 2-24** is the Tsunami Hazard map of Manukan Quadrangle and the project site. Given that the province will be hit by a magnitude 8.0 earthquake coming from the Sulu trench, PHIVOLCS has simulated the tsunami wave heights at the coastlines of each city and municipality. For the municipality of Pres. Manuel A. Roxas, the tsunami wave height can reach up to 7.17 meters.



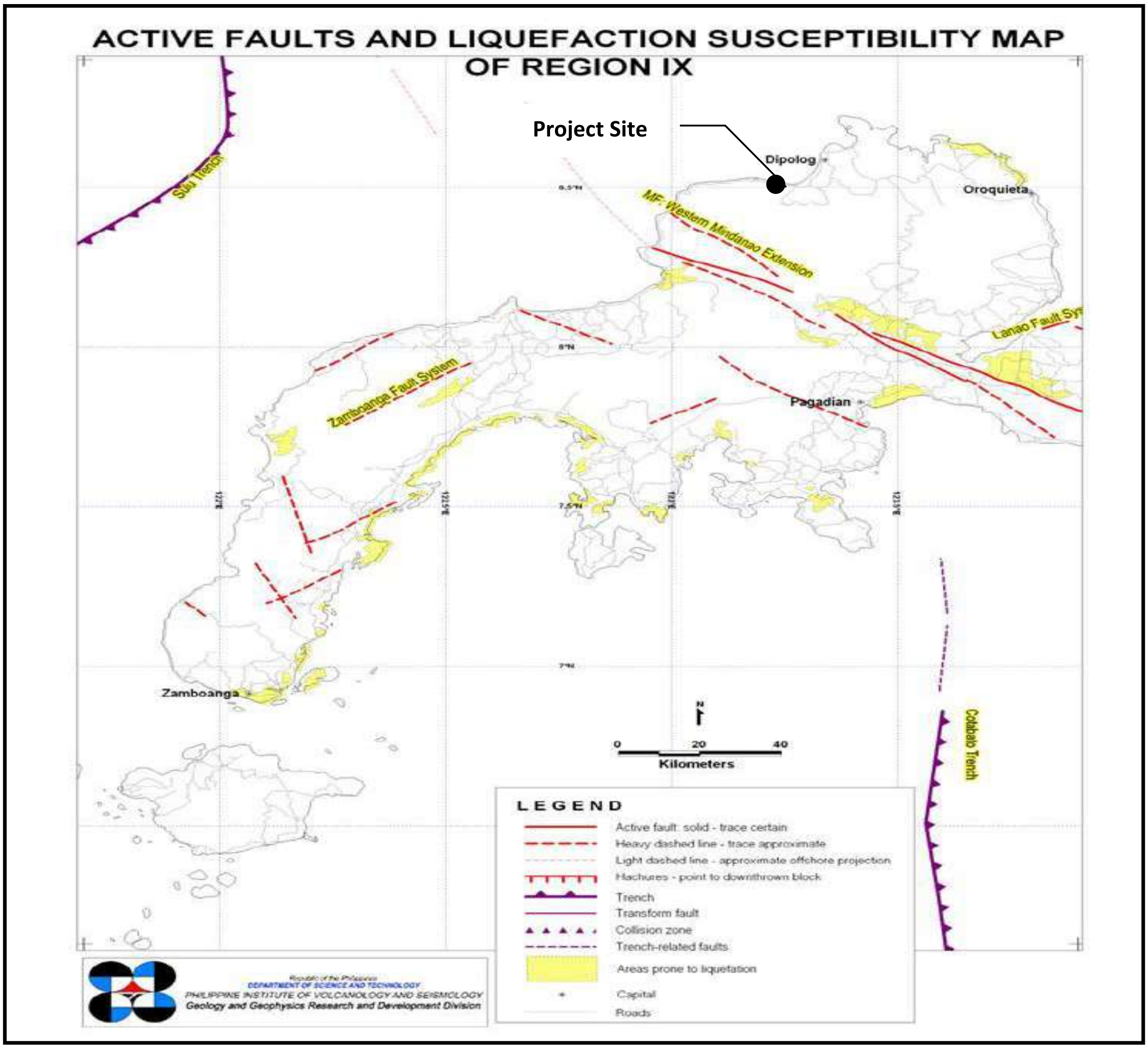
Source: PHIVOLCS, DOST

Figure 2-24 Tsunami Hazard Map of Manukan Quadrangle

Liquefaction

As defined by the US Geological Survey, liquefaction takes place when loosely-packed, water-logged sediments at or near the ground surface lose their strength in response to strong ground shaking. When this phenomenon occurs beneath buildings and other structures, it can cause major damage during earthquakes.

Liquefaction susceptibility map released by PHIVOLCS shows that only sparse areas within the Zamboanga Peninsula are actively prone to liquefaction. Note that these areas are found in close proximity with a fault/fault system.



Source: PHIVOLCS

Figure 2-25 Active Faults and Liquefaction Susceptibility Map of Region 9

Weather-related hazards

Apart from being situated within the Pacific Ring of Fire, the Philippines is also located in the Pacific Typhoon Belt. According to Joint Typhoon Warning Center (JTWC), 19 out of 80 typhoons, which develop above tropical waters, enter the Philippine archipelago. This feat currently makes the Philippines as the most exposed country to tropical storms in the world.

The hazards which are associated with Typhoons include high winds, rip currents, storm surge, heavy rainfall and flooding. The two major hazards which may greatly affect the municipality of Pres. Manuel A. Roxas are discussed below:

Flooding

Flooding generally occurs when water inundates a dry land. The causes for this natural hazard include the following: (1) rivers or streams overflow their banks, (2) excessive rain, (3) ruptured dam or levee, etc. Floods can develop quickly (flash floods) or may take hours or days which can give residents time to evacuate the area.

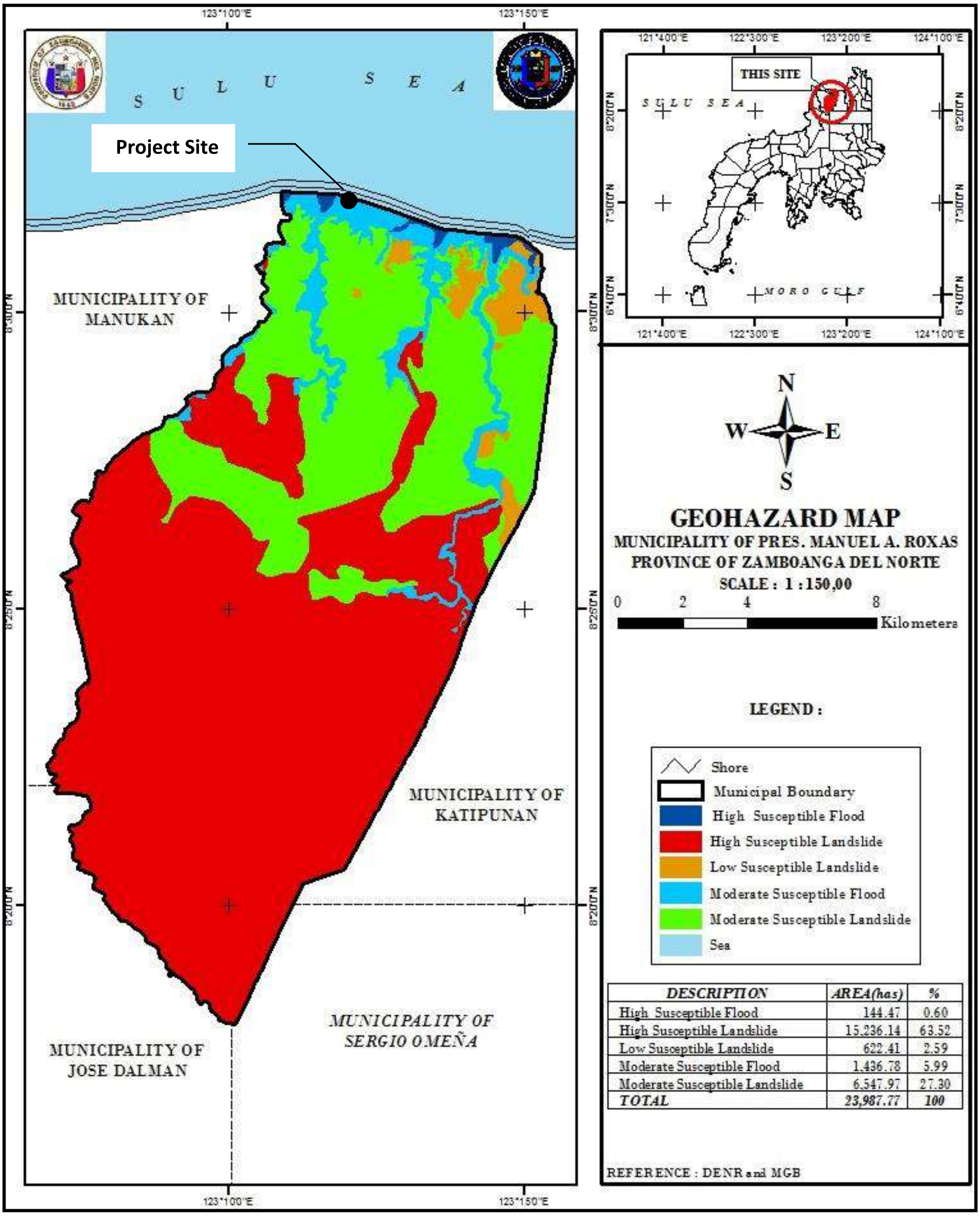
Floods frequently visit the Philippines, causing the government millions of pesos to fund the displacement of thousands of residents and for the structural casualties that the waters left behind. Not only that, it also brings torrential flows that collide with objects in its path, erode riverbeds and riverbanks, and deposit large amount of debris.

The areas which are susceptible to flooding hazards in the municipality of Pres. Manuel A. Roxas includes vicinities along the wide rivers of Barangay Dohinob, Denoman, Marupay, Piñamar, Piñalan, Pangulogon, Piao and Langatian. These rivers usually overflow its banks during rainy seasons and cause the destruction of crops being grown on these areas.

Table 2-8. Results of Flood Assessment of the 31 barangays in Pres. Manuel A. Roxas, Zamboanga del Norte *based on the 2009 Geohazard Report conducted by the MGB Region IX*

BARANGAY	FLOOD SUSCEPTIBILITY RATING	LANDSLIDE SUSCEPTIBILITY
Balubo	Seasonally high (Flashflood)	High
Banbanan	Rarely ; Seasonally high on areas near a creek (sheetflood)	Moderate
Canibongan	None	Moderate
Capase	None	Moderate
Cape	None	Moderate
Denoman	None ; Seasonally high on areas near the Tangian River (sheetflood)	Moderate
Dohinob	None ; Coastal area Storm surge/Coastal erosion	Low
Galukso	High	Low
Gubat	None	Moderate
Lower Irasan	**None ; High Coastal Hazards**	**Low**
Labakid	Seasonally low ; Scouring and lateral erosion are high along the river	Low
Langatian	Channel (threatening the Barangay Hall)	Low
Lipakan	None	Moderate
Marupay	Seasonally high (flashflood)	High
Minang	Seasonally low (sheetflood)	Low
Moliton	None	Moderate
Nabilid	None ; Seasonally low near Minang creek	Low
Panampalay	None	High
Pangulogon	Seasonally Moderate areas near Piao river	Low

Piao	Seasonally low – on low lying areas near Piao River (sheetflood)Coastal erosion / storm surge on coastal front	Low
Piñalan	Seasonally moderate – 0n low lying areas near Piao River (sheetflood)	Low
Piñamar	Seasonally Moderate – on low lying areas near Piao River (sheetflood)	Low
Pongolan	None	Moderate
Salisig	Seasonally High – (sheetflood)	Low
Sebod	None	Moderate
Sibatog	None	Moderate
Situbo	Seasonally high (sheetflood)The community is located at the flood plain	Moderate
Tanayan	None	Moderate
Tantingon	None	High
Upper Irasan	None ; High coastal hazards	Low
Villahermoso	Seasonally high (sheetflood)The community is located at the flood plain	Low

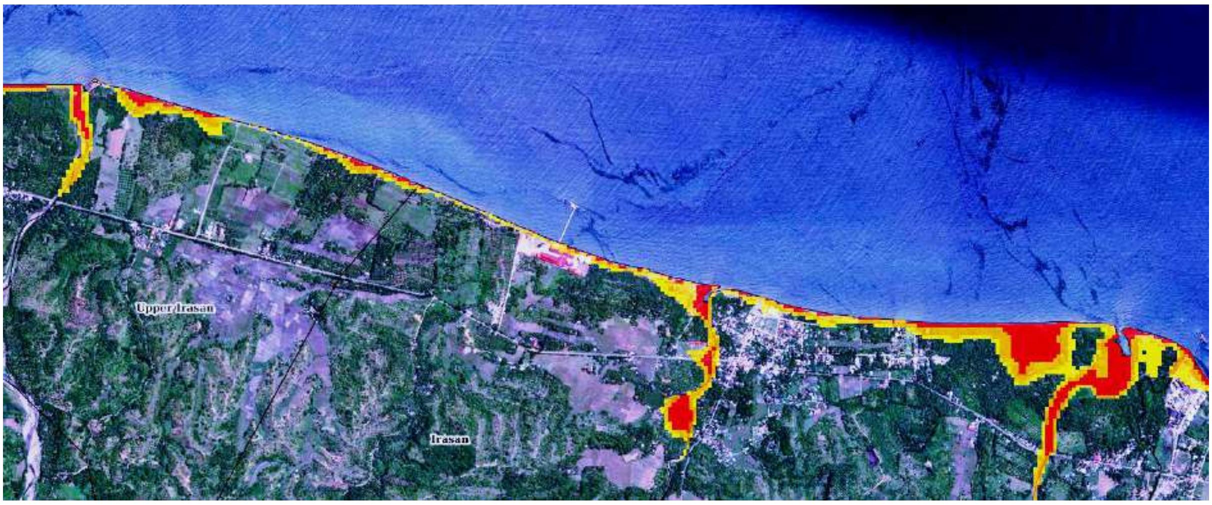


Source: Pres. Roxas MPDO 2015

Figure 2-26 Geohazard Map of Pres. Manuel A. Roxas, Zamboanga Del Norte

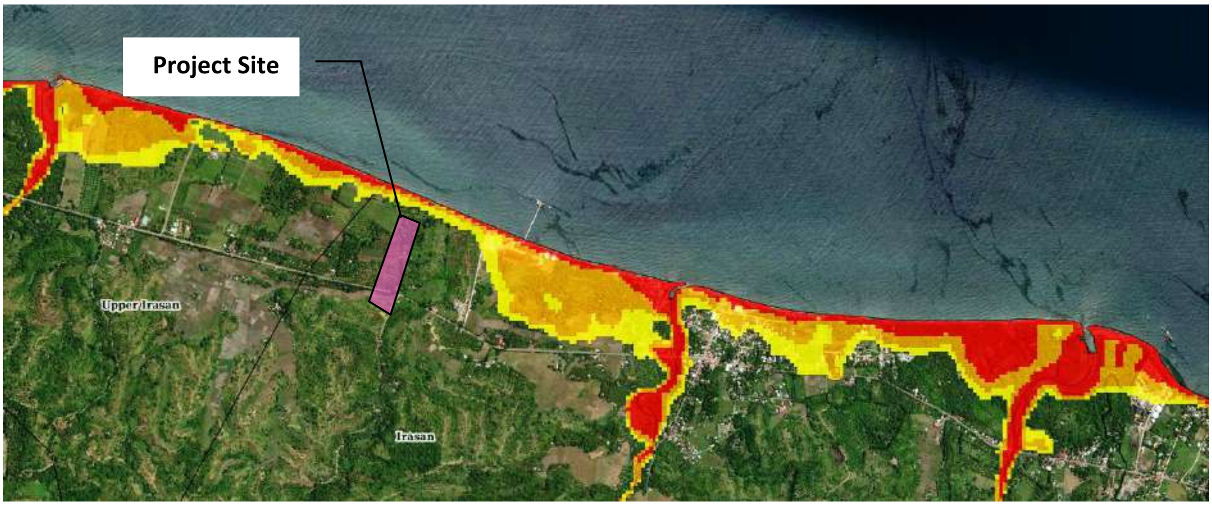
Storm Surge

The municipality is particularly susceptible to storm surges as many of its barangays are located along coastal areas. This destructive phenomenon is defined by National Oceanic and Atmospheric Association as the abnormal rise in seawater level during a storm, measured as the height of the water above the normal predicted astronomical tide. This occurs as a result of strong winds which pushes the water onshore. The orientation of the coastline with the storm strack, local bathymetry and intensity, size and speed of the storm are among the factors which dictate the amplitude of a storm surge. **Figures 2-27 to 2-330** show storm surge affected areas based on predicted storm surge height at 2, 3, 4 and 5 meters (m).



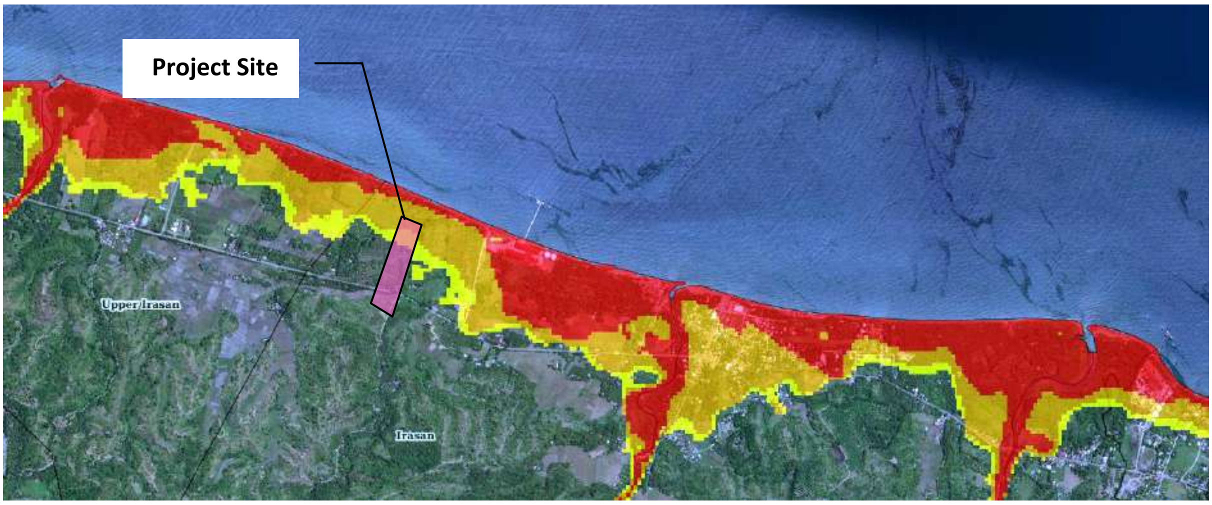
Source: NOAH 2018

Figure 2-27 Storm Surge Hazard Map: Advisory 1 (2m)



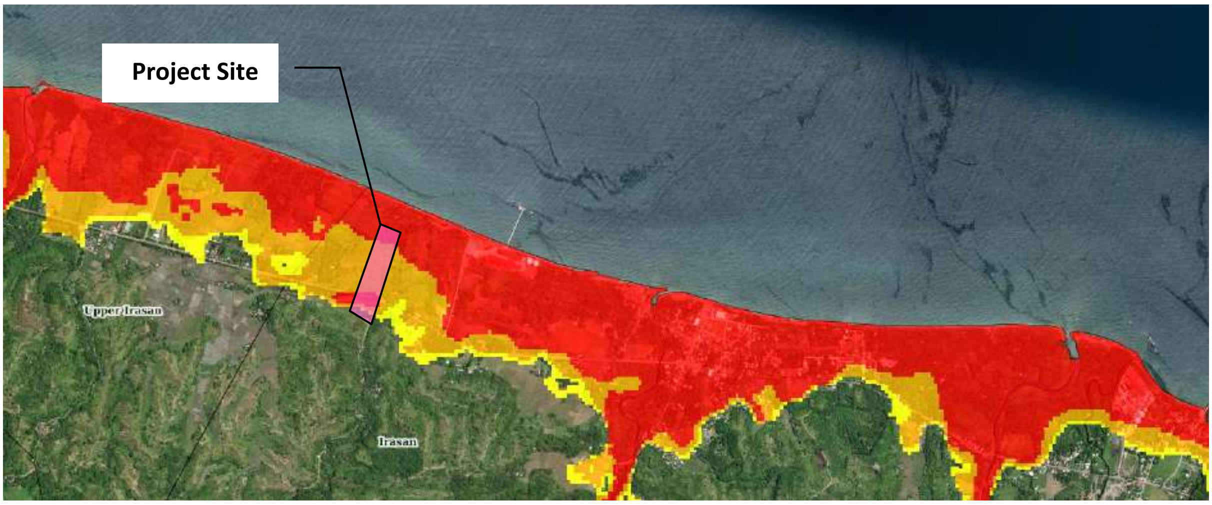
Source: NOAH 2018

Figure 2-28 Storm Surge Hazard Map: Advisory 2 (3m)



Source: NOAH 2018

Figure 2-29 Storm Surge Hazard Map: Advisory 3 (4m)



Source: NOAH 2018

Figure 2-30 Storm Surge Hazard Map: Advisory 4 (5m)

IMPACT ASSESSMENT AND MITIGATION

During Construction and Operation Phase

- Flooding and Erosion

Options for prevention mitigation and/or enhancement

To mitigate the potential effects of the geologic nature to the project and vice-versa, the following recommendations done are to be considered:

- Considering the relatively low ground elevations at the project area, it is likely that backfilling works will be undertaken. Fills and embankments should be compacted to the maximum dry density. Side slopes of embankments may be considered stable with angles of 45 degrees or less.

- Ground shaking hazard can be mitigated by following the provisions of the National Building Code and the Structural Code of the Philippines.

2.1.3 <u>Pedology</u>

This section described the existing properties and soil characteristics within site. Emphasis on this section is on identification of soil characteristics of the project area in order to evaluate the suitability of the baseline characteristics to the development of the cement finishing plant; and analysis and identification of the potential impacts of the project to the existing soil conditions of the area and present appropriate mitigation measures to address the identified potential impacts with regard to soil study.

Methodology

The existing soil characteristics were described by using data in the Lada Soil Series 2013 and the National Soil Sampling and Testing for Fertility and Crop Suitability Assessment Project led by the Soils Survey Division (SSD) in 2016 of the Bureau of Soils and Water Management (BSWM), the CLUP of Pres. Manuel Roxas, and other studies conducted at the site during the site investigation phase. Soil samples were taken from five stations using the standard soil sampling method of the BSWM. Included in this section is the laboratory results of the samples taken from the study area, and incorporated relevant standards and guidelines by which to compare and interpret the results.

The impacts assessed were a) soil erosion /loss of topsoil/ overburden, and b) change in soil quality and/or fertility. The relevant baseline information from the document reviews was included in the impact assessment.

Soils and Sediments Assessment

Field Survey

A total of 10 soil samples in five (5) locations and six (6) sediment samples in three (3) locations were obtained during the field survey conducted on May 19, 2018. **Table 2-9** and **Table 2-10** summarize the location of soil and sediment samples within the project site. Soil test pits have depths of up to 1.4 meters while the other soil observation sites were collected from voids with depths of approximately 70 cm. Test pits with varying soil layers was noted and samples per layer were collected. The surface sediment samples were collected from the coastal area, north of the project site. **Figure 2-31** shows the locations of the different sediment sampling sites and the soil test pit sites. Approximately 3.5 kilograms of sample were collected per site and kept in thick plastic bags tied with a straw and labelled accordingly

Table 2-9. Soil Sample Locations and Coordinates

Location	Sample Names	Depth of Pit (m)	Northing	Easting
Northwest (NW) of site	Petra Soil 001A	0.5	8o31'28.2159"	123o13'4.8435"
	Petra Soil 001B	0.6		
North (N) of site	Petra Soil 002A	0.4	8o31'29'.9125"	123o13'4.6748"
	Petra Soil 002B	0.5		
East (E) of site	Petra Soil 003A	0.5	8o31'27.9656"	123o13'3.0717"
	Petra Soil 003B	0.8		
Center (C) of site	Petra Soil 004A	0.5	8o31'25.1819"	123o13'2.6805"
	Petra Soil 004B	0.8		
South (S) of site	Petra Soil 004A	1.0	8o31'22.9881"	123o13'2.7602"
	Petra Soil 004A	1.4		

Table 2-10 Sediment Sample Locations and Coordinates

Location	Sample Names	Northing	Easting
North/ Coast of site	Petra Sediment A	8°31'32.46"	123°13'5.43"
	Petra Sediment B		
Northeast of Creek	Petra Sediment C	8°31'29.30"	123°13'5.72"
	Petra Sediment D		
South of creek (near roadside)	Petra Sediment E	8°31'17.38"	123°12'59.37"
	Petra Sediment F		

Source: Google 2018

Figure 2-31 Sampling Location Map

Laboratory Analysis

After sampling, the soil and sediment samples were sent to the Mines and Geosciences Bureau-Regional Office IX (MGB-R9), Pasonanca, Zamboanga City for inspection and permitting. Thereafter, box was shipped to the Mach Union office in Las Pinas City for laboratory analysis. The parameters analysed and the analytical method and purpose of each parameter are explained in the tables below (**Table 2-11** to **Table 2-13**).

Table 2-11 Parameters Used in Determining the Physical Characteristics of Soil and Sediment Samples

Parameter	Test Method	Purpose
Particle size analysis (PSA)	Sieve Analysis	This procedure is used to determine the percent fraction of sand, silt, and clay in both soils and sediments. Determining the grain size percent also explains the nutrient retention; cation exchange properties; erodibility; permeability; sealing and drainage.
Moisture content	Gravimetric	Gravimetric procedure based on weight loss over a 12-hour drying period at 103°C to 105° C.
Soil Texture	Plotting	Determination of soil texture for the soil samples was done using the USDA Soil Textural Triangle.
Bulk Density	Sieve Analysis	It is used to estimate the density and porosity of the materials.

Table 2-12 Parameters Used in Determining Soil Fertility of Soil Samples

Parameter	Test Method	Purpose
Total Nitrogen	Kjelulationdahl/ Ion Chromatography/ Calculation	Used to determine the total amount of nitrogen in the samples.
Total Phosphate	Ion Chromatography/ Stannous Chloride	Used to determine the total amount of phosphate in the samples.
Total Organic Matter	Walkley-black	This parameter is a determinant of soil fertility and capability to deliver nutrients to plants.

Table 2-13 Parameters Used in Determining the Geochemistry of Soil and Sediment Samples

Parameters	Test Method	Purpose
Metals: Cu, Zn, Fe, Mn, Mg	Flame AAS/ Calculation	Data will be used as baseline environment values and utilized during monitoring periods to check for metal concentration changes in the environment.
Readily Exchangeable Bases: Ca, Mg, Na, K	Flame AAS/ Calculation	Data will be used as baseline environment values and utilized during monitoring periods to check for metal concentration changes in the environment.

Soil Classification

The soil samples were classified using the General Soil Map of the Philippines (Alcasid, 1995) published by the Bureau of Soils and Water Management (BSWM). Secondary data were supplemented with the soil physico-chemical characteristics obtained from this survey to validate and correlate previous soil classifications. Previous classifications by soil groups and texture were refined and updated using the United States Department of Agriculture (USDA) Soil Taxonomy Guide (1999) to determine the recent soil sub-order or great group equivalents. Available information was also correlated with the USDA soil orders to determine the major soil types. Natural drainage class for each soil class was correlated with the USDA hydrologic group.

Existing Conditions

In this study, soil physical parameters considered are particle size distribution (% clay, sand, and silt), the soil texture, and the moisture content (%). For the sediments, only the soil texture was obtained. **Figure 2-32** shows the soil map of the Municipality of Pres. Roxas.

The particle size distribution aims to determine the percent content of different grain sizes present in the soil: sand, silt, and clay. Sand has particles within the range of 2.0 mm to 0.063 mm while silt has 0.002 mm to 0.063 mm particle size and clay, being the smallest grain size particle, has a size of less than 0.002 mm (i.e. less than 2 micrometers). The particle size distribution is also a determinant in identifying the infiltration rate of water into the soils. If the soil matrix contains a higher percent of clay particles, the soils will have a slow infiltration rate as opposed to the matrix which contain higher amount of sand particles. The particle size distribution may also be a basis to identify the soil's capability of supporting plant life. It is favourable if soils have moderate amount of clay minerals and particles as these can carry soil nutrients, which exchange in cation form, in their matrix because of the charged nature of the clay mineral.

Based on the particle size distribution of the soils, the soil texture of the samples in the project site falls within the ranges of loamy sand and sandy loam. For sediments, it falls under the categories of sand and loamy sand.

Sands are loose and non-aggregated grains. It feels gritty to the touch and do not adhere to each other hence, it is not sticky. Soil materials classified as sands must contain 85-100% sand-sized particles, 0-15% silt-sized particles, and 0-10% clay-sized particles. These percentages are based on the boundaries of the sand portion of the USDA textural triangle.

Loamy sands are consist of material containing 70-90% sand, 0-30% silt, and 0-15% clay. It resembles sands as they are also loose and non-aggregated but since they contain a slightly higher amount of silt and clay compared to sand, loamy sands are slightly cohesive when moist and can be readily formed compared to sand.

Sandy loam on the hand contain less sand, more silt and clay, than loamy sands. They possess characteristics which fall between fine-textured sandy clay loam and coarse-textured loamy sands. Most of the individual sand grains can still be seen and felt but sufficient amounts of silt and/or clay make the soil coherent therefore casts can be formed that may withstand careful handling without breaking.

The soil texture is based on the USDA Soil Textural Triangle and is used to group together soils and sediments with varying grain sizes under collective names. This is done to present an easier depiction of the percent composition of soils and sediments. And from here can be assessed whether the soil is good for plant life or not. **Annex K** shows the USDA Soil Textural Triangle.

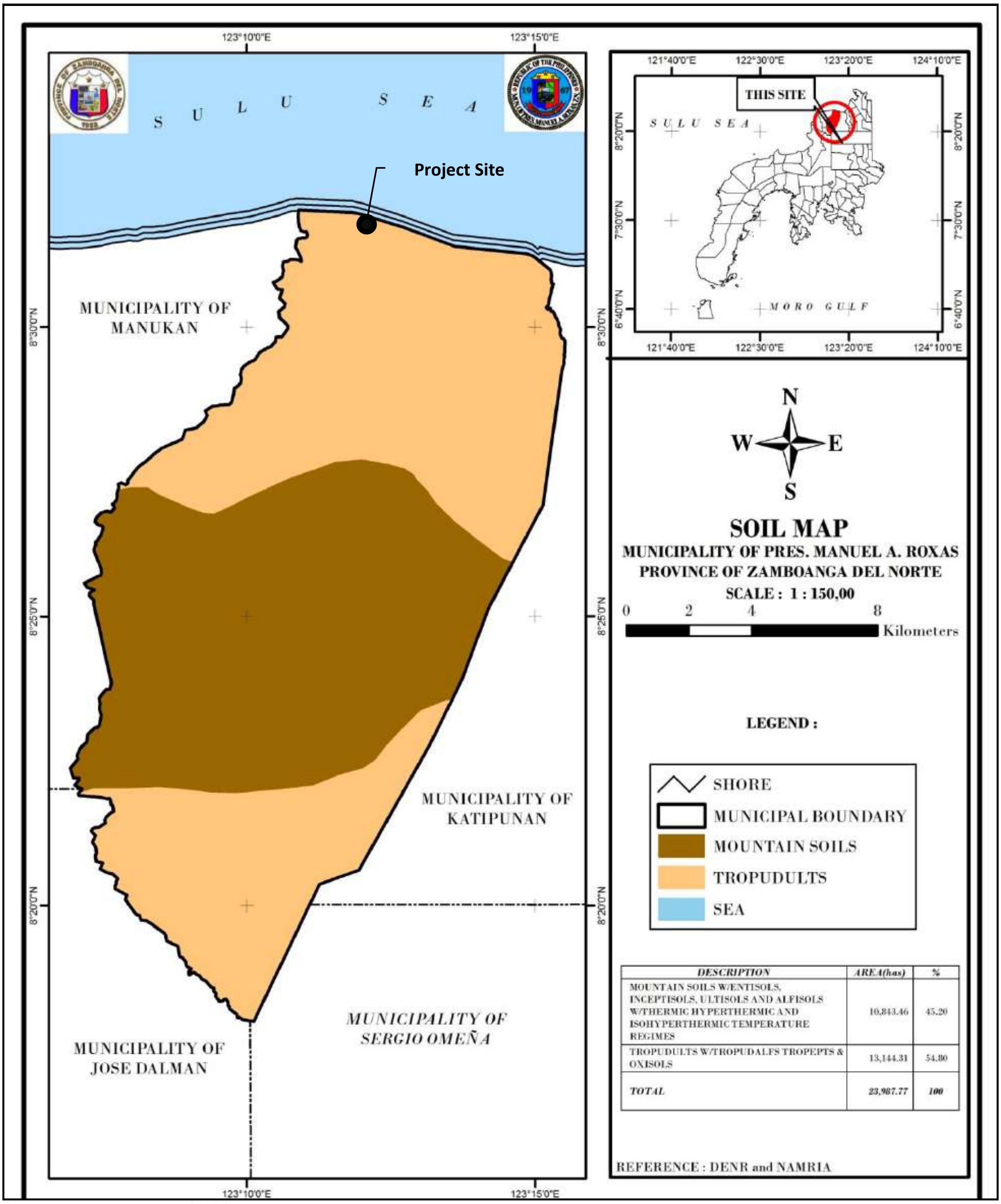
Soil texture is important to be determined as it influences many other soil properties that may be of great significance to land use and management. Soils with high sand content tend to be low in organic matter and native fertility. Thus it has low ability to retain moisture and nutrients. As the relative percentage/s of silt and/or clay grain sizes increase, soil properties are increasingly affected as well. Soils and sediments with finer textures are generally more fertile, contain more organic matter, and are more apt to retain moisture and nutrients.

Moisture content indicates the amount of water which the soils can hold. Soils with uniform particle size tend to drain easily as opposed to soils with a high variation of particle sizes. In addition, soils with higher moisture content indicate the presence of clay minerals which are capable of adsorbing water in their matrix, hence higher moisture contents.

Moisture content present in the soil samples range from 8.57% to 9.9%. Soils with moisture contents that are optimum for plant growth can readily absorb soil water. Soil water dissolves salts present in the soil and creates a solution that is important because it is the medium that supply nutrients to growing plants. Moreover, soil water regulates soil temperature and aids in the chemical and biological activities of the soil.

Table 2-14 Soil Types and Suitability of Pres. Manuel Roxas

SOIL TYPES	LOCATION	CROP SUITABILITY
San Miguel-Sandy Loam	Coastal areas of the town	Best suited for lowland rice, corn, vegetables and rootcrops.
Guinua Clay	Parts of the Poblacion, Nabilid, Lo. Irasan & Up. Irasan	Best suited for lowland rice
Mandawe Clay	Parts of the Poblacion, Nabilid and Piao	Best for cultivation of lowland rice, corn and vegetables
Dohinob Clay	Denoman, Capase, Sebod, Langatian(Malao) and Piñalan	Suited for upland rice, corn, rootcrops, permanent/perennial crops (fruit trees), Coconut, abaca and Banana
Mountain Soil Undifferentiated	Southern areas of the town, Sindutan, Marupay and Moliton	Best for forest trees and pasture grasses



Source: Pres. Roxas MPDO 2015

Figure 2-32 Soil Map of the Municipality of Pres. Manuel Roxas

Change in soil quality/ fertility

Existing Conditions

Attachment K-1 summarizes the soil fertility and nutrient standards of the BSWM while **Attachment K-2** presents the nutrients and metals content of the study samples compared with the BSWM guide levels.

The total organic matter (TOM) concentrations of the soil samples predominantly fall within the deficient or unfavorable conditions. However, copper and zinc concentrations fall within the adequate category. Similarly, phosphorus and potassium contents of the samples taken generally fall under the adequate or favorable category

For other elements and macronutrients such as total nitrogen and total phosphorous the desirable macronutrient levels for soils from the Agricultural Project of South Australia, which has nearly similar conditions for soil mineral levels and moisture to the Philippines, is used since BSWM does not have any criteria for the abovementioned metals and macronutrients utilized in this study.

Based on the guidelines, the nitrate and phosphorus levels of the soils within the vicinity of the project are high or in excess of the common crop requirements.

IMPACT ASSESSMENT AND MITIGATION

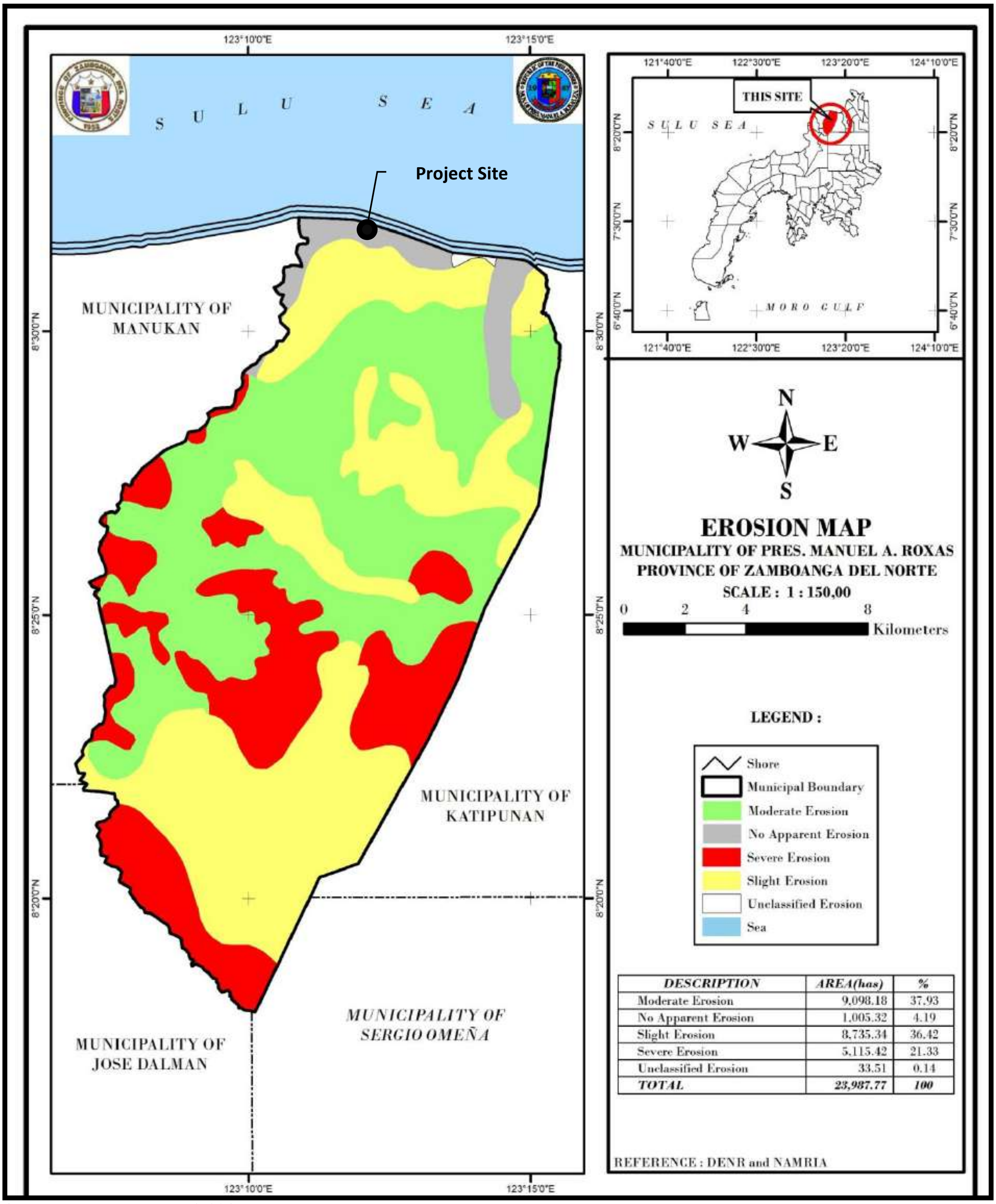
During Construction and Operation Phase

Soil erosion / loss of topsoil/overburden

Impact assessment and options for mitigation and/or enhancement

The site in general has no apparent erosion (**Figure 2-33**). However, the proposed cement finishing plant will entail land development of the project footprint. As construction and development progress, disturbance of the top soil and subsoil will occur. The exposed top soil will be prone to rill erosion if left unprotected.

Surface and gully erosion will be managed using erosion controls. These controls include the installation of drainage networks to channel surface run-off away from cleared or work areas and installation of erosion control devices such as sand bags, pile drive and rip-rap.



Source: Pres. Roxas MPDO 2015

Figure 2-33 Erosion Map of the Municipality of Pres. Manuel Roxas

2.1.4 Terrestrial Ecology

Objectives and Scope of the Study

This assessment of both marine and terrestrial habitats is conducted to assess the current ecological condition of the area given the existing construction works conducted by the company situated in the Barangay Irasan, Roxas, Zamboanga del Norte. This study mainly includes terrestrial, freshwater and marine ecosystems within and adjacent to the project site.

This assessment focuses on the study of terrestrial, freshwater and marine ecosystems. Terrestrial Ecology encompass the land faunal and floristic assemblages. Freshwater ecology includes macroinvertebrate and epilithic assessments. The marine ecology assessment includes corals, reef fishes and seagrasses. All the stations established and sampled are within direct impact areas; secondary impact areas were not sampled due to the areas being privately owned. Below is a Map showing the project located in the Zamboanga peninsula. Figure 2-33 is a Map showing the project located in the Zamboanga peninsula.

Terrestrial communities, especially forests are complex where species of flora and fauna thrive. A thorough study of such area could take years but to get a good picture of community relationships a brief study is enough to generally represent a community.

The site is under construction in terms of land development, construction of foundation and construction of protection measures along the side of the creek. Based on The entire area will be cleared because there is an intension to raise up the elevation thru appropriate filling materials in order to protect the property and the machine considering that the area is prone to flooding. However, tree planting activity shall be implemented to restore and provide greenery inside the project.

Methods

Terrestrial Fauna

All the animal life in a certain area is called fauna. In each area different species of animals thrive depending on its characteristic. Fauna in terrestrial areas such as mountains and plains have diverse species that interact together in a particular environment. Drastic changes in an environment affects the faunal life thus a thorough study of fauna in a certain area is important.

Avifauna

The avifaunal survey was conducted through point- transect method, mist netting and incidental survey. Two (2) transects were established in the area with 1 transect having a length of 300 m. and the other having a 150m transect. Both were 50 meters apart. Presence of birds were identified and counted from 5:00 am- 10am and from 3pm to late afternoon.

Mist netting was also employed in avifauna sampling together with volant mammal sampling, 2 mist nets (3mx10m net size, no.8 mesh size) were established in each station for 2 mist nights. The nets were set around 3:30-5pm in the afternoon and were checked every hour until 10pm and from 4am till 6am. Nets were then removed for 8 hours until 3pm. Birds were then identified by their local names, acoustic calls and visual representations then were further identified by their scientific names with the aide of a field guide (Tanedo,2015 & Kennedy et al., 2000). Fauna caught were releases right after photo documentation.

Photo No. 2E Mist-netting method for avifaunal and volant fauna.

Volant Mammals

Sampling for Volant mammals was conducted using mist nets (see photograph above). The nets were placed along travel lanes of bats at dawn and checked every 8 hours. In each station at least two mist nets measuring 4 m x 12 m with 36 mm mesh size were installed near fruiting trees, in ridge tops or probable flyways. Bats were identified using the Key to Philippine Bats (Ingle and Heaneys, 1992). Captured bats were removed individually and were placed in temporary holding receptacles such as cloth bags. After documentation, bats were revitalized with sugar solution and released back into the wild.

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Photo No. 2F Setting up of mist nets for avifaunal and volant fauna.

Photo No. 2G Identification of bats based on morphology.

Non-Volant

Non-Volant mammals were sampled using live traps and key informant surveys. Traps were set up at about 6:00 in the evening and were checked every four hours until morning. Peanut butter and dried fish were used as bait to attract small non-volant mammals roaming at night and during the day. Traps were positioned along possible runways, near burrow entrances, under root tangles, on top of fallen logs and other probable faunal corridor. Mammals that were trapped in the cage were subjected to basic morphometric measurements and were released thereafter. Identification was based on A Synopsis of Mammalian Fauna of the Philippine Islands by Heaney et al (1998). Total of 5 traps per station were used in non-volant sampling and were deployed in the area. The traps were put around 5-6 pm then checked every 3-4 hours for 3 days.

Photo No. 2H Setting up cage traps for non-volant mammals in one of the study areas.

Herpetofauna

Frogs were sampled using cruising methods or opportunistic sampling. Tanalan creek was searched for frogs during night time. All captured individuals were subjected to morphometric measurement. Frogs and other herpetofauna species were identified based on Amphibians and Reptiles of Luzon Island (Philippines), VII: Herpetofauna of Ilocos Norte Province, Northern Cordillera Mountain Ranged (Brown et. al 2012). Amphibians and Reptiles of Luzon Island, V: The Herpetofauna of Angat Dam Watershed, Bulacan Province, Luzon Island, Philippines (Mcleod et. al 2012).

Terrestrial Flora

Flora surveys were conducted using transect- line method. In each station a 50 m line is laid across the sampling stations. All tree species intercepted along the transect with height greater than 4m were identified and counted. Presence of shrubs and grasses were also identified, a 1x1 m quadrat was established within each transect. Sampling collection was minimized hence identification of plants was done on the field. Field information regarding the taxonomic characters of each plant species were recorded. Photographs were taken using a digital camera for further identification and rechecking of the identified species. Identification and Conservation status of each species was based on the following relevant references: Merrill (1926); Zamora, P. and L. Co. (1986); Madulid (1995, 2001) and Van Balgooy (1997, 1998).Tree is usually wooded body and height above 4m. vegetation below that are considered shrubs if they are herbaceous. Transect line was deployed on areas with the greatest number of tree species present since the area lacks trees instead of plot method that gives less number. Transect line method for trees, plot method for shrubs and grasses such as makahiya and ipil ipil.

Photo No. 2I Transect-line used in the flora survey.

Photo 2J Collection of flora samples in the field.

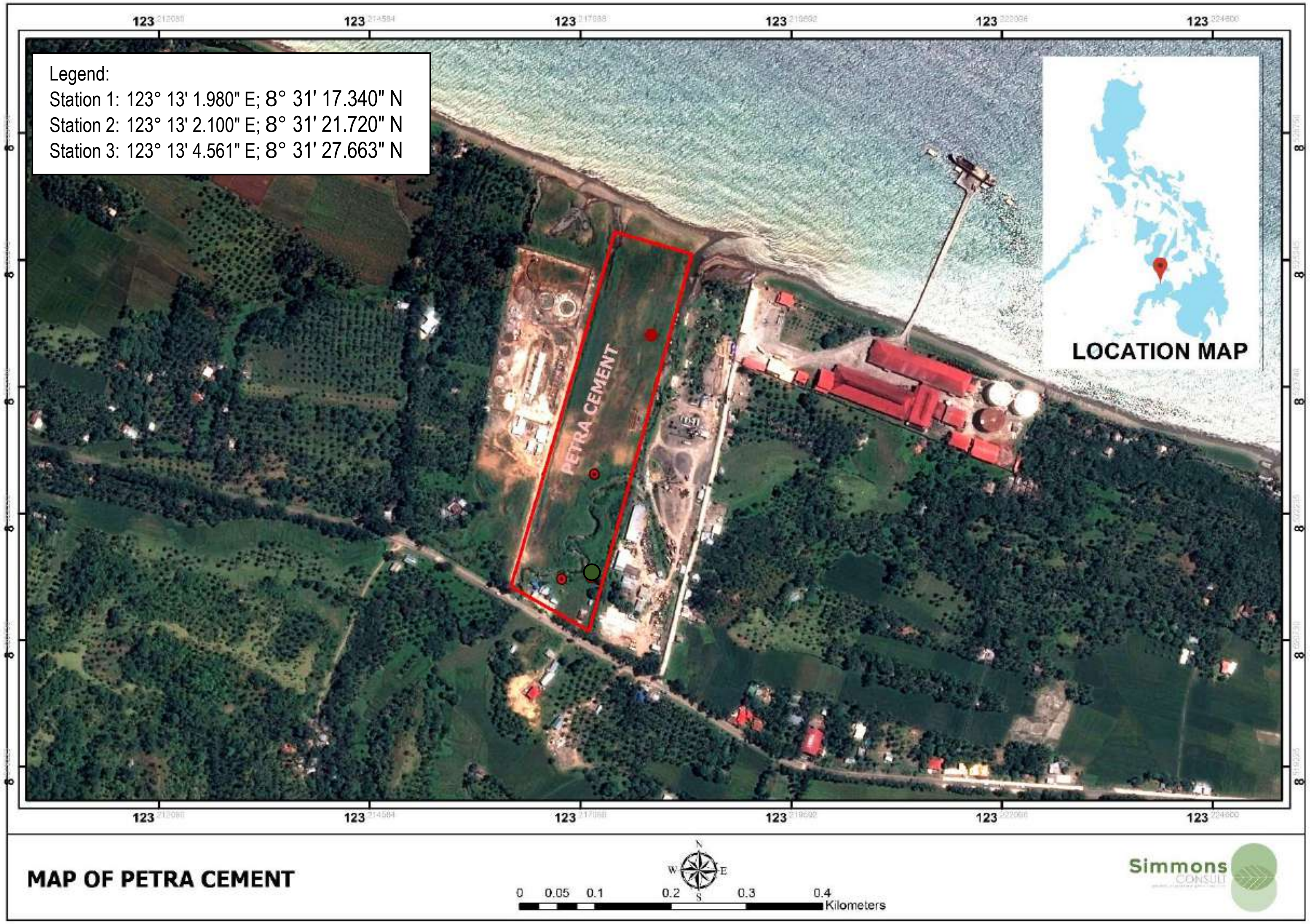


Figure 2-34 Map of the Site for Terrestrial Study

2.1.4.1 Sampling Stations

A total of 3 stations were established within the Petra Cement's property. The table below shows the geographical coordinates of each stations.

Table 2-15 Geographical Location of Terrestrial Sampling Stations in Petra Cement.

SAMPLING STATION	LONGTITUDE	LATITUDE
Station 1	123° 13' 1.980" E	8° 31' 17.340" N
Station 2	123° 13' 2.100" E	8° 31' 21.720" N
Station 3	123° 13' 4.561" E	8° 31' 27.663" N

Description of the Site

Station 1

The first station is situated at the boundary near the construction firm towards the highway area. Out of the 3 sampling stations, this area had the most vegetation cover of vegetation mainly composed of bananas and shrubs.

Photo No. 2K Arial view of Station 1, Petra Cement Inc. Brgy. Irasan, Pres. Quezon

Photo No. 2L Ground view Station 1.

Station 2

Station 2 is located across the creek from Station 1 near the main entrance and established access road of the project. This area is composed of mainly shrubs and grasses.

Photo No. 2M . Aerial view Station 2.

Photo No. 2N Station 2

Station 3

Station 3 is located near the coastal area of the project which is mainly dominated by grasses. Interviews with locals accounts that coconuts used to be planted in the area. This station is where the new office is located.

Photo No. 2-O. Aerial view of the open area of Station 4.

Photo No. 2P. Open area of Station 3 near the coast

Figure 2-35 Project Site showing the flora stations in the study area.

2.1.4.2 Terrestrial Flora

This chapter contains the terrestrial ecology assessment undertaken for the project. Terrestrial ecology assessment consists of flora and fauna existing in the project area or near the project area. The abundance of species provides baseline condition of the status of the environment which can aid the project managers in monitoring the project's impact to the environment.

The area was observed to be in a modified ecological condition with significant level of transformation brought about by the clearing of vegetation. The creek which traverses between the adjacent construction firm and Petra Cement facilities can be considered a natural wetland as defined in the DWAF, 2005: "A Practical Guideline Procedure for the Identification and Delineation of Wetlands and Riparian Zones". Thus, it was assessed to provide floral species within the Petra Cement Plant's footprint.

Species Richness

Plants assessed in the study area are mostly vascular. Common weeds which are usually found in open grasslands and open thickets such as *Mimosa pudica* and *Stachytarpheta jamaicensis* are scattered in the project area's vicinity. While few exotic species such as *Macaranga tanarius* and *Mimosa pudica* were noted, some invasive species such as *Bambusa vulgaris* and *Leucaena leucocephala* are also found to be present. According to the company personnel and as can be visibly observed in the proximate areas, the study area was once a coconut plantation but was cleared off for the establishment of various facilities in the future. However, few coconuts were retained and noted in some portions of the project site.

During data gathering, a total of 21 different species of flora have been recorded. The recorded species can be resolved in to 15 different families. Below are representative species of flora recorded within the three sampling stations.

Photo No. 2Q Agrostis perennans

Photo No. 2R . Amaranthus spinosus

Photo No. 2S. Euphorbia hirta

Photo No. 2T. Ipomoea trilobal

Photo No. 2U. Leucaena leucocaphala

Photo No. 2V. Macaranga tangarius

Photo No. 2W. Mimosa pudica

Photo No. 2X. Rhamnus jujube

Photo No. 2Y. Solanum toryum

Photo No. 2Z. Stachytarpheta jamaicensis

Photo No. 2AA. Mimosa invisa

Vegetation Removal And Loss Of Habitat

About 100 coconut trees have already been cut, Tree Cutting Permit is attached in ***Annex M.***

Threat To Existence And/Or Loss Of Important Local Species

There are no special or important local species identified inside the property area considering that this was used to a coconut plantation.

Threat To Abundance, Frequency And Distribution Of Important Species

Species abundance are often measured by plant cover. The relative area covered by different species of plant within the plot. Species cover is important and often measured characteristic of the composition of plant communities.

Station 1

The figure below shows that *Ipomoea triloba covers* the most (33.40%) of the sampling area within station followed by *Amarantus spinosus* (10.40%), *Minosa pudica* (5.00%), *Ramnus jujuba* (4.58*%), Bambusa vulgaris* (4.46%), *Musa balbisiana* (4.40%), *Paspalum scrobiculatum* (4.20*%), Mangifera indica* (4.00%) and *Agrotis perennance* (4.00%).

Ipomoea triloba is known to occur in various habitats, including cultivated fields, sandy ground and grassy swamp margins, on hedges, and in thickets, from low to middle elevations. In other parts of the world it is used as ornamental plant and is also use for medicinal purposes.

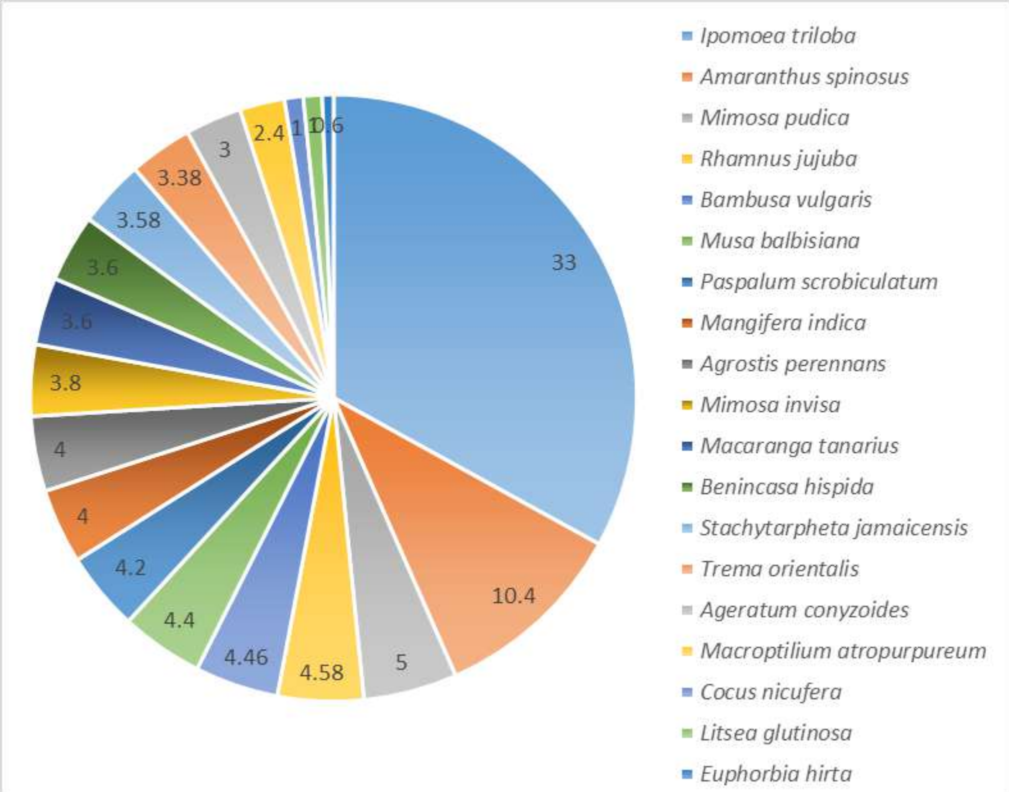


Figure 2-36. Percent species cover of plants within Station 1

Station 2

For station 2, the figure below shows that *Mimosa pudica* (32.20%) covers the most of the sampling area followed by *Euphorbia hirta* (13.2%), *Benincasa hispida* (10.00%), *Amarantus spinosus* (8.60%), *Ipomoea trilobal* (4.60%), *Leucaena leucoephala* (3.76%), *Cocus nicufera* (3.46%) and *Macaranga tanarius* (3.40%).

Mimosa pudica is considered as a serious weed of crops and pasture especially within tropic regions. It reproduces by seed and can be dispersed on animal fur, feather and even on people's clothing. The plant has also been included in the Global Invasive Species Database. It is also listed as noxious weed in other countries like Australia and East Africa. Despite being a harmful and invasive it has been used for medicine since its matured roots is effective in treating urinary tract infection and its leaves have anti-microbial properties.

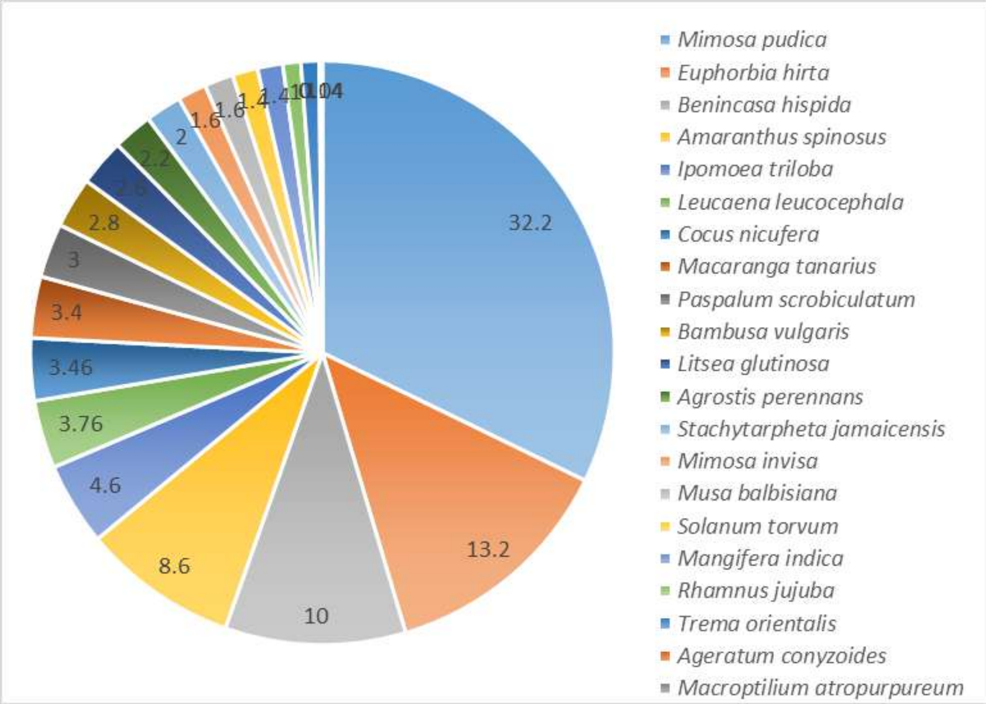


Figure 2-37. Showing the percent species cover for station 2.

Station 3

Kawayan killing (*Bambusa vularis 5.04%*) covers the most of the sampling area including *Ipomoea trilobal* (4.42%), *Macroptilium atropurpureum* (4.35%), *Euphorbia hirta* (3.08%), *Mangifera Indica* (3.00), *Solanum torvum* (2.98) and *Trema orientalis* (2.46%). Other plant species recorded within the sampling station includes, *Amaranthus spinosus* (2.23%), *Ageratum conyzoides* (2.09%), *Mimosa invisa* (2.09%), *Agrostis perennans* (2.04%) *Paspalum scrobiculatum* (2.04%), *Leucaena leucocephala* (1.94%) etc.

Bamabusa vulgaris is a species of bamboo that usually grows along bodies of water and usually is found around the Municipality of Irasan

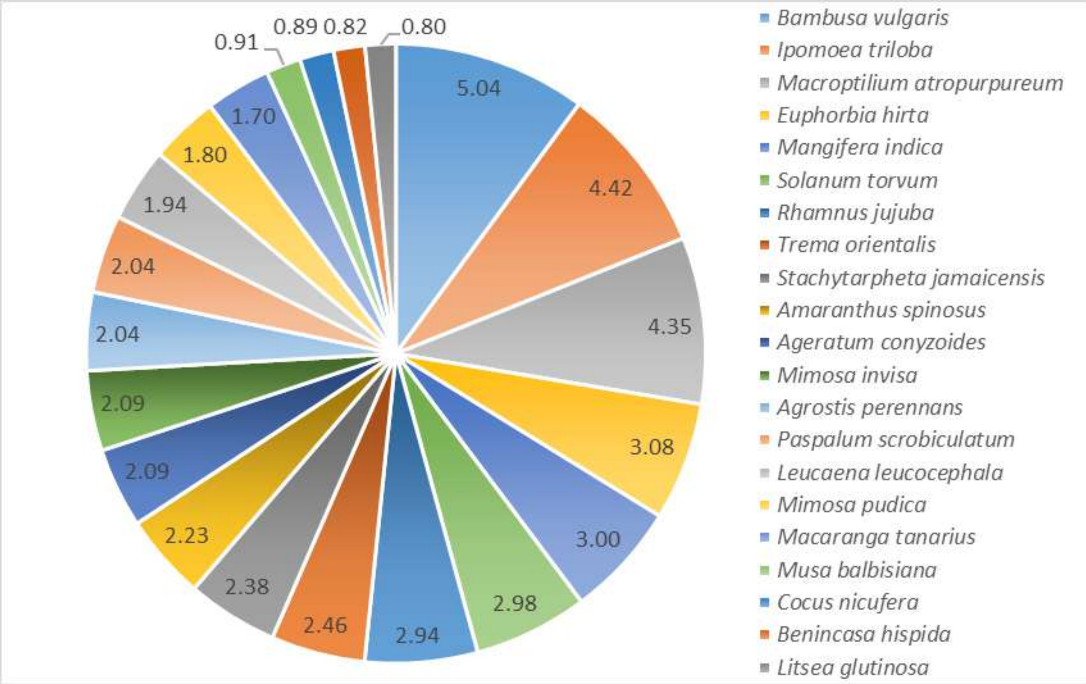


Figure 2-38. Percent Species Cover of Plants within Station 3.

Conservation Status

IUC Red List

The International Union for Conservation of Nature (IUCN) lists and identifies the threatened species as a group of 3 categories: Vulnerable, Endangered and critically endangered species. The aim of the system is to provide a framework for the broadest classification of species in relation to their corresponding extinction risk.

DAO 2017-11

An updated list of threatened species of plants in the Philippines issued by the Department of National Resources; species of plants listed here are considered threatened and are monitored by the DENR. The categories fall under critically endangered, endangered, vulnerable and other threatened species. The list is based on scientific and internationally accepted criteria. (DAO 2017-11).

Below is the conservations status of different flora species recorded within the sampling stations. The table summarizes almost all plants identified in this study are not listed in the IUCN and DAO 2017-11 except *Paspalum scorbiculatum*. The flora assessed in this study are considered non- threatened except for one species identified as Least concern which both classification as far from extinction. It is unlikely that other Species of Conservation Concern (SCC) will be encountered on site due to ongoing anthropogenic activities and frequent access on area which may result in lack of suitable habitat for floral SCC. However, should any floral species of conservation concern be observed in the area in the future, it should be rescued and relocated by a qualified specialist to a suitable habitat.

Table 2-16. Conservation status of floral species observed within Petra Cement.

Common Name	Family Name	Scientific name	IUCN	DAO 2007-11
Binunga	Euphorbiaceae	*Macaranga tanarius*	Not yet Listed	Not yet Listed
Banana	Musacea	*Musa balbisiana*	Not yet Listed	Not yet Listed
Anabiong	Ulmaceae	*Trema orientalis*	Not yet Listed	Not yet Listed
Sabung-sabungan	Poaceae	*Paspalum scrobiculatum*	Least Concern	Not yet Listed
Bayambang	Amaranthaceae	*Amaranthus spinosus*	Not yet Listed	Not yet Listed
Ipil-Ipil	Fabaceae	*Leucaena leucocephala*	Not yet Listed	Not yet Listed
Damong pallas	Asteraceae	*Ageratum conyzoides*	Not yet Listed	Not yet Listed
Manga	Anacardaceae	*Mangifera indica*	Not yet Listed	Not yet Listed
Sablot	Lauraceae	*Litsea glutinosa*	Not yet Listed	Not yet Listed
Mansanita	Rhamnaceae	*Rhamnus jujuba*	Not yet Listed	Not yet Listed
Wild eggplant	Solanaceae	*Solanum torvum*	Not yet Listed	Not yet Listed
Kandi-kandilaan	Verbenaceae	*Stachytarpheta jamaicensis*	Not yet Listed	Not yet Listed
Kawayan kiling	Poaceae	*Bambusa vulgaris*	Not yet Listed	Not yet Listed
Morning glory	Convolvulaceae	*Ipomoea triloba*	Not yet Listed	Not yet Listed
Upland bentgrass	Poaceae	*Agrostis perennans*	Not yet Listed	Not yet Listed
Kondol	Cucurbitaceae	*Benincasa hispida*	Not yet Listed	Not yet Listed
Coconut	Arecaceae	*Cocus nicufera*	Not yet Listed	Not yet Listed
Purple bush-bean	Fabaceae	*Macroptilium atropurpureum*	Not yet Listed	Not yet Listed
Makahiya	Fabaceae	*Mimosa*	Not yet Listed	Not yet Listed
Makahiyang-lalaki	Fabaceae	*Mimosa invisa*	Not yet Listed	Not yet Listed
Gatas-Gatas	Euphorbiaceae	*Euphorbia hirta*	Not yet Listed	Not yet Listed

IMPACT ASSESSMENT AND MITIGATION

It is expected that the entire property will be cleared due to the proposed backfilling of the area to protect the property from damage due to possible occurrence of flooding. It is expected that the site is exposed to strong winds because of its location. All structures to be built in the area is made considered heavy structures made of steel.

Based on the interview conducted at the caretaker of the property, there had been no experience of pest infestation nor forest and grass fire.

The estimated air pollutant based on the emission due to the use of equipment, trucks and othe moving vehiles is estimated below:

Fuel Consumption:

Loader = (42.80 gallons/ hour) x (8 hrs/day) x (26 days/mo) x (12 mo / year) = 106,828.80 gal/yr
Backhoe= (42.80 gallons/ hour) x (8 hrs/day) x (26 days/mo) x (12 mo / year)= 106,828.80 gal/yr
Trucks = (42.80 gallons/ hour) x (8 hrs/day) x (26 days/mo) x (12 mo / year) = 106,828.80 gal/yr
Vehicles= (42.80 gallons/ hour) x (4 hrs/day) x (26 days/mo) x (12 mo / year)= 53,414.40 gal/yr

A = 373,900.80 gallons/year

Table 2-17. Emission Factor (EF)

Using AP 42 5th Edition Table: Gensets		Equipment	Vehicles
A. PM	13.38 lbs / 1000 gallons of fuel	-	0.0052 lbs/hr
B. NOx	428.3 lbs / 1000 gallons of fuel	0.047 lbs/hr	0.9500 lbs/hr
C. CO	133.8 lbs / 1000 gallons of fuel	0.101 lbs/hr	12.400 lbs/hr
D. SOx	133.835 lbs / 1000 gallons of fuel	$1.86x10^{-3}$	-
E. VOC	12.045 lbs / 1000 gallons of fuel	4.83 lbs/hr	1.360- lbs/hr

Emission Estimation (E):

A. PM E_{PM} = 373,900.80 gals / year x 13.38 lbs /1000 gals of fuel x 1 MT / 2200 lbs
E_{PM} = 2.27399 MT/year

B. NOx E_{NOx} = 373,900.80 gals / year x 428.3 lbs /1000 gals of fuel x 1 MT / 2200 lbs
E_{NOx} = 72.7916876 MT/year

C. CO E_{CO} = 373,900.80 gals / year x 133.8 lbs /1000 gals of fuel x 1 MT / 2200 lbs
E_{CO} = 22.7399668 MT/year

D. SOx E_{SOx} = 373,900.80 gals / year x 133.835 lbs /1000 gals of fuel x 1 MT/2200 lbs
E_{SOx} = 22.7459153 MT/year

E. VOC E_{VOC} = 373,900.80 gals / year x 12.045 lbs /1000 gals of fuel x 1 MT/2200 lbs
E_{VOC} = 2.04710688 MT/year

About 22.38 pounds of **CO2** are **produced** by burning a **gallon of diesel** fuel. Therefore, it is estimated that 373,900.80 gals of diesel per year x 22.38 lbs of CO_2= 8,367,899.90 lbs x 1 kilo/2.2 lbs = 3,803,590.87 kilos/year x 1 ton/1000 kilos = **3,803.59087 tons per year**.

During Construction Phase

<u>Loss of Existing Vegetation and Faunal Species</u>

Stripping of overburden, site preparation and road construction will remove plants and disturb animal communities. The area is not a breeding ground of various fauna, only migrants species occasionally troop to the area, however, they do not permanently settle there.

During the conduct of the study, no endangered species was found in the area.

Mitigating Measures

- Tree planting and landscaping shall be restored by planting more trees and other fauna so that the lost flora will gradually return.
- Stripping should be done during dry months only;
- Proper temporary stock piling area with side protection and proper compaction of filling materials after spreading to open areas.

Solid Waste Generation of the Workers

Excess construction debris will be generated during the construction phase.

Solid waste to be generated by the laborers is very minimal. It is mainly compost of left-over food and food wrappers such as paper, cartons and plastics.

Mitigating Measures

To minimize the impact of the solid waste, a temporary area within the site will be designated for storage and segregation of solid wastes prior to final disposal or putting a color coded garbage bins for identification of biodegradable and non-biodegradable. A solid waste management system that encourages recycling will be established and enforced during the construction phase.

Contribution to Global Warming and Climate Change

Possible contribution to global warming and climate change is expected for the use of power and equipment and vehicles due to use of diesel and gasoline. During day time especially the summer months from November to April where temperature is expected to rise both due to natural and artificial factors.

Mitigating Measures

It is recommended that the proponent should plant trees in the surrounding open space area and maintain the plants along the boundary of the property. Fuel switching as well as use of LED and other energy saving lights is also recommended.

During Operation Phase

Re-vegetation and Landscaping

Landscaping and re-vegetation of the area during operation will enrich the terrestrial vegetation resources of the area apart from the added beautification in the project. Various trees and other ornamental plants are to be planted within the property.

Increase in Traffic Generation Due to Increase in Number of Trucks and Equipment

The project is an expansion of the capacity operation which is not yet operational at the time study was conducted, therefore increase in terms of number of vehicles, and trucks is expected.

Mitigating Measures

Implement traffic management system inside the property, though it has enough area to move, movement of vehicles inside the property will not cause traffic congestion. However, the ingress and egress of the vehicles may have a minimal contribution.

Access road along National Highway will install adequate signages with proper scheduled hours will be posted on strategic places for easy access and provide personnel to manage or direct the vehicle going in and out of the premises.

Generation of Hazardous Wastes

Hazardous waste generated by the project operation is coming from the used oil during maintenance (change oil) of equipments.

Mitigating Measures

Hazardous material is stored separately from other material and hauled by an accredited treater for treatment. This may be accomplished by:

- separate storage area and has an adequate safety distances from other materials,
- Hazardous materials are stored to prevent exposure to direct sunlight or located heat
- Hazardous storage area are properly and prominently marked or identified; and
- Hazardous area shall be secured at all times with access only to authorized personnel.

Storage Management

- Workers eating facilities, rest areas, lockers, and comfort rooms are far from hazardous materials storage and work areas.
- Those managing the workplace are responsible for ensuring that the inventory is complete, accurately maintained and updated as changes occur. The inventory list shall be available to all employees and safety officers.

2.1.4.3 Terrestrial Fauna

Unlike flora, identification of all species present in the area is not always feasible due to the elusive nature of many faunal species and their mobility. The subject property was divided into two faunal habitats, namely, the transformed habitat (modified area) and wetland habitat (nearby creek). Although majority of the study area had undergone varying degree of disturbance, it still provides suitable habitat for various foraging avifauna and mammal species.

Sampling Stations

There are three established sampling stations for avifauna and volant mammals (Table 2-18). Within the three sampling stations for avifauna six points were done by bird watching method. Below are the points done for bird watching.

Table 2-18. Geographical location of all sampling stations for bats and birds

Points No.	Coordinates	Elevation (ft)
Pt. 1	N 08°31.289' E123°13.033'	85.3
Pt. 2	N 08°31.358' E123°13.028'	36.1
Pt. 3	N 08°31.376' E123°13.059'	72.2
Pt. 4	N 08°31.418 E123°13.069'	62.3
Pt. 5	N 08°31.445 E123°13.083'	88.6
Pt. 6	N 08°31.481 E123°13.090'	23.0

Figure 2-39. Visual representationof the sampling stations for Fauna in Petra Cement Inc.

a. Avifauna

Avifauna commonly known as birds are warm blooded vertebrates that lay eggs. Around 600 species or 6% of the world's avifauna is found in the Philippines. Since the country has a wide range of habitats such as tropical forests, mangrove areas, peat swamp forests and montane forests it supports a huge diversity of birds that results to high endemism.

A number of species of avifauna was observed to be present during the sampling period. Although no Species of Conservation Concern (SCC) was observed, but the possibility that some avifaunal SCC may utilize the area for food hunting still exists. Should there be any bird with Species of Conservation Concern encountered in the future, help from a biodiversity specialist must be sought in order to avoid any impact on the species.

Sampling Stations

There are three established sampling stations for avifauna and volant mammals. Within the three sampling stations for avifauna six points were done by bird watching method. Below are the points done for bird watching.

Table 2-19. Geographical location of all sampling stations for Avifauna sampling.

Points No.	Coordinates	Elevation (ft)	Elevation (m)
Pt. 1	N 08°31.289' E123°13.033'	85.3	25.99
Pt. 2	N 08°31.358' E123°13.028'	36.1	11.00
Pt. 3	N 08°31.376' E123°13.059'	72.2	22.00
Pt. 4	N 08°31.418 E123°13.069'	62.3	18.98
Pt. 5	N 08°31.445 E123°13.083'	88.6	27.00
Pt. 6	N 08°31.481 E123°13.090'	23.0	7.01

Figure 2-40. Visual Representation of the sampling Area for avifauna in Petra Cement Inc.

Species Richness

A total of 22 species of birds were observed in all sampling stations for avifaunal species which is resolved to 17 families. Below are representative birds that were recorded within the sampling stations.

Photo No. 2BB. Philippine Yellow Vented Bulbul (Hypsipetes philippinus)

Photo No. 2CC. Pied fantail (Rhipudura javanica)

Photo No. 2DD Elegant tit (Parus elegans)

Photo No. 2EE. Common kingfisher (Alcedo atthis)

Presence

The table below shows the presence of the different bird species recorded within the sampling stations. There are more species of birds observed within Station 1 (19 species). Station 2 has about 15 species as compared to Station 3 with 10 species. Due to the proximity of this stations, the number of species are almost the same.

Table 2-20. Presence of different species of birds recorded within the sampling areas

Scientific Name	Common Name	S1	S2	S3
Aerodramus mearnsi	Philippine Swiftlet	*	*	*
Amaurornis phoenicurus	White-breasted Waterhen	*		
Aplonis panayensis	Asian Glossy Starling	*		*
Ardea intermedia	Intermediate Egret		*	
Artamus leucoryn	White-breasted Woodswallow	*	*	
Bubulcus ibis	Cattle Egret	*		*
Cincloramphus timoriensis	Tawny Grassbird	*		
Cinnyris jugularis	Olive-backed Sunbird	*	*	
Corvus macrorhynchos	Large-bellied Crow	*	*	
Geopelia striata	Zebra Dove	*	*	
Hirundo rustica	Barn Swallow	*	*	*
Hirundo tahitica	Pacific Swallow	*		*
Ixobrychus sinensis	Yellow Bittern		*	
Lonchura atricapilla	Chesnut Munia	*	*	*
Lonchura punctulata	Scaly-breasted Munia	*	*	
Megalurus palustris	Striated Grassbird	*	*	
Passer montanus	Eurasian Tree Sparrow	*	*	*
Pycnonotus goiavier	Yellow-vented Bulbul	*	*	*
Rhipidura nigritorquis	Philippine Pied Fantail	*	*	*
Spilopelia chinensis	Eastern Spotted Dove	*		
Todiramphus chloris	Collared Kingfisher	*		*
Zosterops everetti	Everett's White Eye		*	

Conservation Status

The list of categories and criteria of IUCN are intended to be an easy and widely understood system for classifying species at high risk of global extinction. The general aim of the system is to provide an explicit, objective framework for the classification of the broadest range of species according to their extinction risk. However, while the Red List may focus attention on those taxa at the highest risk, it is not the sole means of setting priorities for conservation measures for their protection. Below are definition of conservation status and or criteria.

Table 2-21 Definition of Conservation Status and/or Categories.

Conservation Status / Categories	International Union for the Conservation of Nature (IUCN)
EXTINCT (EX)	A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
EXTINCT IN THE WILD (EW)	A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
CRITICALLY ENDANGERED (CR)	A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered (see Section V), and it is therefore considered to be facing an extremely high risk of extinction in the wild.
ENDANGERED (EN)	A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered (see Section V), and it is therefore considered to be facing a very high risk of extinction in the wild
VULNERABLE (VU)	A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable (see Section V), and it is therefore considered to be facing a high risk of extinction in the wild.
NEAR THREATENED (NT)	A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.
LEAST CONCERN (LC)	A taxon is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category

DATA DEFICIENT (DD)	A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate. It is important to make positive use of whatever data are available. In many cases great care should be exercised in choosing between DD and a threatened status. If the range of a taxon is suspected to be relatively circumscribed, and a considerable period of time has elapsed since the last record of the taxon, threatened status may well be justified.
NOT EVALUATED (NE)	A taxon is Not Evaluated when it has not yet been evaluated against the criteria.

The table below shows the conservation status of the different bird species recorded within the area. The twenty-two (22) recorded bird species are listed under least concern category. Bird species that were observed were common and populations are widespread. Seven (7) species were identified as migratory indicating bird species that move around often depending on the season and source of food. Four (4) species were identified as endemic in the Philippines and ten (10) species were identified as residents or birds that can be found throughout an area for long periods of time and don't migrate.

Table 2-22. Conservation Status of Birds recorded within the sampling stations.

Common English Name	Family Name	Scientific Name	Endemicity	IUCN Status
Intermediate Egret	Ardeidae	*Ardea intermedia*	Migratory	LC
Cattle Egret	Ardeidae	*Bubulcus ibis*	Migratory	LC
Yellow Bittern	Ardeidae	*Ixobrychus sinensis*	Migratory	LC
White-breasted Waterhen	Rallidae	*Amaurornis phoenicurus*	Migratory	LC
Eastern Spotted Dove	Columbidae	*Spilopelia chinensis*	Resident	LC
Zebra Dove	Columbidae	*Geopelia striata*	Resident	LC
Philippine Swiftlet	Apodidae	*Aerodramus mearnsi*	Endemic	LC
Collared Kingfisher	Alcedinidae	*Todiramphus chloris*	Migratory	LC
White-breasted Woodswallow	Artamidae	*Artamus leucoryn*	Resident	LC
Pacific Swallow	Hirundinidae	*Hirundo tahitica*	Migratory	LC
Barn Swallow	Hirundinidae	*Hirundo rustica*	Migratory	LC

Yellow-vented Bulbul	Pycnonotidae	*Pycnonotus goiavier*	Endemic	LC
Large-bellied Crow	Corvidae	*Corvus macrorhynchos*	Resident	LC
Tawny Grassbird	Locustellidae	*Cincloramphus timoriensis*	Resident	LC
Striated Grassbird	Locustellidae	*Megalurus palustris*	Resident	LC
Philippine Pied Fantail	Rhipiduridae	*Rhipidura nigritorquis*	Endemic	LC
Olive-backed Sunbird	Nectariniidae	*Cinnyris jugularis*	Resident	LC
Asian Glossy Starling	*Sturnidae*	*Aplonis panayensis*	Resident	LC
Eurasian Tree Sparrow	Passeridae	*Passer montanus*	Introduced	LC
Everett's White Eye	Zosteropidae	*Zosterops everetti*	Endemic	LC
Chesnut Munia	Estrildidae	*Lonchura atricapilla*	Resident	LC
Scaly-breasted Munia	Estrildidae	*Lonchura punctulata*	Resident	LC

b. Volant Mammals

One of the most diverse and poorly known mammalian order in the Philippines is the order Chiroptera. It is believed that there are at least sixty-eight known species of bats in the Philippines. In number of species, bats exceeds even rodent of which sixty-seven are now known. About twenty two species of bats that was discovered are endemic to the Philippines. Species richness and endemism are factors of special importance currently because of the rapid rate loss of natural habitat in the Philippines

Table 2-23 . Geographical location of sampling stations for Volant mammmals.

Fauna Stations	Latitude	Longitude
Station 1	08°31.289' N	123°13.033' E
Station 2	08°31.287' N	123°13.012' E
Station 3	08°31.362' N	123°13.035' E

Species Listing

Three species of non-volant mammals or bats were identified for the whole project site as shown below.

Photo No. 2FF. Common dawn bat (Eonycteris spelaea).

Photo No. 2GG. Common dawn bat (Eonycteris spelaea)

Photo No. 2HH. Lesser- Dog faced fruit bat (Cynopterus brachiotis)

Photo No. 2II. Greater Musky Fruit Bat (Ptenochirus jagori)

Presence

There are three different species of bats recorded within the sampling areas. All recorded bats belonged to Family Pteropodidae, which are fruit eating bats but there is also nectar and pollen-eating bats recorded and is a member of Pteropodidae family (*Eonycteris spelaea*). Below is a table showing the presence of bats species within each station.

Table 2-24 Presence of different bat species within each station.

Common Name	Scientific Name	Station 1	Station 2	Station 3
Lesser- Dog faced fruit bat	Cynopterus brachiotis	x	x	x
Greater Musky Fruit Bat	*Ptenochirus jagori*	x	x	
Common Dawn Bat	*Eonycteris spelaea*	x	x	

Conservation Status

IUCN Conservation Status of bats that was recorded within the sampling area are presented below. All species are listed under least concern category and no threat of extinction due to their wide range distribution and populations are unlikely to decline (IUCN).

Table 2-25. Conservation Status of recorded bats.

Common Name	Scientific name	IUCN Status
Lesser- Dog faced fruit bat	Cynopterus brachiotis	Least Concern
Greater Musky Fruit Bat	*Ptenochirus jagori*	Least Concern
Common Dawn Bat	*Eonycteris spelaea*	Least Concern

Percent Abundance

A total of sixty-three (63) bats were collected and identified during the sampling activity. These bats are resolved to 3 species under Family Pteropodidae. The most abundant species identified was *Ptenochirus jagori.* Such species is widespread and abundant with large population (IUCN). It is commonly found in lowland forest but also present in agricultural area. Although forest loss had caused decline on its population, but overall, it remains common and is not significantly threatened

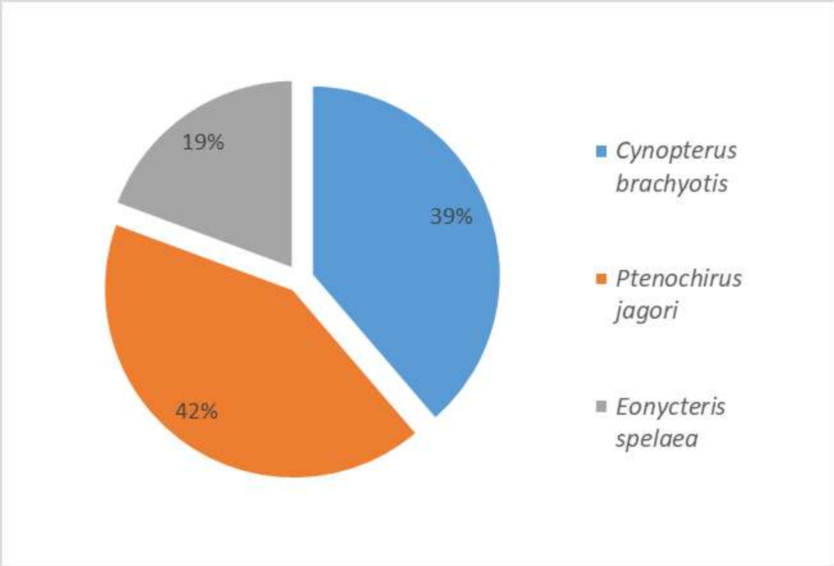


Figure 2-41. Relative abundance of bats in Petra Cement Inc.

Station 1

Percent abundance of bats within Station 1 is presented below. There are twenty-one (21) individual bats sampled. Both *Cynopterus brachiotis* also known as Lesser Short Nosed Fruit Bat and *Ptenochirus jagori* or the Greater Musky Fruit Bat) has the highest abundance which is about 38% out to the total number sampled individuals while *Eonycteris spelaea* (Common Dawn Bat) is about 24% .

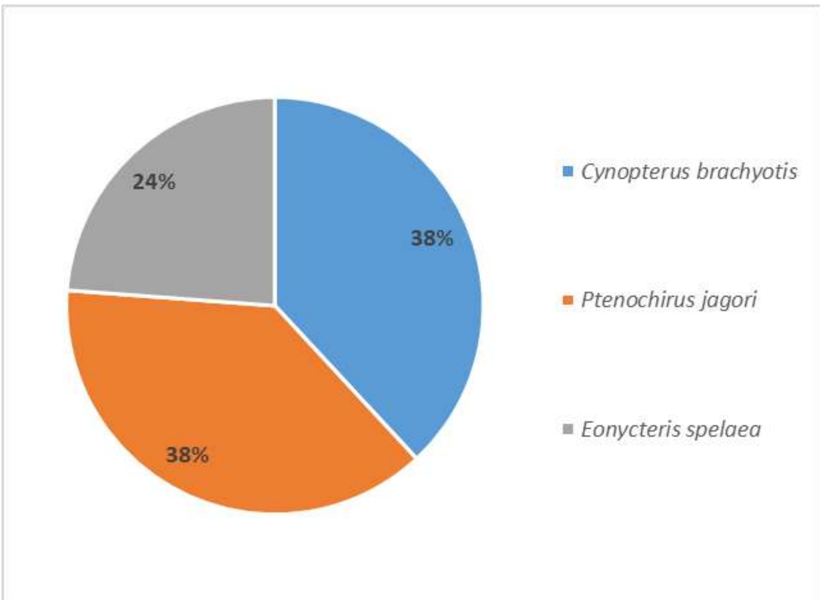


Figure 2-42 Percent Abundance of bats in Station 1.

Station 2

In Station 2, a total of twenty-eight (28) individuals of bats which belongs to three species were identified. In terms of percent abundance, *Ptenochirus jagori* (46%) is the highest followed by *Cynopterus barachiotis* (36%) and *Eonycteris spelaea* (18%). Both stations 1 and 2 were near bodies of water, flight ways and have vegetation cover.

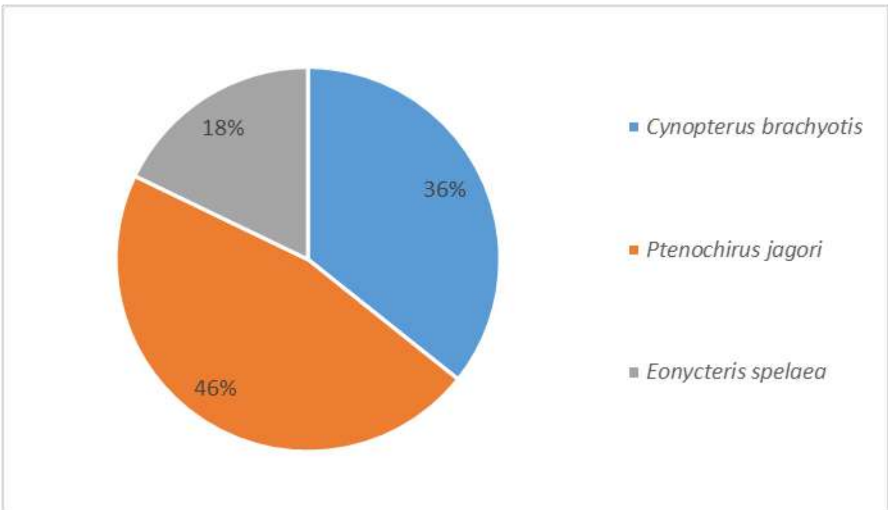


Figure 2-43. Percent Abundance of bats within Station 2.

Station 3

Station 3 was located in the grassland area with the least cover of shrubs and no fruit trees were observed. This part of the project area was already devoid of trees and shrubs due to the clearing activities in the past years according to the company personnel. During data gathering, only thirteen individual bats were recorded which is resolved to three (3) species. The area is proximate to a crushing site and near the plant road which may be the reason why there are only a few number of bats recorded. The figure below shows that *Cynopterus brachiotis* (67%) is the most abundant followed by *Ptenochirus jagori* (33%) and *Eonycteris spelaea* (15%).

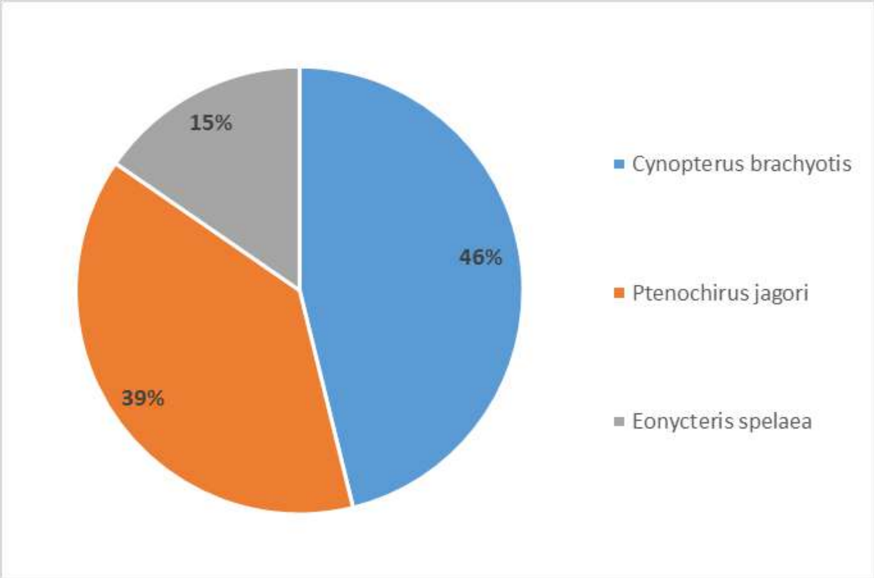


Figure 2-44. Percent Abundance of bats within Station 3.

c. Non - Volant Mammals

Non-volant mammals are land-based mammals that are not able to take flight such as rodents. At the time of sampling no non-volant mammals were caught in the live traps but follow up key informant interviews were done. As mentioned by key informants roaming in the area there are presence of rodents such as the *Rattus tanezumi* or commonly known as the Oriental House Rat especially near the office and creek area. This species belongs to the Family Rodentia and is under the least concern category in the IUCN Red List conservation. It is listed under least concern category due to its wide distribution and population that is able to tolerate broad ranges of habitat.

Table 2-26. List of Volant mammals found in Petra Cement.

Common Name	Family Name	Scientific name	IUCN status
Oriental House Rat	Rodentia	*Rattus tanezumi*	Least concern

d. Herpetofauna

The amphibians and reptiles of a certain locality, herpetofauna are important indicators for changes in the environment since they are sensitive to slight changes specially to changes in water and flora over a locality. At the time of sampling only amphibians were caught and identified while no reptile was found. According to key informant interviews, reptiles are present in the area such as snakes and lizards.

d.1 Amphibians

Only two individual species of amphibians were recorded within the area - a Four Lined Tree Frog (*Polypedates leucomystax*) and Cane Frog (*Rhinella marina*). As to their conservation status, they are listed under least concern category due to their wide distribution, tolerance of a broad range of habitats, presumed large population, and because they are unlikely to be declining fast enough to qualify for listing in a more threatened category. The table below lists the 2 species of amphibians identified in the area of Petra cement Inc. divided into two families of Bufonidae and Rhacophoridae.

Table 2-27. Amphibians identified in Petra Cement Inc.

Common Name	Family Name	Scientific name	IUCN status
Cane Toad	Bufonidae	*Rhinella marina*	Least concern
Four-lined Tree Frog/White-lipped Tree Frog	Rhacophoridae	*Polypedates leucomystax*	Least concern

Photo No. 2JJ. Lateral view of the four lined tree frog (Polypedates leucomystax).

Photo No. 2KK. Cane toad (Rhinella marina) not the actual picture

d.2 Reptiles

There were no reptiles such as snakes and gecko that were collected during the sampling but according to key informants, the area has a lot of snakes due to its physical characteristics such as the thick vegetation cover of shrubs and grasses in some areas. These reptiles accounted by locals are Philippine cobra (*Naja philippinensis*) and To-kay Gecko being spotted in the area.

The Philippine Cobra species is widely distributed throughout disturbed and forested low elevation habitats of the Luzon, Mindoro, Visayas and Mindanao faunal regions. This species it is persistently persecuted by humans which causes its population size to decline. Due to the current situation, it was listed under near threatened category. Another mammal mentioned during data gathering is the To-kay Gecko (Gekko *gecko*) was identified through its call. The key informant also verified that there were To-kay gecko in the area.

2.1.4.4 Hindrance To Wildlife Access

Once the project becomes operational, and with all development such as buildings, warehouses and silos and with the installation of the grinding and mixing machine, it is expected that no wildlife shall stay in the area considering that this will no longer be suitable as habitat or breeding place.

IMPACT ASSESSMENT AND MITIGATION

During Construction and Operation

Impact assessment and options for mitigation and/or enhancement

Earthmoving and site development activities at the site will temporarily disturbed the presence of faunal species in the area. In addition the on-going construction of depot and the operation activity of the asphalt and oil milling plant will prevent migrants or local species to promote habitat in the area.

Introductions of native species of plants and fruit trees as part of the ornamental plants for landscaping purposes will invite local birds and migrants in the area.

2.2 THE WATER

This section presents the key baseline conditions of the project's site in terms of drainage morphology and inducement to hydrologic hazards, depletion of water source and existing quality of the waterways.

The potential impacts of the project's activities during pre-construction, construction, operations, and abandonment stage on these environmental aspects and their corresponding options for prevention, mitigation or enhancement are also assessed and discussed in this section.

Methodology

This geohazard assessment was prepared following the activities enumerated below.

- Literature research/desk study
- Ocular investigation
- Assessment and report preparation

Literature research/desk study is the initial work carried out for the assessment. Efforts were given to collecting of technical study reports, engineering designs, and published reports and maps on the general topography, geology, hydrology and past natural hazards that occurred in the project site and vicinity. On this aspect, the subsurface investigation of ARS Testing and Inspection, Inc. was consulted. This investigation comprises of three (3) exploratory borings of uniform depths of 40m below ground surface. Site investigation followed the desk study to get acquainted with the study area, validate secondary data acquired and identify hazards in the general area that may influence the project site. It includes ocular examination within the limits of the project site and the immediate surroundings. This involves walkover survey. The approach employed in identifying geohazards in this undertaking is a combination of site-specific condition and historical record. Site-specific condition relies on recognition of hazards based on observations made in the field as well as findings based on analysis of data acquired such as those from subsurface examination. Historical approach utilizes existing information, mostly published reports, in recognizing geologic hazards. Based on the information and field observations gathered, analysis and interpretation of laboratory results were made to determine geologic conditions and predict magnitude of potential geologic hazards within the project area and its immediate vicinity.

The sub-surface and physical geotechnical properties of the soil and rock material were adopted from the Geotechnical Investigation Report prepared by Levin Ace Geotechnical Services. A total of 11 eleven (11) exploratory boreholes was drilled over the property of Petra and Seaoil all of which are located at the mid-section and near the shore line. The report bears the drilling methodology applied, bore logs, laboratory tests and brief descriptions of the geology and water table. Attached herein are the complete drilling investigation report for your information and perusal.

Sources of Information

The data and information in this report, as mentioned above, came from primary and secondary sources. Primary data and information were obtained during the fieldwork, while the secondary facts and figures were acquired from various agencies and institutions, including the project proponent.

Primary information was acquired through ocular site investigation. Interviews with were also made to gain information on past natural hazards, particularly on ground shaking, landslide, and tephra fall that occurred in the area, including extent and magnitude of destruction. It is known beforehand that the locality is susceptible to seismic and volcanic hazards, being in the mobile zone and one of the volcanic belts in the archipelago. Secondary information and data were obtained from published and unpublished reports and maps prepared by the *Mines and Geo-Sciences Bureau (MGB), the National Water Resources Board (NWRB) and National Mapping and Information Administration (NAMRIA)* of the Department of Environment and Natural Resources (DENR); *the Philippine Institute of Volcanology and Seismology (PHIVOLCS) and Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA)* of the Department of Science and Technology (DOST) and various data and information readily available from different websites.

2.2.1 <u>Hydrology/Hydrogeology</u>

The surface water that directly drains the project site form part from a huge catchment basin that stretches from the deltaic coastal margin and flat valley floor in the north to the hill slopes and low ridges to the south. Its headwater measures about two (2) aerial kilometer from the tip of the shoreline toward the southern rim of the catchment basin at Brgy Labakid ***(Figure No. 2-45).*** The entire watershed was estimated at 5.50km² and depending on the amount of precipitations, an estimated potential monthly discharge flow may range from 0.45 million m³ (march, dry season) to 2.09Mm³ (November, wet season). Apparently, the unnamed creek appears to be a sub-waterhed of much larger watershed about 200meters to the east of the project site and referred thereto as Tanian watershed and its river system. Said Tanian Watershed is roughly three times (3x) in size and dimension with that of the watershed covering the project site. As seen from Namria topographic map, the unnamed river system is being controlled by moderately densely spaced northeast trending drainage lines and resembles a tree-like structure (dentritic flow pattern) which are by far the most commonly develop in areas where the rock (or unconsolidated material) beneath the stream has no particular fabric or structure and can be eroded equally easily in all directions. The conspicuous difference of Nambria topo map (Manucan Quad) and the recent online satellite enhance image notably lies in the distinct drainage channel structure which apparently defines a straight-forward downstream flow leading to the shoreline in the latter map as compare to the apparent meandering behavior and abrupt curvature in the old published topo map**.**

2.2.1.1 Change In Drainage Morphology/ Inducement Of Flooding/Reduction In Stream Volumetric Flow

The surface water of the site is regionally being controlled by closely spaced northeast-southwest trending meandering drainage systems. Conversely, the southeastern limits of the property is bounded by the main river channel that drains from the north with downstream flow in a northeast direction and empty to Sulu Sea. The estimated catchment basin of about 6km² or roughly 600hectares associated with several merging tributaries system can induce flooding to low-lying area especially during extreme weather disturbance or rainfall. Apparently, there will be no drastic changes in the morphologic structures which may cause volumetric reduction in drainage flow or discharge.

Hydrologic Hazard

Hydrologic hazards include flood, lateral and vertical channel erosion, sedimentation and siltation. The degree of susceptibility of drainage system in the project site to each of these potential hazards would vary depending on various factors, such as basin size, stream gradient, channel morphology, vegetation cover and the underlying lithology.

Flooding (Overflowing)

The proposed site is relatively a flood prone area due to the fact that the site is located adjacent to the coastal zone. The difference in elevation between the proposed project site ground surface and the current river water level ranges from 3.0m to <1.0m in the beach front. Height of the river water dramatically rises to cause overflowing from the river bank especially in times of extreme weather condition and intense precipitation. Based on the ***Mines and Geosciences Bureau (MGB)*** published flooding and landslide susceptibility map in 2010 suggests that the site is indeed prone to moderate to high flooding hazard ***(Figure No. 2-46) .***

Erosion (Channel Erosion)

Erosion is simply defined as removal of surface material from the earth's surface, primarily soil and rock debris and the transportation of the eroded materials by natural agencies from the point of removal. At the site, the erosion of banks is caused by the scouring action of the moving water, particularly in times of flood. Easily erodible materials that made up of bank slopes are those situated on the concave side of the creek (looking towards downstream) unless bank protective measures are to be done.

Retaining vegetal cover on most areas underlain would provide additional support to the river bank and may prevent further erosion. Ripraps or retaining walls could further enhance the slope stability. However, drainage design should suit the sloping condition of the area. The water flow must be controlled so as not to alter the foundation of the slope. Improper design of surface water flow may infiltrate rock or concrete joints inducing pressures along the opening that may eventually result in wall collapse.

Sedimentation and Siltation

Future earth moving activities as well as the removal of vegetation cover within the project area will create large amount of loose materials that will end up in several sections of the drainage systems and eventually may alter the natural drainage system and increase in sediments load into creek and stream systems. As a result, siltation and sedimentation of steam will experienced and if not properly mitigated will greatly affect the downstream portion of stream. Silt trap, sediment collecting ponds as well as interceptor structures should be installed along the river/creek channels to collect these loose eroded fragments.

Tsunami

A ***tsunami*** or **tidal wave**, also known as a **seismic sea wave**, is a series of waves in a water body caused by the displacement of a large volume of water, generally in an ocean or a large lake. Earthquakes, volcanic eruptions and other underwater explosions (including detonations of underwater nuclear devices), landslides, glacier cavings, meteorite impacts and other disturbances above or below water all have the potential to generate a tsunami. Wave heights of tens of meters can be generated by large events such as Japan tsunami in 2011. Although the impact of tsunamis is limited to coastal areas, their destructive power can be enormous and they can affect entire ocean basins. The effects of possible tsunami occurrences that could reached the project may have a major effect based on the presently published Tsunami Map prepared by Phivolcs in 2007 ***(Figure No. 2-47)***.

As gleaned from the map, it appears that in case of Magnitude 8.0 earthquake from the Sulu Trench, a 3meter high tsunami will reached the western coasts of Zamboanga, and may result in a tremendous devastation could be expected particularly in Dipolog City. At the project site, such waves were predicted to force inland several kilometers from the shoreline. This natural hazard likewise reflects the damages it may inflict at the project site.

Strom Surge

A **storm surge**, **storm flood** or **storm tide** is a coastal flood or tsunami-like phenomenon of rising water commonly associated with low pressure weather systems (such as tropical cyclones and strong extratropical cyclones), the severity of which is affected by the shallowness and orientation of the water body relative to storm path, as well as the timing of tides. Most casualties during tropical cyclones occur as the result of storm surges. It is a measure of the rise of water beyond what would be expected by the normal movement related to tides.

Project Noah is a government program that seeks to assist the country in disaster risk reduction and management, climate change adaptation and mitigation efforts and related activities through research, development and extension services. The Program was launched in 2011 after the aftermath of TS Sendong in Central Mindanao. One of the important function attached therein was to provide a 6-hour lead-time warning to agencies involved in disaster prevention and mitigation. In their official website, Noah depicts a simulated presentation of various level of warnings/advisories and its impacts during storm surge event ***(Figure No. 2-48).*** As shown, Advisory No. 2 and 3 indicates a probable severe impact of raising sea water to the project site.

IMPACT ASSESSMENT AND MITIGATING MEASURES

During Construction Phase

Possible Flooding Within Area

There is a possibility that during heavy rain fine materials at the stockpile be brought down to the creeks and tributaries and finally inducing flooding of the area and siltation of Tanalan Creek. .

Mitigating Measures

The area is recommended to increase the elevation at a minimum of 4.0 meters. It is recommended that proper drainage shall be constructed during construction to divert the flow of run-off to the creek.

Possible Siltation of Tanalan River

Overburden soil stockpile which is also a possible source of sedimentation/siltation when wash away during rainy days.

Mitigating Measures

Observed legal easement along the sides of Tanalan Creek and Stockpile shall be placed away from the creek side. Immediate spreading and compaction of the fill materials shall be done and installation of sand bags at the critical area along the Tanalan Creek.

During Operation Phase

The company will construct settling ponds to treat the wastewater generated during maintenance. Zero water discharge will be practiced in the plant. Water source shall be supplied by the Local Water District and others such for maintenance use shall be from the pond.

<u>Possible Increase in Sedimentation of Tanalan Creek</u>

The sediments during the grinding and mixing of clinker, and other materials may cause sediments at Tanalan Creek.

Mitigating Measures

Settling ponds shall be constructed to ensure that silts are gathered and collected at the pond with sand bags therefore only overflow clear water goes directly to the final outfall.

2.2.1.2 Change In Stream, Lake Water Depth

Figure 2-49 shows the existing creek alignment and the alignment based on NAMRIA Map. Based on the survey conducted, the alignment of the waterway upstream of Irasan Bridge is no longer the same as its original alignment in the NAMRIA Map.

There are present development on the east side of the property and the original flow path of the waterway was backfilled by the property owner, source: *Page 7 Hydrologic and Hydraulic Assessment Study by AMH Philippines, Inc., Jul 21, 2017*

IMPACT ASSESSMENT AND MITIGATING MEASURES

During Construction and Operation Phase

No significant impact since the creek shall remain as is.

Mitigating Measures

Observed proper legal easement along the sides of the Tanalan Creek.

2.2.1.3 Depletion Of Water Resources/ Competition In Water Use

Water resources refers to water that are used for agricultural, household, recreational and environmental activities. About two (2) types of water resources are identified at the site and are explained as follows;

a. Surface Water. Surface water are water in rivers, lakes and wet lands. It is naturally replenished by precipitation and loss through discharge to ocean, evaporation and recharge to underground flow. At the site, surface runoff from precipitation were collected in a naturally confined 6.0km² catchment basin or watershed located to the south. Calculated peak river discharge based on field measurements and simulated hydrologic flow analysis conducted by AMH in 2017 shows that occurrence of peak surface flows would range from 13.70³/s to 27.44m³/s ***(AMH, 2017).*** With this volume, occurrences of flooding to low land and coastal towns had been a usual norm in these areas. While, scarcity of surface water source had been felt during dry months due to decreasing discharge.

b. Groundwater; It is define as water lies beneath the ground and had been exploited for domestic, livestock and irrigation. In groundwater, stored water are found in pore spaces between grains of sediment and in bodies of clastic sedimentary rock and in rock openings, cracks and crevices with sufficient quantities embedded on permeable layers and/or underground reservoir known as aquifers. Naturally emerging groundwater to ground surface in the form of water table spring or pumped from a well normally fills rivers, streams, lakes, ponds, and wetlands. Based on the topography and distribution of the major rock units, the area may be classified into two (2) distinct hydrogeologic units ***(Figure 2-50).*** These are: 1) hilly to mountainous areas that are underlain by slightly fractured and generally impermeable rocks which yield little or no groundwater ***(localized with insignificant groundwater yield);*** and 2) the coastal area underlain by the Quaternary Alluvium, which produce fairly to moderate amounts of groundwater ***(fairly extensive to productive aquifers).***

Figure 2-50 Groundwater Availability Map

Large portion of the project site are underlain by loose to dense alluvium deposits with water table at depth of 1.5m to 3.00mbgs ***(LAGS drilling report, 2017).*** This may implies the possible productive groundwater source in the area. Moreover, during the site investigation, majority of houses living nearby the site are supplied through individual shallow hand pumps or dug wells with very few houses are being tapped to the local water district. Although there been reports of abandoned wells due salt water contamination, the used of groundwater through pump tube well at the site will be confined only to washing and cleaning of transport vehicles and industrial equipment's (i.e. ball mills, bagging machine and conveyors) at a given specific or scheduled time. Thus, a minimal consumption of water resource.

IMPACT ASSESSMENT AND MITIGATING MEASURES

During Construction Phase

Increased Water Demand

Water requirement during operation is about 5.0 cubic meters per day. Water used for construction related activities, maintenance, washing, and domestic use will be sourced from the Local Water District.

Mitigating Measures

Since the water will be sourced from the Local Water District, however, the proponent shall implement rainwater/catchment collection to reuse of water during maintenance.

During Operation Phase

Increased Water Demand

Water requirement during operation is about 12.50 cubic meters per day. Water used for cooling machine, maintenance, washing, and domestic use will be sourced from the Local Water District.

Mitigating Measures

Since the water will be sourced from the Local Water District, however, the proponent may have the option to extract water underground as back-up source during full operation. Geo-resistivity study shall be conducted in the event of such, NWRB permit shall be secured.

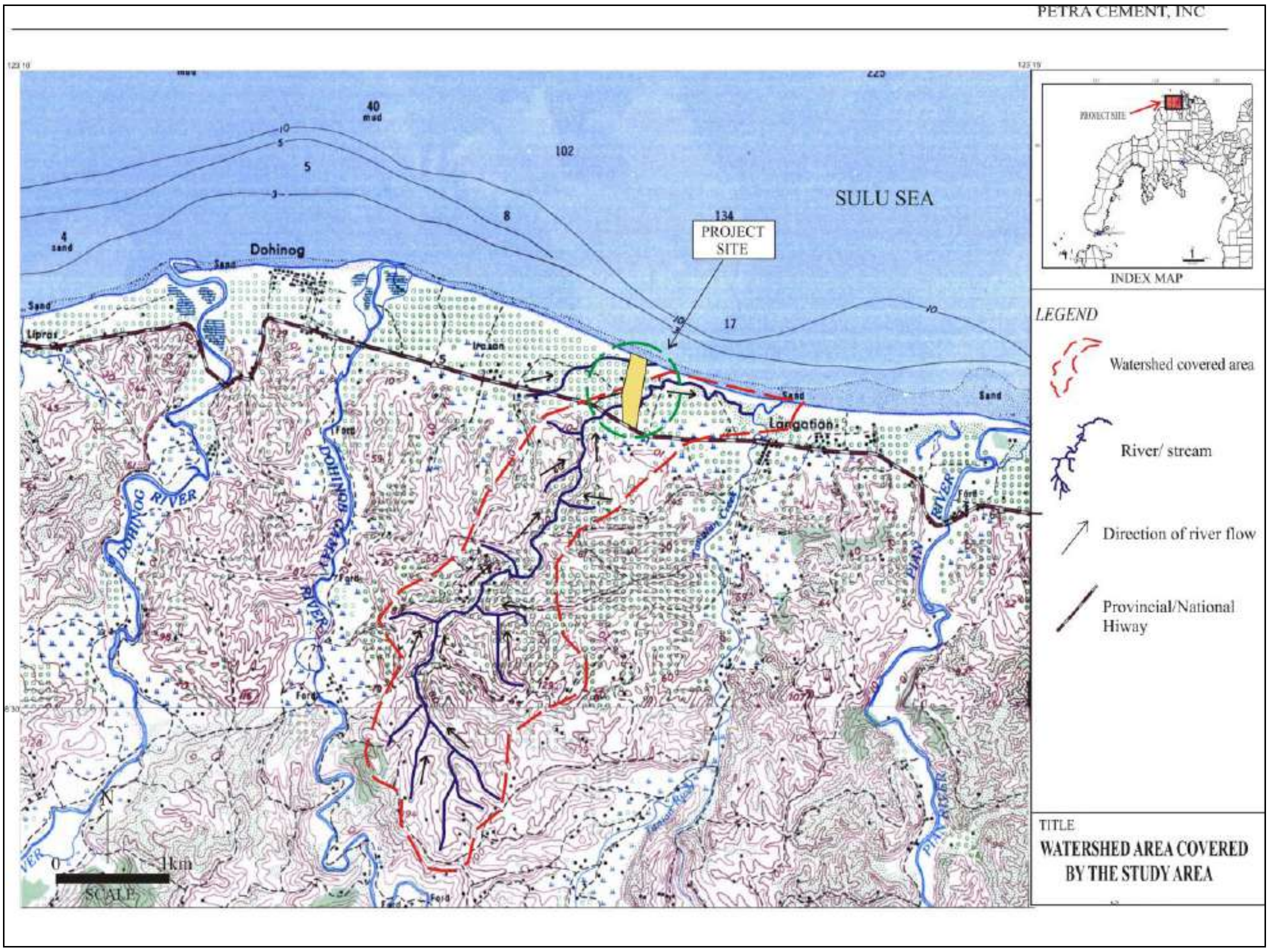


Figure 2-45 Watershed Area Covered by the Study Area

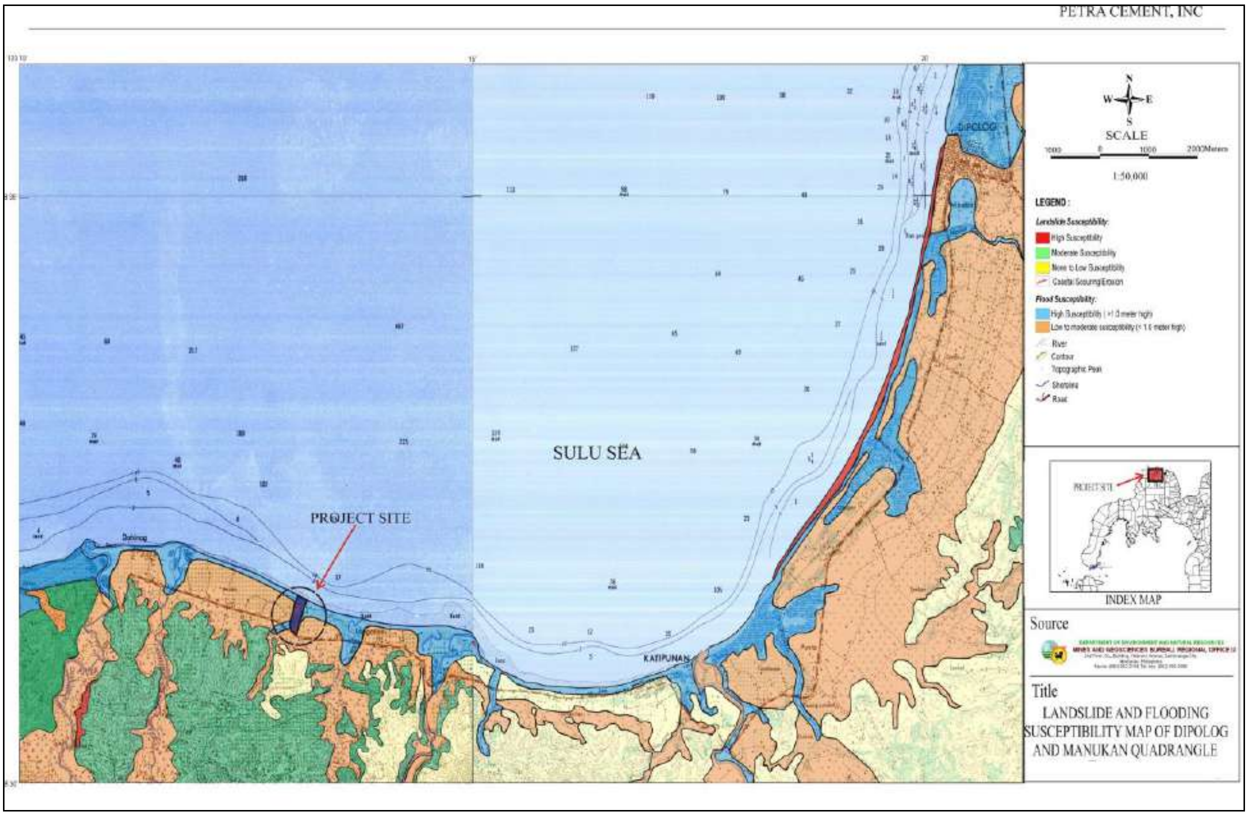


Figure 2-46 Flood Hazard

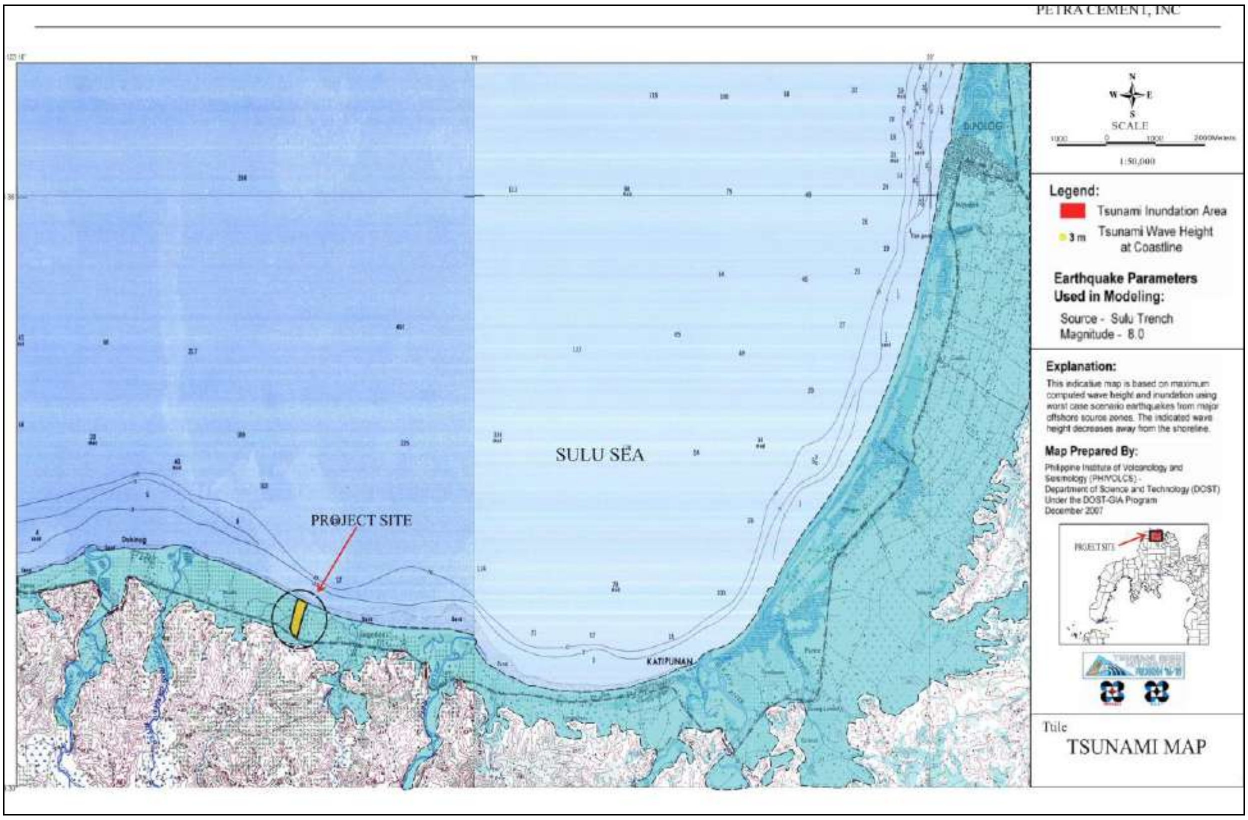


Figure 2-47 Tsunami Map

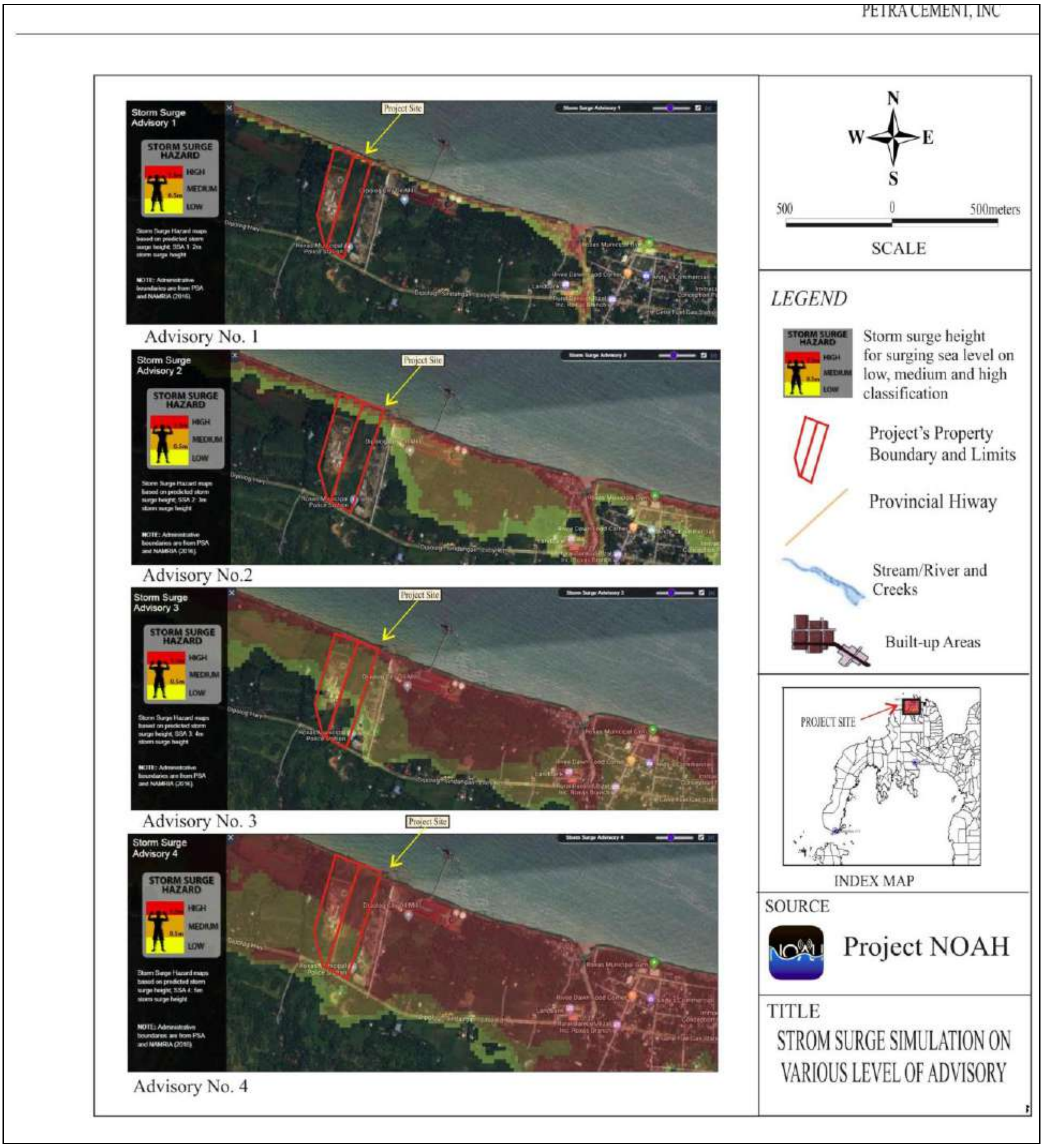


Figure 2-48 Project Noah

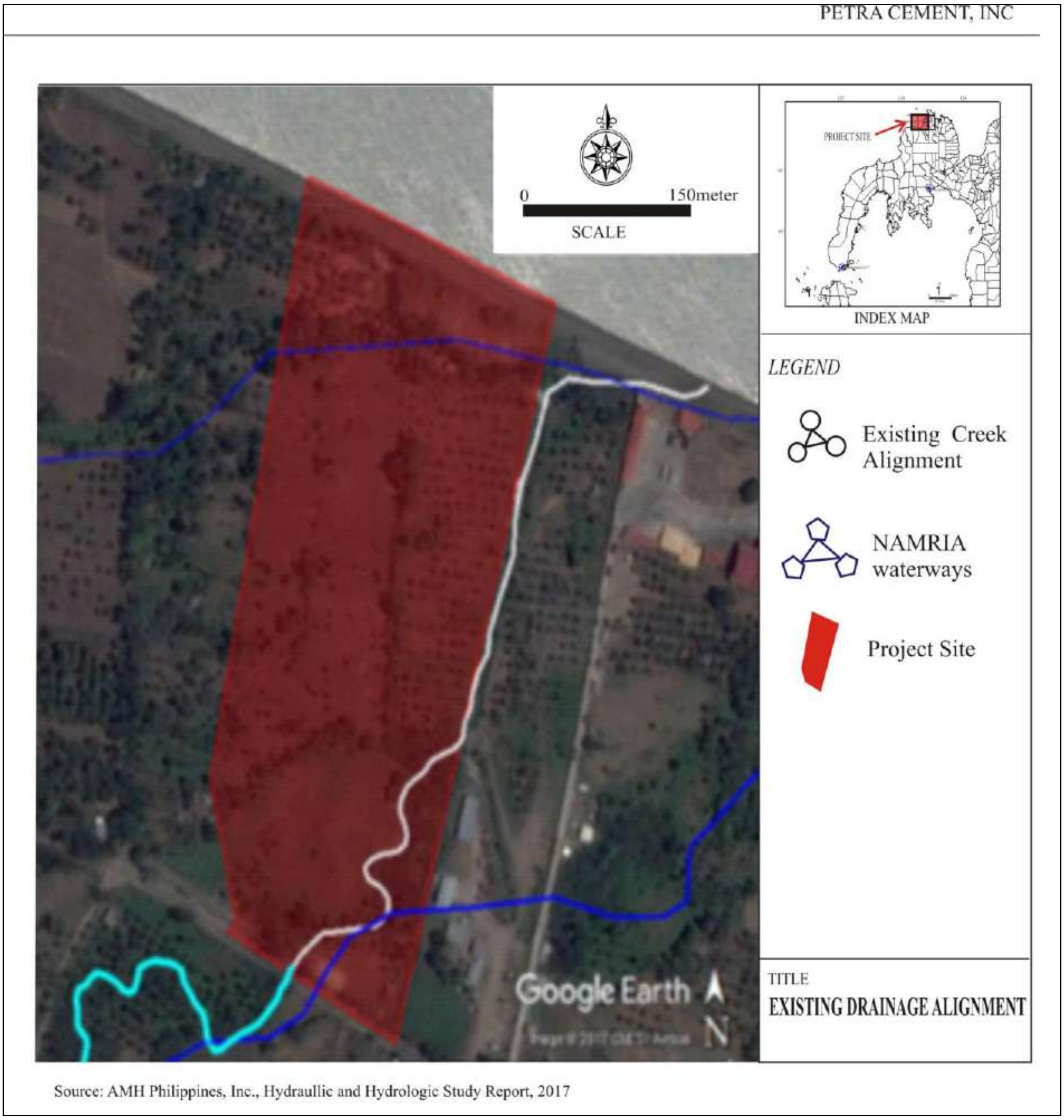


Figure 2-49 Existing Drainage Alignment

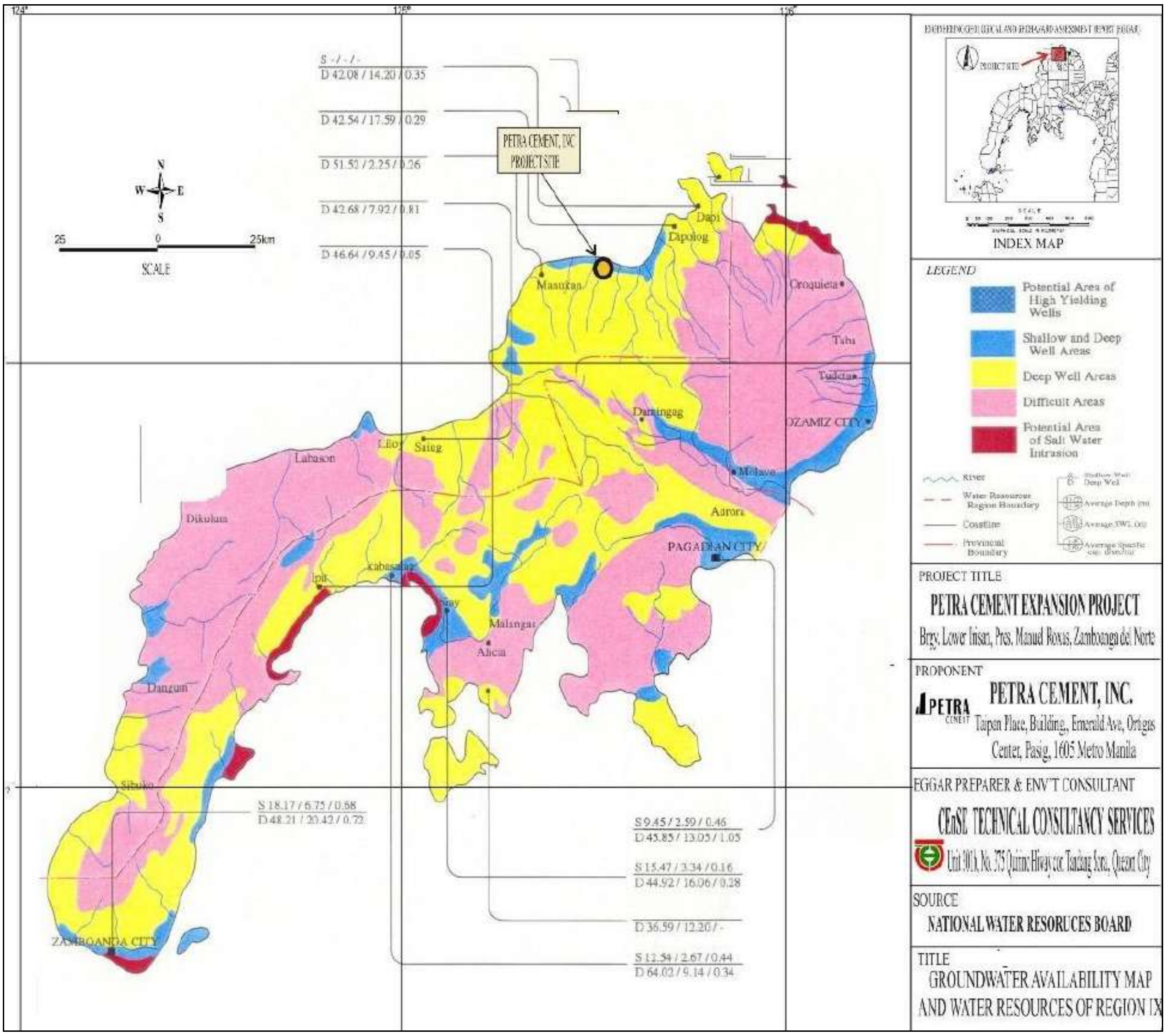


Figure 2-50 Groundwater Availability Map

2.2.2 <u>Oceanography</u>

The cement finishing plant has an agreement with Good Hope and Seaoil for the use of the Port Facility which has already an Environmental Compliance Certificate (ECC) issued in favor of Seaoil Philippines, Inc., ***see Annex O.*** This particular section is no longer applicable considering that Petra Cement, Inc. will not construct any port facility.

2.2.2.1 Change/Disruption In Water Circulation Pattern, Littoral Current, And Coastal Erosion and Deposition

Coastal erosion consist of erodible material and is intensified due to human activity. There will be no change or disruption in the water circulation pattern since the project development area shall be located inland. Proper easement along the shoreline shall be observed with approximate length of 100-meters.

2.2.2.2 Change In Bathymetry

No disturbance on the surface or sub-surface navigation in the expansion project. In addition, during the ecological marine inventory, there were no special species identified in the area.

IMPACT ASSESSMENT AND MITIGATING MEASURES

During Construction and Operation Phase

This particular section shall have no significant impact to Petra Cement, Inc. since there will be no port facility that will constructed in the area, however, another company will be handling and shall be responsible for the is management measures.

Mitigating Measures

Strictly follow and adhere to the Agreement (if any) with the owner of the port facility in the event the plant is already operational.

2.2.3 <u>Water Quality</u>

2.2.3.1 Degradation Of Groundwater Quality

Saltwater intrusion occurs to most coastal aquifers, owing to the hydraulic connection between fresh groundwater and seawater. Because saline water has a higher mineral content than freshwater, it is denser and has a higher water pressure. As a result, saltwater can push inland beneath the freshwater Certain human activities, especially groundwater pumping from coastal freshwater wells, have increased saltwater intrusion in many coastal areas and thus resulting for flow further inland and thus the reduction of both the quality and quantity of groundwater.

There was no identified groundwater within the primary impact area, where a sampling point is identified. The shallowell mostly used by the residents is about 1.30 kilometers from the site and is considered outside of the secondary impact area.

2.2.3.2 Degradation Of Surface Water Quality

Other contributors to saltwater intrusion include navigation channels or agricultural and drainage channels, which provide conduits for saltwater to move inland, and it can also make sea level rise. Saltwater intrusion can also be worsened by extreme events like hurricane storm surges.

With climate change, according to the IPCC Assessment Reports, it can expect sea-level to rise, more frequent extreme weather events, coastal erosion, changing precipitation patterns and warmer temperatures. All of these factors combined with an increased demand for freshwater, as a result of global population growth and development, could boost the risk of saltwater intrusion.

Surface Quality Sampling Results

Methodology

Baseline Result Conducted March 28, 2016

Water samples were taken from the downstream portion of the nearest receiving body of water in the development site, which is considered as "creek", sample is collected using a 2.5-liter sterilized plastic water bottle. Standard water sample preparation procedure was followed. The sample bottle was properly labelled; the caps was securely sealed with the adhesive tape, and placed in a chest filled with ice to preserve the samples. The samples were later brought to the laboratory Elarsi, Inc. for analysis of parameters defined by the Environmental Management Bureau (EMB), those are Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Color, Oil & Grease, Total Coliform, Power of Hydrogen (pH) and Total Suspended Solids (TSS).

Field measurement of pH was undertaken. A 500 ml sterilized beaker was filled with samples from the said creek. Using a portable digital pH meter, on-site measurement was taken. The pH meter was properly calibrated prior to use. Physical appearance of the water is also observed.

Table 2-28 Results of Tanalan Creek – Downstream 1

Parameters	**Method**	**Result Downstream March 28, 2016**	**Standard**
Coordinates		8°31'30.28"N; 123°13'6.33"E	
pH	4500^{+} Electromagnetic Method	7.8 (In-situ)	6.5-9.0
Temperature	2550-B Laboratory and Field Method		
Color, PCU @pH 6.60	2120-B Visual Comparison Method	50	150 (a)
BOD$_5$, mg/L	5210-B 5-Day BOD Test	3	7 (10)
COD, mg/L		13	
Oil and Grease, mg/L	5520-B Partition-Gravimetric Method	<1	
TSS, mg/L	2540-D Gravimetric Method	30	
Dissolved Oxygen	4500-O C. Azide Modification		
Nitrates,	4503-NO_3 D. Nitrate Electrode Method		7
Phosphate, r	4500-P. D.Stannous Chloride Method		0.50
Surfactants MBAS m /L	5540-C Anionic Surfactants as MBAS		1.50
Ammonia,	4500-NH_3 Ammonia Selective Electrode Method		0.50
Total Coliform, MPN/100 mL		1.1 x 10^3	

Source: Berkman System, Inc., April 30, 2018

Discussion of the Results

Surface Water sample was collected last March 28, 2016 as baseline for the 50,000 MT pear year of the existing Environmental Compliance Certificate (ECC). The results of analyses was compared based on the DENR Standards for Class "C" Waters which found to be within standards with reference to DAO AO 35 Effluent Standards for Class "C" waters, ***attached in Annex N is the Surface Water Sampling Result March 28, 2016.***

Monitoring Result Conducted March 11, 2018

Surface Water Quality Monitoring

The results of the surface water analyses are presented in **Table 2-29**. For comparison purposes, the DENR water quality guidelines for Class C waters were also included.

Class C water is intended for the beneficial use of the following: (1) propagation and growth of fish and other aquatic resources; (2) boating, fishing, or similar activities; and (3) agriculture, irrigation, and livestock watering.

The collected surface water samples have no unusual odor and no perceived surface oils. The weather was both clear before and during sampling

Table 2-29 Surface Water Quality Monitoring Results

Parameters	**SW1 (Downstream) April 12, 2018 0905H** 8°31'30.28"N; 123°13'6.33"E	**SW2 (Midstream) April 12, 2018 0915H** 8°31'25"N; 123°13'4"E	**SW3 (Upstream) April 12, 2018 0930H** 8°31'16"N; 123°12'58"E	**DAO 2016-08 Water Quality Guidelines for Class C waters**
pH (In-situ)	9.0	8.7	8.8	**6.5 – 9.0**
Temperature (In-situ)	30.5	30.5	30.6	**25-31[(b)]**
BOD_5, mg/L	3	3	3	**7**
COD, mg/L	6	7	5	**none**
TSS, mg/L	< 5	< 5	< 5	**80**
Oil and Grease, mg/L	< 1	1	< 1	**2**
Total Coliform, MPN/100 mL	$2.3x10^4$	$2.3x10^3$	$2.3x10^4$	**none**

[(b)] *The natural background temperature as determine by EMB shall prevail if the temperature is lower or higher than the WQG; provided that the maximum increase is only up to 10 percent and that it will cause any risk to human health and the environment*

Discussion of the Results

Based on the marine water results, all three stations are within the prescribed water quality guidelines with reference to DAO No. 2016-08 Class SC waters. Likewise, the surface water results of all three stations are within the prescribed water quality guidelines with reference to DAO No. 2016-08 Class C waters. On the other hand, there is no limiting concentration for COD and total coliform both for marine and surface waters.

Comparison of the March 28, 2016 and March 11, 2018 for Downstream

Since there were no surface water samples collected for upstream and midstream, downstream results comparison are still within the DENR Standards. Considering that there is an on-going development in the area, the result of the Total Suspended Solids (TSS) is lower than the first sampling test prior to development.

Surface Sampling Map is presented in Figure 2-51.

IMPACT ASSESSMENT AND MITIGATING MEASURES

During Construction Phase

<u>Possible Siltation of Tanalan River</u>

Overburden soil stockpile which is also a possible source of sedimentation/siltation when wash away during rainy days.

Mitigating Measures

Observed legal easement along the sides of Tanalan Creek and Stockpile shall be placed away from the creek side. Immediate spreading and compaction of the fill materials shall be done and installation of sand bags at the critical area along the Tanalan Creek.

During Operation Phase

The company will construct series of settling ponds to treat the wastewater generated from washing and cleaning. Zero water discharge will be practiced in the plant.

<u>Possible Increase in Sedimentation of Tanalan Creek</u>

The particulate matter or suspended solids during the grinding and mixing of clinker, and other materials may cause sediments at Tanalan Creek.

Mitigating Measures

Settling ponds shall be constructed to ensure that silts are gathered and collected at the pond with sand bags therefore only overflow clear water goes directly to the final outfall.

<u>Possible Contamination of Tanalan Creek</u>

The domestic wastewater to be generated by the workers and the possible oil spill during maintenance of the machines if not property treated may contaminate the quality of Tanalan Creek.

Mitigating Measures

Provision for three chamber or purifying septic tank shall be constructed for primary treatment of domestic wastewater. Installation of oil and water separator shall be implemented by the proponent.

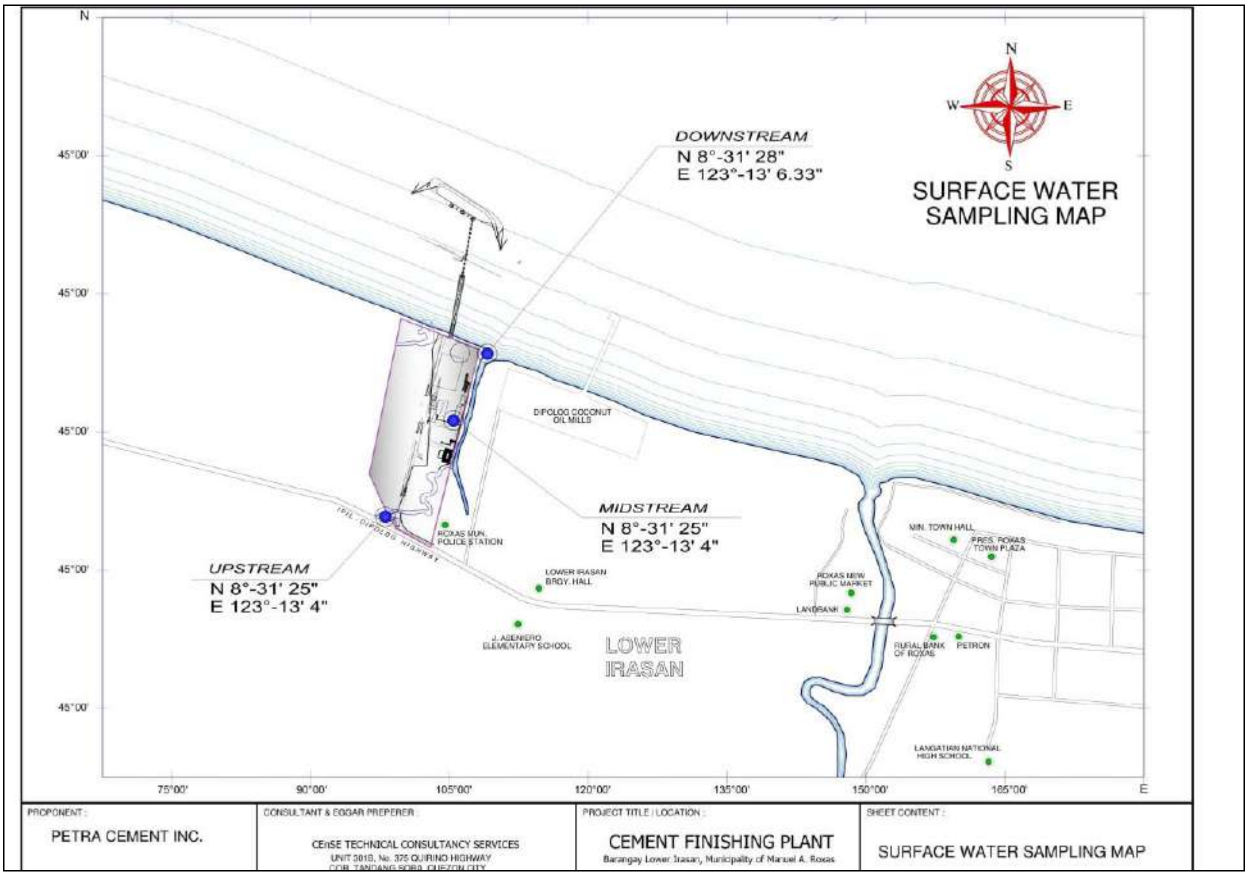


Figure 2-51 Surface Sampling Map

2.2.3.3 Degradation Of Coastal/Marine Water Quality

Sampling Procedure

Representative water samples were collected from the source. The samples were preserved in an ice-filled cooler before sending to an independent laboratory for analysis. The parameters and methods of analyses used to determine the characteristics of the water samples are presented in the *Table 1* in the succeeding page. The sampling procedures and analyses were in accordance with the prescribed methods indicated in the Ambient Water Quality Monitoring Manual issued through EMB Memorandum Circular 2008-008 and with the American Public Health Association's (APHA's) Standard Methods for the Examination of Water and Wastewater.

Table 2-30 Water Sampling Methods of Analyses

Parameters	Methodologies
pH (in-situ)	Glass Electrode
Temperature (in-situ)	Digital Thermometer
Biochemical Oxygen Demand (BOD_5)	Azide Modification (Dilution Technique)
Chemical Oxygen Demand (COD)	Closed Reflux – Colorimetric
Total Suspended Solids (TSS)	Gravimetric
Oil & Grease	Partition – Gravimetric
Total Coliform	Multiple Tube Fermentation Technique

Table 2-31 Marine Water Quality Monitoring Results

Parameters	**MW1 (Left Boundary) April 12, 2018 0830H** 8°31'33"N; 123°13'2"E	**MW2 (Center) April 12, 2018 0840H** 8°31'32"N; 123°13'4"E	**MW3 (Right Boundary) April 12, 2018 0850H** 8°31'31"N; 123°13'7"E	**DAO 2016-08 Water Quality Guidelines for Class SC waters**
pH (In-situ)	8.7	8.5	8.5	**6.5 – 8.5**
Temperature (In-situ)	28.2	28.2	28.1	**25-31$^{(b)}$**
BOD_5, mg/L	2	2	2	**n/a**
COD, mg/L	16	22	16	**none**
TSS, mg/L	47	25	78	**80**
Oil and Grease, mg/L	< 1	< 1	< 1	**3**
Total Coliform, MPN/100 mL	< 1.8	78	< 1.8	**none**

$^{(b)}$*The natural background temperature as determine by EMB shall prevail if the temperature is lower or higher than the WQG; provided that the maximum increase is only up to 10 percent and that it will cause any risk to human health and the environment*

Discussion of the Results

Based on the marine water results, all three stations (except for pH at station *MW1*) are within the prescribed water quality guidelines with reference to DAO No. 2016-08 Class SC waters. Likewise, the surface water results of all three stations are within the prescribed water quality guidelines with reference to DAO No. 2016-08 Class C waters. On the other hand, there is no limiting concentration for COD and total coliform both for marine and surface waters, ***Figure 2-52 shows the Marine Sampling Map Station.***

IMPACT ASSESSMENT AND MITIGATING MEASURES

During Construction Phase

<u>Possible Siltation of Coastal Shoreline of Sulu Sea</u>

Overburden soil stockpile which is also a possible source of sedimentation/siltation when wash away during rainy days.

Mitigating Measures

Observed buffer and salvage zone and legal easement at the shoreline. Stockpile shall be placed away from the shore. Installation of boulders and sand bags along the easement side.

During Operation Phase

<u>Possible Contamination of Sulu Sea</u>

The domestic wastewater to be generated by the workers and the possible oil spill during maintenance of the machines if not property treated may contaminate the quality of sea.

Mitigating Measures

Provision for three chamber or purifying septic tank shall be constructed for primary treatment of domestic wastewater. Installation of oil and water separator shall be implemented by the proponent.

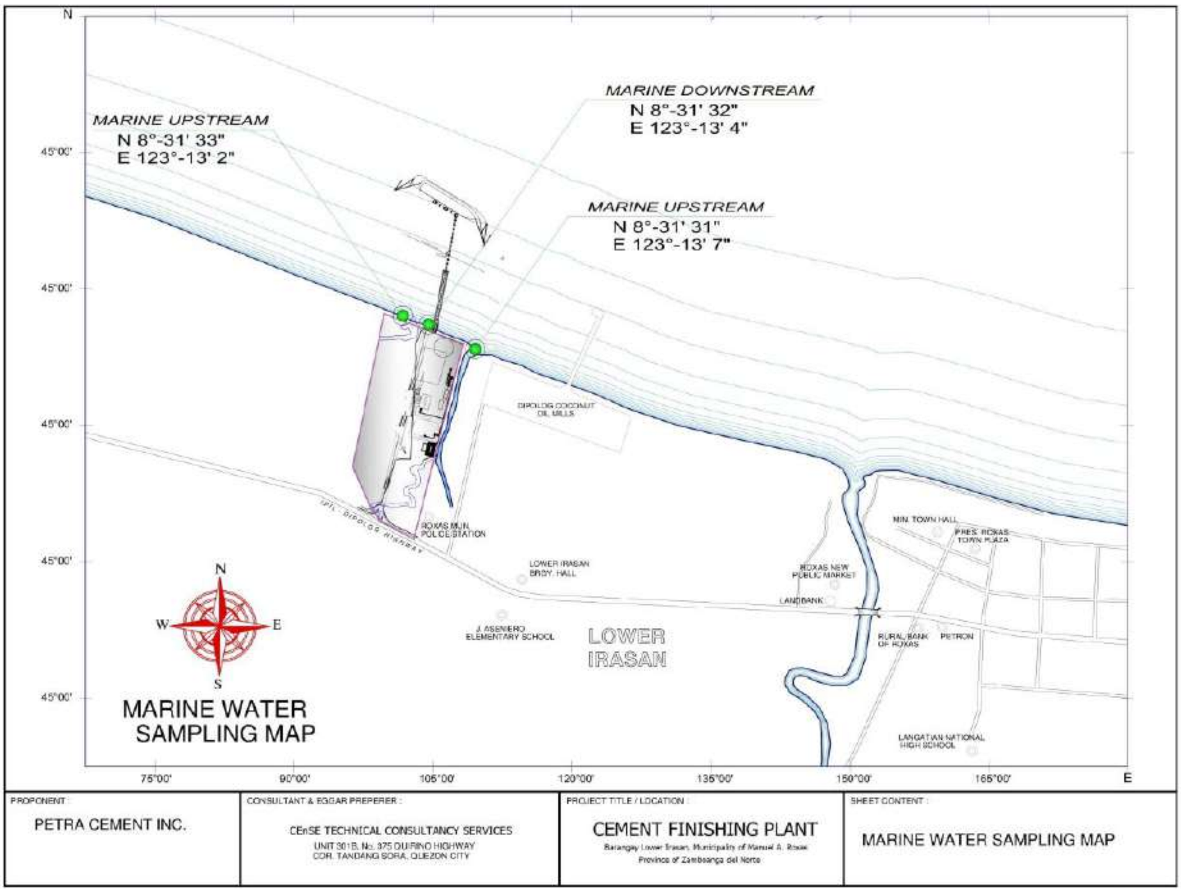


Figure 2-52 shows the Marine Sampling Map Station

2.2.4 Freshwater Ecology

In this study, only the epilithic assemblages and macroinvertebrates were studied for they are good indicators of the water quality in the creek. Usually found in or near bottoms of rocks, logs, sediments, debris along creeks and rivers during their early stages of life especially for macroinvertebrates.

Macroinvertebrates and epilithic algae are organisms that can be seen without the aid of a microscope, their sizes vary from as lesser than 1mm and greater. Epilithic assemblages composed of freshwater algae are considered as primary producers in freshwater bodies that are important in the production of the energy flow within the ecosystem. Macroinvertebrates serves as the primary consumers of epilithic algae that in turn is important for higher consumers such as fishes.

Three stations were established along the creek inside within the project site.

Since the freshwater area is traversed by the the property, based on the hydraulic and hydrograohic report, the original creek has been relocated or diverted due to the development of the Aphalt Plant brough about by backfilling activities. The project shall still observed legal easement, however, creek side development to prevent scouring is forseen to be done in the area for the protection of the property and its assest.

There will be cooling water system for the purposed of maintaining the temperature of the machine while running, this shall serve as the function similar to the radiator in all vehicles. This will be a closed-loop type of system with provision for cooling tower with volume of 6.0 cubic meters, therefore no wastewater coming from the cooling tower shall be discharged at the creek. However, replenishment due to evaporation is expected and is estimated at 5% losses shall be refilled from the local water source.

Description of freshwater Area

Tanalan Creek is the nearest water body to the project area that runs adjacent to the project site draining to the coastal area of Brgy. Irasan, Pres. Roxas. This body of water stretches further up from the project site. It has a length of about 630 m from the regional highway with width that ranges from 5 to 16 meters. Depth of water during the time of sampling ranges from 5 cm to 153 cm. No water flow and stagnation of water was observed during the sampling. Evident flows were accounted by locals during the wet season. Few vegetation thrives along the banks of the creek which consist of a few trees, mostly shrubs and vines

2.2.4.1 Threat To Existence And/Or Loss Species Of Important Local And Habitat

Creek Station 1

Station 1 of the creek is located near the main entrance of the project site. The image below shows section of the creek where water flow is flowing at a very slow speed. Few species of vines and grasses dominantly covered the banks except for the few patches of trees on the riparian. The minimal number of trees and bank stabilizing structures along the creek could be the reason why erosion is evident within the sampling area.

Photo No. 2LL. Tanalan creek station 1

Photo No. 2MM. Part of Station 1 where sampling was conducted

Creek Station 2

Unlike the first station, the second station has less diversity of vegetative cover. Grasses dominated the area and bank erosion is more conspicuous. To avoid further damage, riprap was installed along the creek but does not sufficiently covers all erodible areas. Station 2 has also stagnant waters with algal blooms. A sewage outlet from the other plant was observed to be connected to the creek.

Photo No. 2NN. Station 2 of Tanalan creek.

Photo No. 2-OO. Station 2 of Tanalan creek, algal blooms evident.

Creek Station 3

Station 3 was established at the downstream area of Tanalan Creek. It is a very shallow portion of the creek where beds are already exposed. The station is located near the mouth of the creek before it empties into the sea in front of the project site. Due to very slow water flow, a small delta or islet was formed nearby. It was formed from the picked-up sediments from the bed, eroding banks and debris on the water. This portion of the creek was observed to be the driest among the sampling areas for freshwater ecology.

Photo No. 2PP. Station 3 of Tanalan creek

Photo No. 2QQ.. Station 3 located near the coastal area.

Sampling Stations

Three stations were established for sampling with its relative locations summarized in the table below. All sampling stations are within Barangay Irasan, Roxas Zamboanga del Norte.

Table 2-32. Sampling stations with corresponding coordinates in the area.

FRESH WATER ECOLOGY	LATITUDE	LATITUDE
STATION 1	123° 13' 1.721" E	8° 31' 19.067" N
STATION 2	123° 13' 4.040" E	8° 31' 22.858" N
STATION 3	123° 13' 5.520" E	8° 31' 28.205" N

Figure 2-53. Map of Freshwater Ecology Sampling Stations relative to the project site.

2.2.4.2 Threat To Abundance, Frequency And Distribution Of Species

Macroinvertebrates

Macroinvertebrates are found in streams and rivers that plays an important role in the aquatic ecosystem. Mostly composed of larval stages of insects, mollusks and arthropods these animals aide in nutrient cycling in freshwater bodies. Also, they are considered as secondary consumers that are important for the energy flow between primary producers and other consumers. Macroinvertebrates are generally grouped by their feeding mechanisms, their movement within the aquatic environment and more importantly how they are categorized by their tolerance to pollution. In this study macroinvertebrates' tolerance to pollution is computed by HBI or Hilsenhoff biotic index and EPT or Ephemeroptera, Plecoptera and Trichoptera indices.

Important indicators of water quality, specifically in rivers and streams for pollution, macroinvertebrates are useful indicators of pollution because they show a wide range of tolerance in their reactions to various degrees of pollution. Some of these species that are sensitive to slight changes die rapidly if water quality in an area is not suitable while other species are tolerant to sudden changes in water quality.

a. Macroinvertebrates identified

A total of 87 macroinvertebrates were identified belonging to 2 Phyla; Arthropoda and Mollusca. Macroinvertebrates identified within Talanan Creek includes a crab, gastropod, beetles, midges and mostly flies which are then identified into 12 families of macroinvertebrates. The families identified were the following: Elmidae, Anthericidae, Chironomidae, Simuliidae, Tabanidae, Calopteridae, Gerridae, Libellulidae, Polyentropodidae, Hydropsychidae and Thiaridae.

Most of the macroinvertebrates identified are from Order Diptera with 5 families followed by order Trichoptera with 2 families. Diptera, also known as "true flies" can be found in all freshwater environments and can be very tolerant to poor water quality and anoxic conditions. Insects of this order use only a single pair of wings to fly during adult stages and have no appendages during larval stages. Among the orders identified Trichoptera is considered as one of the three major orders when it comes to macroinvertebrates abundance and is known to have a low tolerance to pollution. Identified families are also represented on the following plates.

Table 2-33. Freshwater macroinvertebrates identified in the creek of Petra Cement Inc.

Phylum	*Order*	*Family*	*Common Name*	*Station 1*	*Station 2*	*Station 3*
Athropoda	Coleoptera	Elmidae	Riffle Beetles	x	x	x
	Brachyura		Crab			x
	Diptera	Anthericidae	Snipe Flies	x	x	
		Chironomidae	Non- biting Midges	x	x	x
		Simuliidae	Black Flies	x	x	x
		Tabanidae	Horse Flies	x	x	x
		Calopteridae	Damsel Flies	x		x
	Hemiptera	Gerridae	Water Striders	x	x	x
	Odonata	Libellulidae	Dragonfly	x	x	
	Trichoptera	Polyentropodidae	Trumpet Net Caddisfly	x	x	

		Hydropsychidae	Caddisfly	x	x	
Mollusca	Gastropoda	Thiaridae				x

Photo No. 2RR. Macroinvertebrate belonging to Family Polycentropodidae

Photo No. 2SS. Macroinvertebrate belonging to Family Hydropsychidae

Photo No. 2TT. Macroinvertebrate belonging to Family Chirominidae

Photo No. 2UU. Macroinvertebrate belonging to Family Simuliidae

Photo No. 2VV. Macroinvertebrate belonging to Family Libellulidae

Photo No.2WW. Macroinvertebrate belonging to Family Gerridae

Photo No. 2XX Freshwater gastropod from Family Thiaridae

Photo No. 2YY. Freshwater gastropod from Family Thiaridae

Relative Abundance

Among the 12 families identified, macroinvertebrates under the Family Chironomidae are the most abundant with 24% followed by both Gerridae and Simuliidae with 13% each.

Chironomidae also called "lake flies" or "non-biting midges are the largest family of aquatic insects. Larval stages of this family are abundant in bottom of streams and lakes and are usually distinguished by their narrow bodies with pairs of anterior and posterior prolegs. Macroinvertebrates belonging in this family are indicators of poor water quality because of its tolerance to anoxic conditions. Invertebrates belonging to Family Gerridae or commonly called water striders have the ability to skate on the water surface by large groups. Their slender and long bodies have long posterior legs that enables them to glide on surface waters. These predators often prefer living in aquatic habitats with little wave action. Macroinvertebrates belonging to Simuliidae also called "black flies "are common and widespread in aquatic habitats. Prefers swift-moving waters, macroinvertebrates in this family are moderately tolerant - tolerant to low water quality and elevated nutrients such as nitrogen and phosphorus. Macroinvertebrates with the least abundance in the creek belong to Family Thiaridae with 2% abundance. This type of tropical gastropod snail has a turreted shell with an operculum.

Among the 3 stations established in the creek, Station 1 had the highest abundance of 46% followed by Station 2 with 34% and the least abundant station was Station 3 with 20% (see figure below). Most macroinvertebrate families were found in Station 1 with 10 families while the least station was station 3 with 7 identified families.

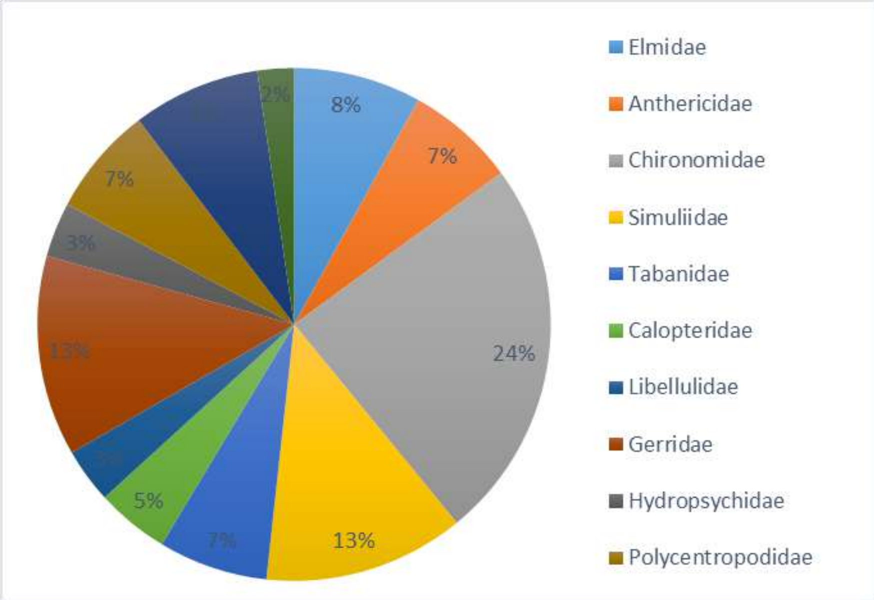


Figure 2-54. Relative abundance of macroinvertebrate families.

Station 1

A total of 40 macroinvertebrates were identified in Station 1 which is the highest among the established sampling stations. The most abundant macroinvertebrates belonged to Simuliidae with 22% followed by Chironomidae with 20% and Gerridae with 13%. Macroinvertebrates that is least abundant belonged under Tabanidae, Hydropsychidae and Libelludidae with abundance of about 2%, 3% and 5% respectively. Simullidae or commonly known as "black flies" is usually associated with slow moving streams, creeks or rivers (UF/IFFAS, 2017). Although, at its immature stages, it requires oxygenated water sources, many species of Simullidae can tolerate pollution. Other species, in fact, shows high tolerance to water pollutions (Ciadamidaro et.al, 2016). The sampling station provides ideal habitat preference for Simullidae and could be the reason why among the three sampling stations, they were found to be abundant on the first station where stream flow is faster.

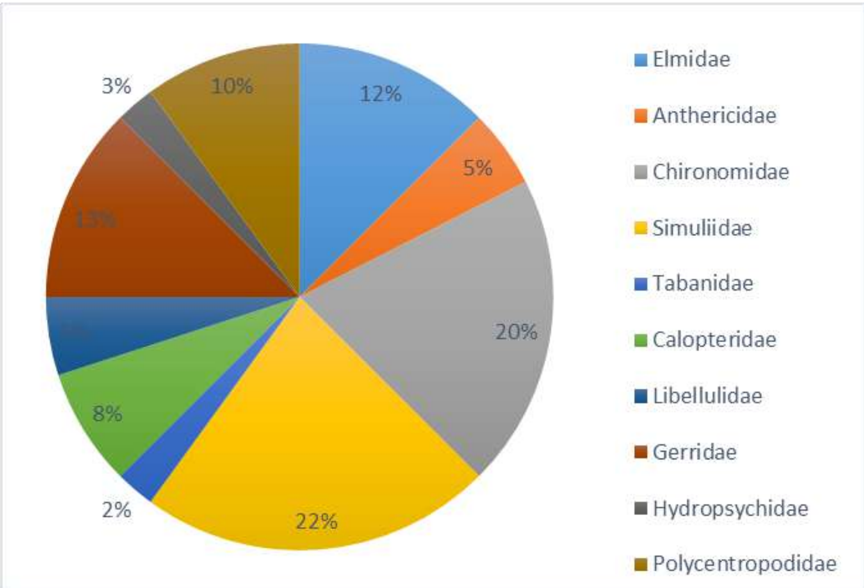


Figure 2-55. Relative abundance of macroinvertebrates per station.

Station 2

A total of 30 macroinvertebrates were collected in Station 2. Macroinvertebrates under Family Chironomidae had the highest abundance of 37% followed by both Anthericidae and Gerridae with 13% while the least abundant macroinvertebrate identified for station 2 belonged to F. Elmidae commonly or riffle beetles and F. Libellulidae or dragon flies. Abundance of Chironomidae in this area could be justified by its usual preferred habitat. Some species of this family can be commonly found in littoral zones with organic matter and muddy bottom (Butakka et.al, 2014). Its distribution, however, is not limited to standing water as characterized by Station 2 but can also be diversely found even in running waters.

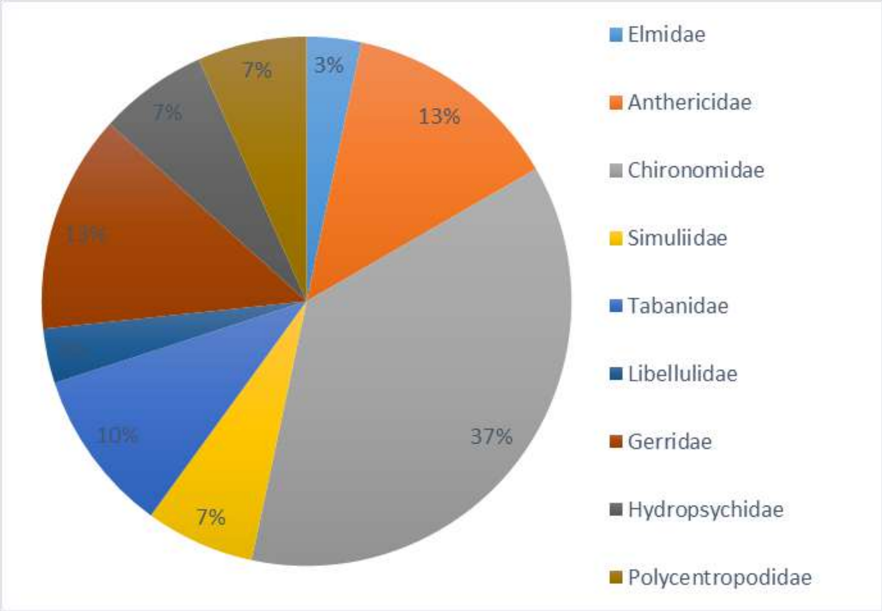


Figure 2-56. Relative abundance of macroinvertebrates in Station 2.

Station 3

Station 3 had the least number of macroinvertebrates identified with only 17 individuals belonging to 7 families. The most abundant macroinvertebrate identified and counted in this station is under order brachyura or commonly known as crabs with 40%, followed by Families Chironomidae, Gerridae and Tabaanidae each with 2%. Crabs dominate this station due to its proximity to the creek outlet where during high tides sea water enters the creek. The lowest Families in terms of abundance belong to F. Calopteridae and Elmidae both with 1% abundance.

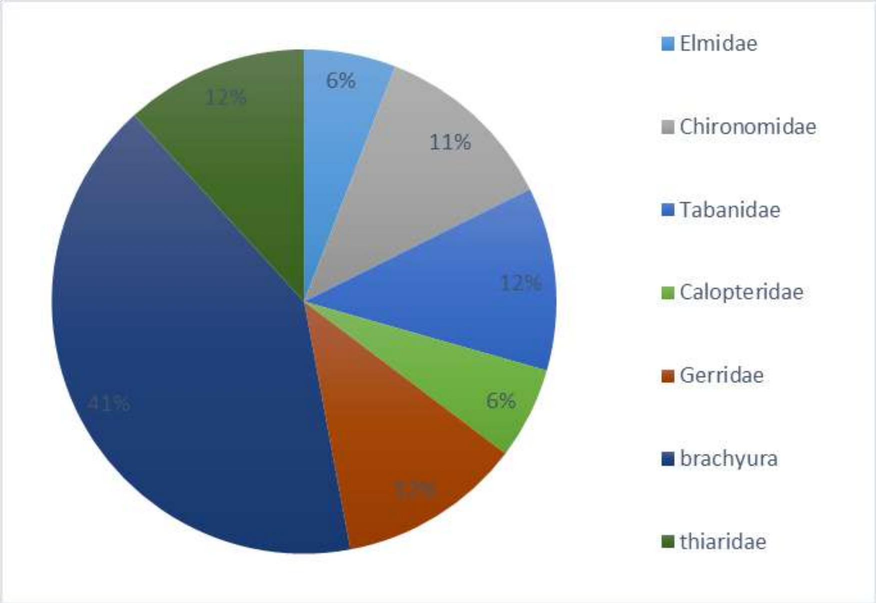


Figure 2-57. Relative abundance of macroinvertebrates in Station 3.

Family Biotic Index

Macroinvertebrates can be used as biotic indicators for water quality and organic pollution based on their tolerance and sensitivity to water quality changes in an aquatic habitat. Biotic indexes such as HBI is important in assessing water quality in a given water body. Hillsenhoff's Biotic Index (HBI) uses categorized tolerance values of each macroinvertebrate family over the total abundance of macroinvertebrates in a given sample.

Table 2-34 below shows the water quality of each sampling stations based on Hilsenhoff Field Biotic Index. Water quality for all stations established in the creek of Petra Cement Inc. is considered as "fair" with fairly significant organic pollution. This is mainly brought by the untreated domestic sewerage draining to the creek by the adjacent industrial plant across the street and the stagnant waters coming from the upstream of the project area as well as the algal blooms present in the creek caused by no flow of water due to the dry season where the sampling was done. Furthermore, the water in the area has a foul odor and some solid waste such as sachets and plastics, detergents and many more were thrown in the creek.

Table 2-34. Water quality of each stations based on Family Biotic Index (from Hilsenhoff, 1977)

Station	FBI	Water Quality	Degree of organic pollution
1	5.93	Fair	Fairly Significant organic pollution
2	5.97	Fair	Fairly Significant organic pollution
3	5.65	Fair	Fairly Significant organic pollution

a. Epilithic Microalgae

Epilithic microalgae are photosynthetic microorganisms that can live as single cells or as colonies. They form benthic algal communities on stones, rocks and other aquatic substrates. Epilithic algae communities may be used as indictors of aquatic environmental disturbance since these organisms are the primary producers for benthic feeders such as prawns and other crustaceans. Epilithic microalgae also modify nutrient exchange especially

Sampling Stations

Epilithic sampling was done at the same station as the sampling for macroinvertebrates. 3 stations were established and 2 submerged rocks from each sampling station was obtained and sampled for epilithic assemblage.

Epilithic Algae Identified

Eleven (11) species of epilithic algae were identified in Tanalan Creek, of these 9 species belonged to Phylum Bacillariaphyta commonly called Diatoms, a species each from Chlorophyta (Green Algae) and Cyanophyta (blue green algae). The following images are some of the epilithic algae identified in the area.

Table 2-35. Epilithic algae found in Tanalan Creek, Petra Cement

	Phyla	Species
Blue Green Algae	Cyanophyta	*Oscillatoria sp.*
Green algae	Chlorophyta	*Spirogyra sp.*
Diatoms	Bacillariaphyta	*Acnanthus sp.*
Diatoms	Bacillariaphyta	*Cocconeis sp.*
Diatoms	Bacillariaphyta	*Cymbopleura sp.*
Diatoms	Bacillariaphyta	*Fragellaria sp.*
Diatoms	Bacillariaphyta	*Gomphonema sp.*
Diatoms	Bacillariaphyta	*Melosira sp.*
Diatoms	Bacillariaphyta	*Navicula sp.*
Diatoms	Bacillariaphyta	*Nitzchia sp.*
Diatoms	Bacillariaphyta	*Thallasionema sp.*

Relative Abundance

A total of 601 epilithic algae were identified within the 3 stations in Tanalan Creek belonging to 11 genus. The most abundant was *Fragellaria* sp. with a percent abundance of 20% followed by Spirogyra sp. with 13% while *Navicula* sp., *Nitzchia* sp. and C*ymbapleura* sp. had 10% relative abundance each. The least abundant epilithic algae was *Thallasionema* sp. with a 5% relative abundance.

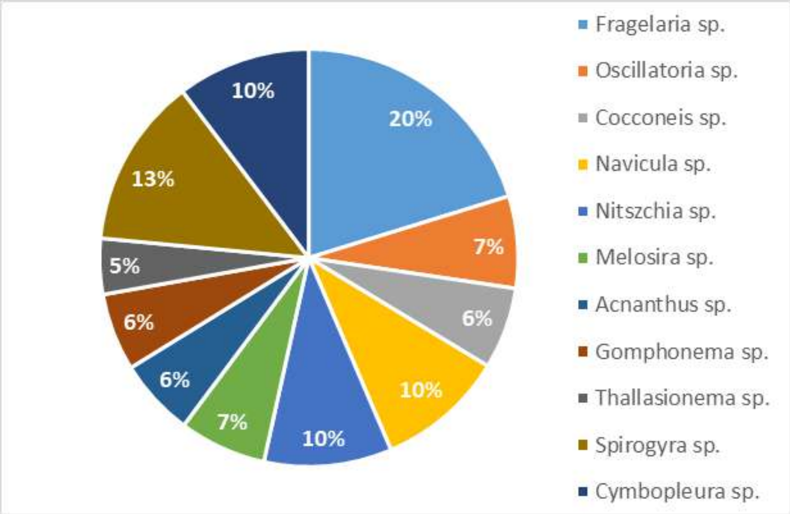


Figure 2- 58. Percent abundance of epilithic algae in Tanalan Creek, Petra Cement, Inc.

Station 1

The most abundant species of epilithic algae in Station 1 belongs to *Spirogyra sp.* with 19% followed by *Cymbopleura* sp. with 14% and *Fragillaria* sp. with 12%. *Spirogyra* sp. is a species of green algae that is under Phylum Chlorophyta that is distinguished by its "twisted" or "coiled"arrangement of cells forming long filaments that is common in most freshwater habitats. The least abundant species of epilithic algae was *Oscillatoria* sp. a green algae with 1%.

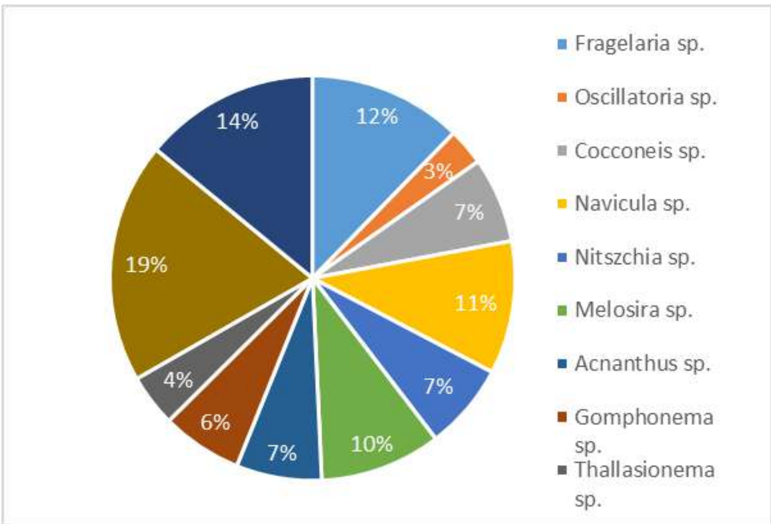


Figure 2-59. Percent abundance of Epilithic algae in Station 1 of Tnalan Creek, Petra Cement

Station 2

In station 2 the most abundant species of epilithic algae was *Fragllaria* sp. with 33% followed by *Nitzschia* sp. with 11% and *Oscillatoria* sp. with 9%. *Fragilaria* sp. is distinguished by its linear or linear-lanceolate shape that often forms "chainlike" or "ribbonlike" colonies that are both found in benthic and planktonic habitats. The least abundant algae was *Gomphonema* sp. and *Cymbopleuara* sp. with percent abundance of 4% and 5%.

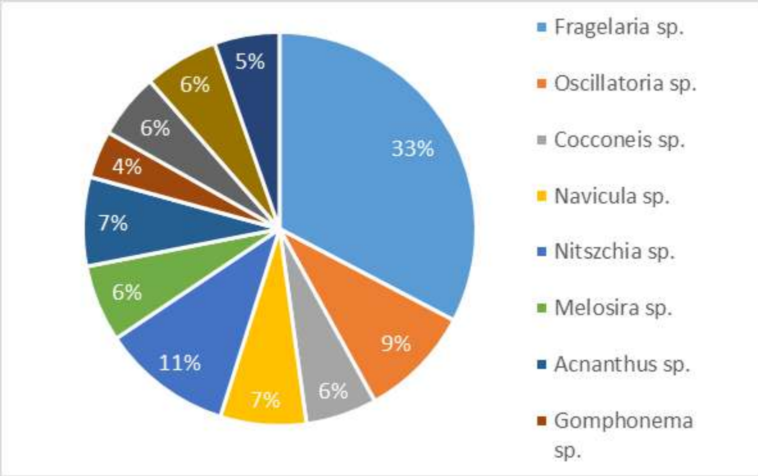


Figure 2-60. Percent abundance of epilithic algae in Station 2 of Tanalan Creek, Petra Cement, Inc.

Station 3

In Station 3 the most abundant epilithic algae belongs to *Fragelaria* sp. with 17% followed by *Nitzchia* sp. with 14% and *Navicula* sp. with 13%. *Nitszchia* sp. is a solitary elliptical diatom that often is in the benthos, it has 2 chloroplasts at the end of its cells and its raphes are diagonally opposite. The least abundant algae belongs to *Acnanthus* sp. and *Melosira* sp. with 2% each.

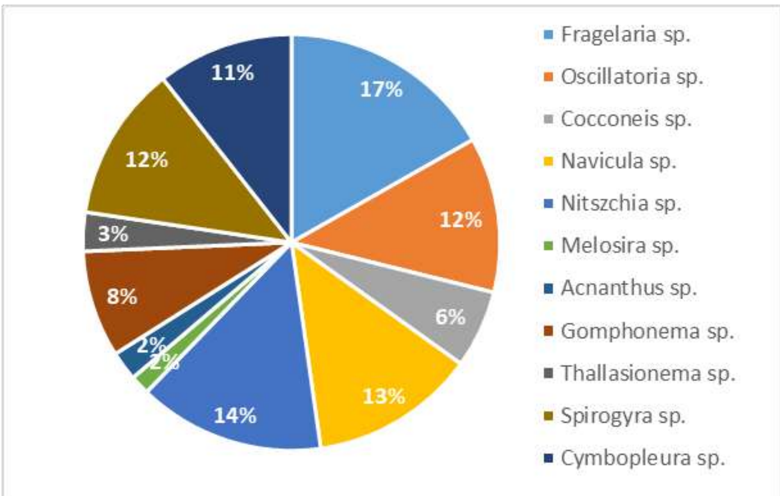


Figure 2-61. Percent Abundanc eof Epilithic algae in Tanalan Creek, Petra Cement

IMPACT ASSESSMENT AND MITIGATING MEASURES

During Construction Phase

Loss of Freshwater Habitat Along Tanalan Creek

Overburden soil stockpile which is also a possible source of sedimentation/siltation when wash away during rainy days.

Possible Erosion/Scouring along the side of the Creek

Mitigating Measures

Observed legal easement at the creek. Installation of boulders and sand bags along the easement side.

No development shall be done at Tanalan Creek except for improvement and enhance of the area for the protection of the property and the project.

During Operation Phase

Possible Contamination of the Creek

The domestic wastewater to be generated by the workers and the possible oil spill during maintenance of the machines if not property treated may contaminate the quality of creek.

Mitigating Measures

Provision for three chamber or purifying septic tank shall be constructed for primary treatment of domestic wastewater. Installation of oil and water separator shall be implemented by the proponent.

2.2.5 Marine Ecology

Marine ecology assessment was done on the coastal zone of Petra Cement. Marine resources found in the intertidal area were sampled such as the Seagrass, Macroinvertebrates, Coral cover and fishes. The map below shows the intertidal zone of the project site where stations were established for each of the marine resources. Sampling was done from May 12-14, 2018 from 6am to 12 nn. The map below, Figure 2-62 shows the intertidal zone of the project site with the stations established for each of the marine resources.

Figure 2-62 Coastal map of Petra Cement Inc. in Brgy. Irasan, P.Roxas Zamboanga del Norte

Description of Coastal Area

The coastal area of Petra Cement is part of the coast of Brgy. Lower Irasan which is part of the Sulu Sea. The whole coastal area is composed of sand. Mangrove resources were not observed in the area.

Methodology

Seagrass

The transect-quadrat method was used in the assessment of seagrass in the area. In each station two (2) 50m transect lines were placed perpendicular to the shoreline and are spaced at 40 meters apart from each other. In each transect line 2 replicate quadrats (0.25m x 0.25m) that are divided further into 25 smaller squares were placed along each transect line at 10m intervals. Seagrass species present in the quadrat were identified, percent cover were estimated and recorded using the SeagrassNet percentage cover photo guide which is based on the methods of Short et.al (2006). Species identification and classification were based on pictures and descriptions on references from Calumpong and Menez (1997) and Philipps and Menez (1988). A 0.5m x 0.5 m quadrat was used to estimate the percent cover for all species of seagrass. Density of each species of seagrass will be determined using a non-destructive technique by counting each seagrass shoot within each quadrat. For *Enhalus acoroides* species, density will be directly counted within the 0.5 x 0.5 m quadrat. Sub-sampling for density using one 0.25 x 0.25 m quadrat will be used for the density of the smaller seagrass species such as *Thalassia* sp., *Cymodocea* sp., *Haladule* sp. And *Halophila* sp. (PCA manual).

Figure 2-63 Seagrass and Macrobenthic invertebrate stations in Petra Cement inc.

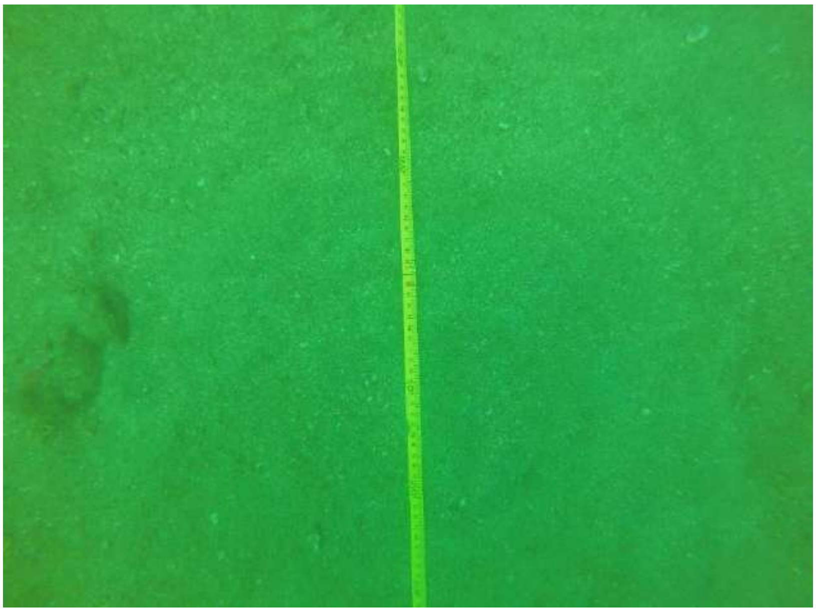


Photo No. 2ZZ. Transect line method used in seagrass assessment

Photo No. 2AAA . Quadrat method used in seagrass and macroinvertebrate sampling

Macroinvertebrates

The transect-quadrat method was used in the assessment of macroinvertebrates in the area. In each station two (2) transect (50m) were placed perpendicular to the shoreline. Quadrats (1m x 1m) were laid alternately on left and right sides of each transect line at 10m interval. All macro benthic invertebrates were identified and counted; representative samples were taken and were placed in plastic jars with 95% ethanol for preservation and further identification using the book of Shells of the Philippines (Springsteen and Leobrera, 1986), World echinoidea database (Kroh & Mooi, 2015) and A snorkler's guide to marine life of the Philippines (Goldman, 2012). Macroinvertebrate sampling was done simultaneously with seagrass sampling since they have the same sampling stations.

Corals

Video-Photo Transect survey technique was used to assess the sessile benthic community of the area using Self Contained Underwater Breathing Apparatus (SCUBA). The percent cover of the major lifeforms in the reef was translated into status categories (Gomez et al., 1981) to indicate the reef's condition. Two (2) stations with a depth of 10m-60m were established using the Global Positioning System (GPS). In each station, a transect line was laid and videography was employed to record the corals present. Identification of corals was based on the references: Veron (1993) and Allen and Steene (1999). Benthic categories identified include soft corals and hard corals

***Photo No. 2AAA -1*. Scuba used in coral and fish sampling in the coast of Brgy. Irasan,**

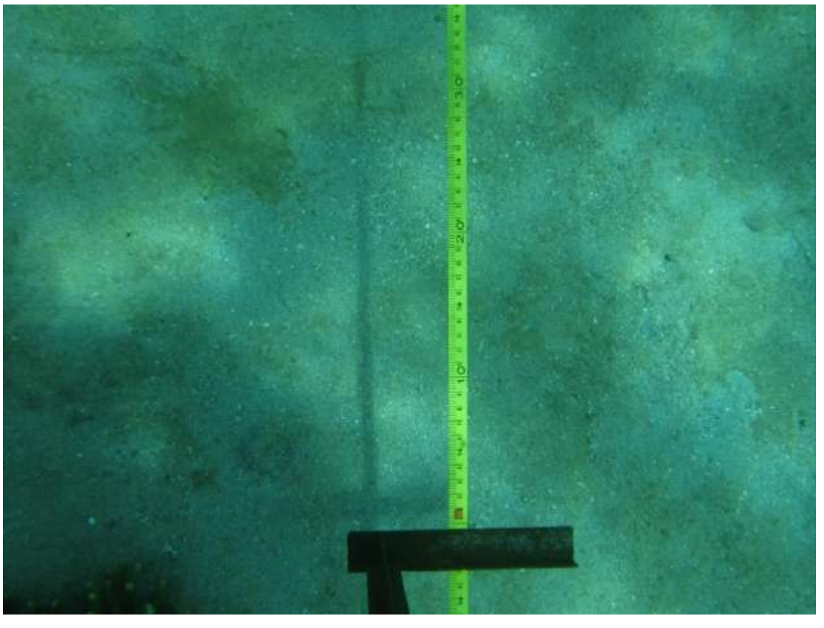


***Photo No. 2AAA-2*. Video-Photo Transect method used in Coral assessment.**

Fish communities

The reef fish communities within the sampling sites were assessed using Fish Visual Census (FVC) method adopted by English, 1997. Two (2) 50 meter transect lines were laid parallel to the shoreline. Size and count of individuals were counted by every five meters of the transect to estimate fish abundance from the actual fish count encountered along the 50 meter transect line within 2.5 meter on each side. Fish encountered were identified to species level and their size were estimated in situ to the nearest cm (English, 1997). Fish identification was identified using the book reference of Allen et al. (2003) and Fish Base (2007).

Reef fish status was determined based on the fish diversity, abundance and fish biomass using the categories describe by Nañola et al. (2006) where are coverage was computed through 1000m^2 and was exploited from 250m^2 as sampling area covered to be able to use the fish species diversity category. Fish biomass was calculated using the formula:

$$W = a*L^b$$

Where: W= weight in grams (g)
a= the multiplying factor
L= the estimated length (cm)
b= the exponent (b<1)

The specific constant *a* and *b* values used in this study were determined following the methods adopted through Fish Base (2004). For species where no constant exist, the known constant that was closely relative within the same body type, morphology were used.

Table 2-36. Categories of sites according to Fish Diversity and Abundance (Adopted from Nañola et al. (2006).

Fish Species Diversity (Species/1000m^2)				
Very Poor	Poor	Moderate	High	Very High
0-26	27-47	48-74	76-100	>100
Fish Density (Ind/1000m^2)				
0-201	202-676	677-2,267	2,268-7,592	>7,592

Table 2-37. Categories of sites according to Fish Biomass (Adopted from Nañola et al. (2006)..

Fish Biomass (MT/km^2)				
Very Low	Low	Medium	High	Very High
<5	06-10	11-20	21-40	>41

Plankton

A plankton net with a hoop radius of 15cm and a porosity of 0.44 mm was used. The net was towed vertically from 20 meters depth. Three replicate samples were collected per station. The samples were collected from the bucket into 250ml dark bottles with equal volume of five percent buffered formalin. The samples are then brought to the laboratory for identification and counting. Each 1ml sub-sample was placed on a Sedgewick rafter at a time for identification and counting. A binocular or compound microscope (4x and 10x) was used for said purpose. Taxonomic identification is based on the external morphological structures using Yamaji (1977) and Newell & Newell (1967) as references

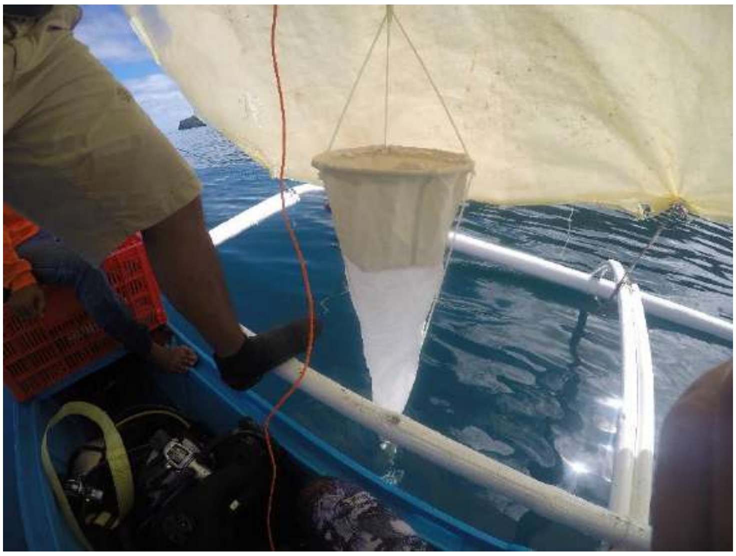


***Photo No. 2AAA-3*. Deploying of the Plankton net used in the coastal area of Petra Cemement.**

Photo No. 2AAA-4. Collection of samples from the Plankton net.

Photo No. 2BBB **Aerial view of the coastal area of Petra Cement Inc.**

Photo No. 2CCC**. Coastal waters of Petra Cement .**

Results and Assessment

Seagrass

Seagrasses are flowering plants found in shallow coastal areas that can survive saline water levels. In the Philippines, Seagrass can be divided into three families Posidoniaceae, Hydrocharitaceae and Potamogetonaceae. They form meadows by using their shoots and rhizomes that attaches to every substrate that in turn is very important in reducing sediment loads in the ocean. Since they are photosynthetic organisms they are very important in the global carbon cycle. They are also important in biodiversity and support marine organisms especially economically important fishes, crustaceans and shellfishes.

Two (2) sampling stations were established in the coastal area of the project site. In each station 2 transects were done to assess seagrass present in the area.

Table 2-38. Coordinates of the Seagrass sampling stations.

Station	Latitude	Longitude
MS 1	8°31'34.44"N	123°13'2.15"E
MS 2	8°31'32.39"N	123°13'6.84"E

Presence

Only a species (1) of seagrass was found in the two stations as shown below. This seagrass belongs to Family Hydrocharitaceae which are angiosperms that can be distinguished based on the leaves differentiated into a sheath and blade with the presence of a ligule; which is a membranous projection at the junction between the sheath and the leaf blade (Calumpong and Menez, 1997). *Halophila ovalis* commonly called "Lusay" in some parts of the Philippines has a spoon like round shape that is often found in sandy areas all over the Philippines.

Table 2-39. Seagrass species found in the coastal area of Petra Cement

Family	Species
Hydrocharitaceae	*Halophila ovalis*

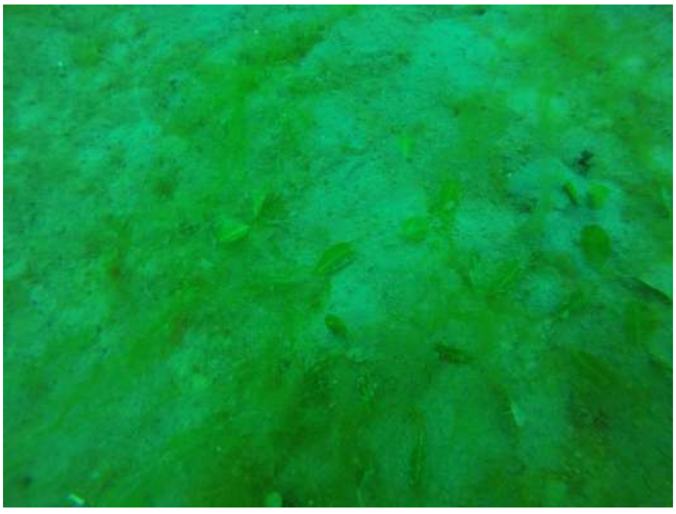


Photo 2DDD. Seagrass species Halophila ovalis observed in the habit. .

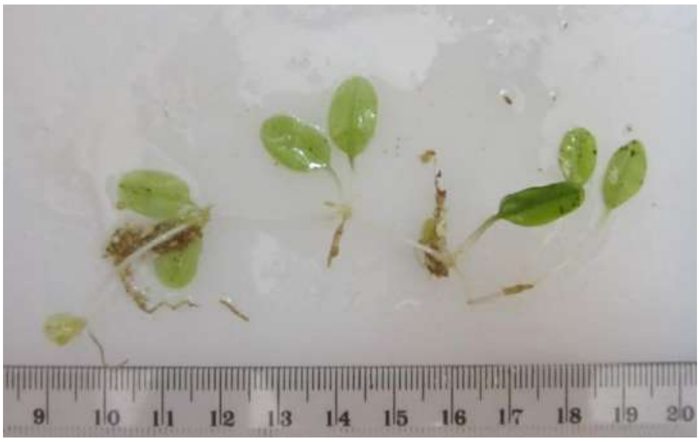


Photo 2EEE. Halophila ovalis

Seagrass Cover

Average cover of *Halophila ovalis* in the coastal area of Petra Cement is between 3%-5%. Station 2 had a higher cover of 5% as compared to station 1 with 3%.

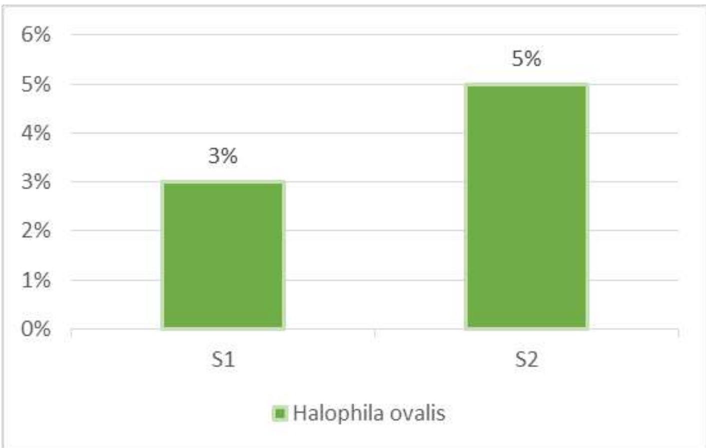


Figure 2-64 Percent cover of Halophila ovalis in the 2 stations of Petra Cement ..

Shoot Density

Average shoot density for Petra Cement is 47.5 shoots/m^2. Station 2 has a higher shoot density with about 61 shoots/m^2 compared to Station 1 with 34 shoots/m^2.

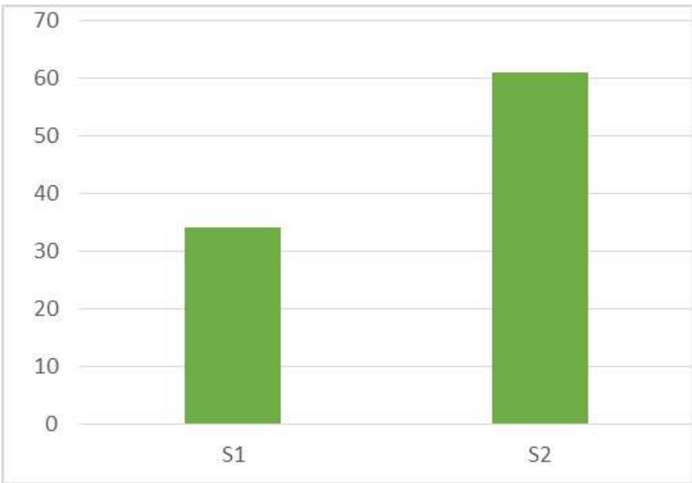


Figure 2-65. Shoot Density of Halophila ovalis .

Macroinvertebrates

Marine macrobenthic invertebrates are animals that lack backbones, but evolved strategies such as using the body's hydrostatic pressure, developed exoskeletons and shells. They comprise many groups of different organisms such as sponges, corals, worms, shells, sea urchins, starfish, crustaceans, sea cucumbers and nudibranchs. Their size ranges from tiny microscopic organisms to several meters in length, and they have an amazing diversity of form.

Many invertebrates are commercially important, such as oysters, prawns, scallops and pearl oysters and squids while corals are important in marine productivity.

Table 2-40. Macroinvertebrates sampling stations.

Station	Latitude	Longitude
MS 1	8°31'34.44"N	123°13'2.15"E
MS 2	8°31'32.39"N	123°13'6.84"E

Photo 2FFF Macroinvertebrate sampling using the transect quadrat method in the coastal area of Petra Cement .

Macroinvertebrates Identified

A total of 110 macroinvertebrates were counted in the coastal area of Petra Cement belonging to 9 species. Macroinvertebrates in Petra Cement is grouped into 3 Phyla namely: Echinoidea, Mollusca and Cnidaria. Macroinvertebrates under Phylum Echinoidea is grouped into 3 classes; Class Asteroidea where sea stars belong, Class Holothuroidea the class of the sea cucumbers and Class Echinoidea where sea urchins belong. The table below lists the species identified along with their classes and Phylums they belong. Both the two stations have macroinvertebrate species counted except for *Pterygia fenestrata* that was absent in Station 2.

Table 2-41. Macroinvertebrates identified in the coastal area near the site.

Phylum Echinodermata		
C. Asteroidea		
Archaster typicus	18	11
C. Holothuroidea		
Synapta sp.	4	2
C. echinoidea		
Diadema setosum	2	7
P. Mollusca		
C. Gastrpoda		
Cerithidea quadratum	5	9
Clanculus atropurpureus	2	1
Cypraea annulus	10	2

Cypraea eglantina	7	1
Polinices cumingianus	3	5
Pterygia fenestrata	1	
Phylum Cnidaria		
Virgularia sp.	9	11

Macroinverbtrates identified

Photo 2GGG. Species of Sea star, Archaster typicus

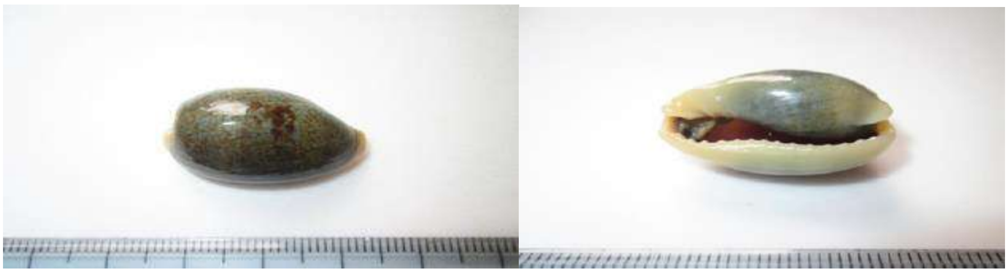


Photo 2HHH. Cypraea eglantina

Photo 2III. Cypraea annulus

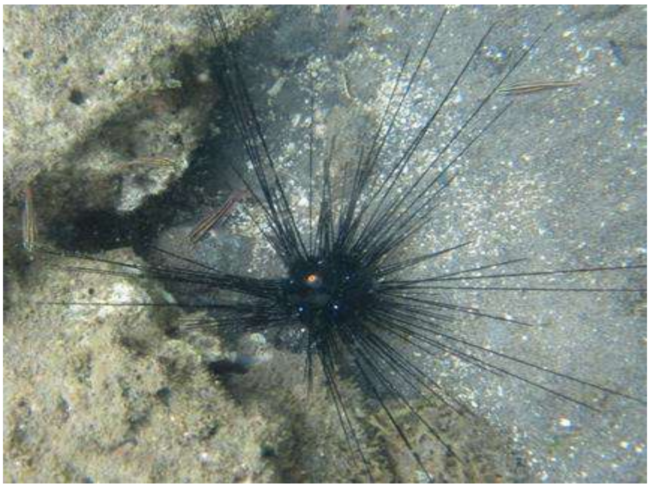


Photo 2JJJ. Diadema setosum

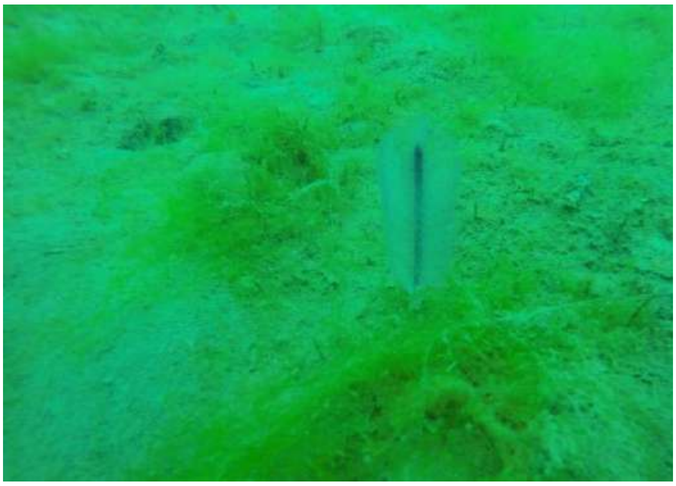


Photo 2KKK. Virgularia sp.

Station 1

In station 2 the most abundant species of macroinvertebrate is *Archaster typicus* with 30% relative abundance followed by *Cypraea annulus* of about 16% and *Virgularia* sp. with 15% out of the total sampled macroinvertebrates. *Archaster typicus* is a species of sea star that is commonly found in sandy areas. The least abundant species in station 2 are *Pterygia fenestra* with 2%, *Clanculus atropurpureus* with 3% and *Diadema setosum* also with 3%.

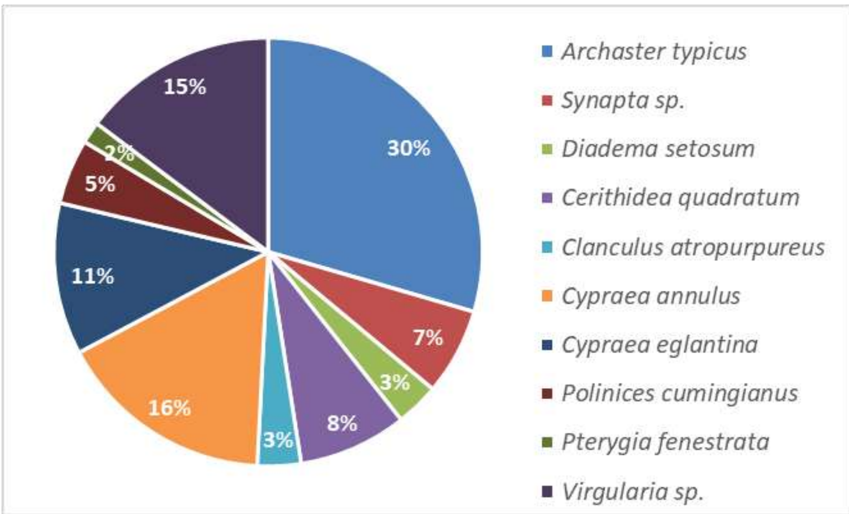


Figure 2-66. Relative abundance of macroinvertebrate species.

Station 2

In Station 2 the most abundant macroinvertebrates are *Archaster typicus* and *Virgularia* sp. both with 23% relative abundance. *Virgularia* sp. is a species of seapen that is often found in tropical areas that are sandy, belonging to the same Phylum Cnidaria with corals. These anthozoan feed on plankton and has a peduncle that is submerged in the substrate for stability. Its axial polyp is usually purple and its feeding polyps are white. The least abundant species are *Clanculus atropurpureus* and *Cypraea eglantina with a relative abundance of 2% each.*

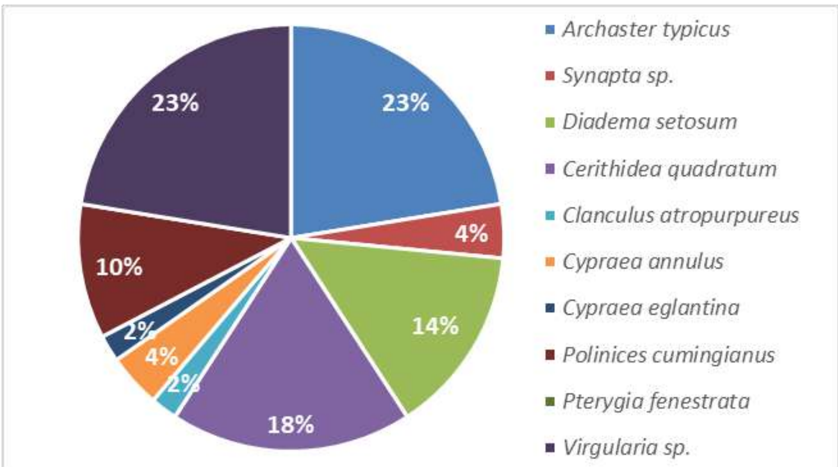


Figure 2-67. Relative abundance of macroinvertebrate species .

Corals Assemblage/ Benthic lifeforms

Corals belonging to Phylum Cnidaria are animals that form skeletons of compacted calcium carbonate. That serves as shelter and source of food for marine organisms such as fishes, molluscs, sponges and crustaceans. More abundant in tropical areas because of the water quality, they form coral reefs that are commonly found at depths shallower than 30 meters. The Philippines being part of the Coral Triangle along with Indonesia and Malaysia is known for having vast coral reef cover. In this assessment percent cover of benthic life forms were considered such as algae and abiotic for no corals were present in the area. Abiotic benthic lifeforms includes sand and silt components.

Sampling stations

Two (2) sampling stations were established in the coastal area of the project site. From the coast the divers dived to identify the coral areas but no corals were found within the areas. Station 1 (S1) is located westward near the waters of the petroleum depot and Station 2 (S2) at the east near the waters of the construction firm. Dived stations were estimated 200 meters from the beach area of Petra Cement.

Table 2-42. Stations for benthic lifeform assessment.

Station	Latitude	Longitude
FC 1	8°31'48.94"N	8°31'48.94"N
FC 2	8°31'44.23"N	123°13'11.57"E

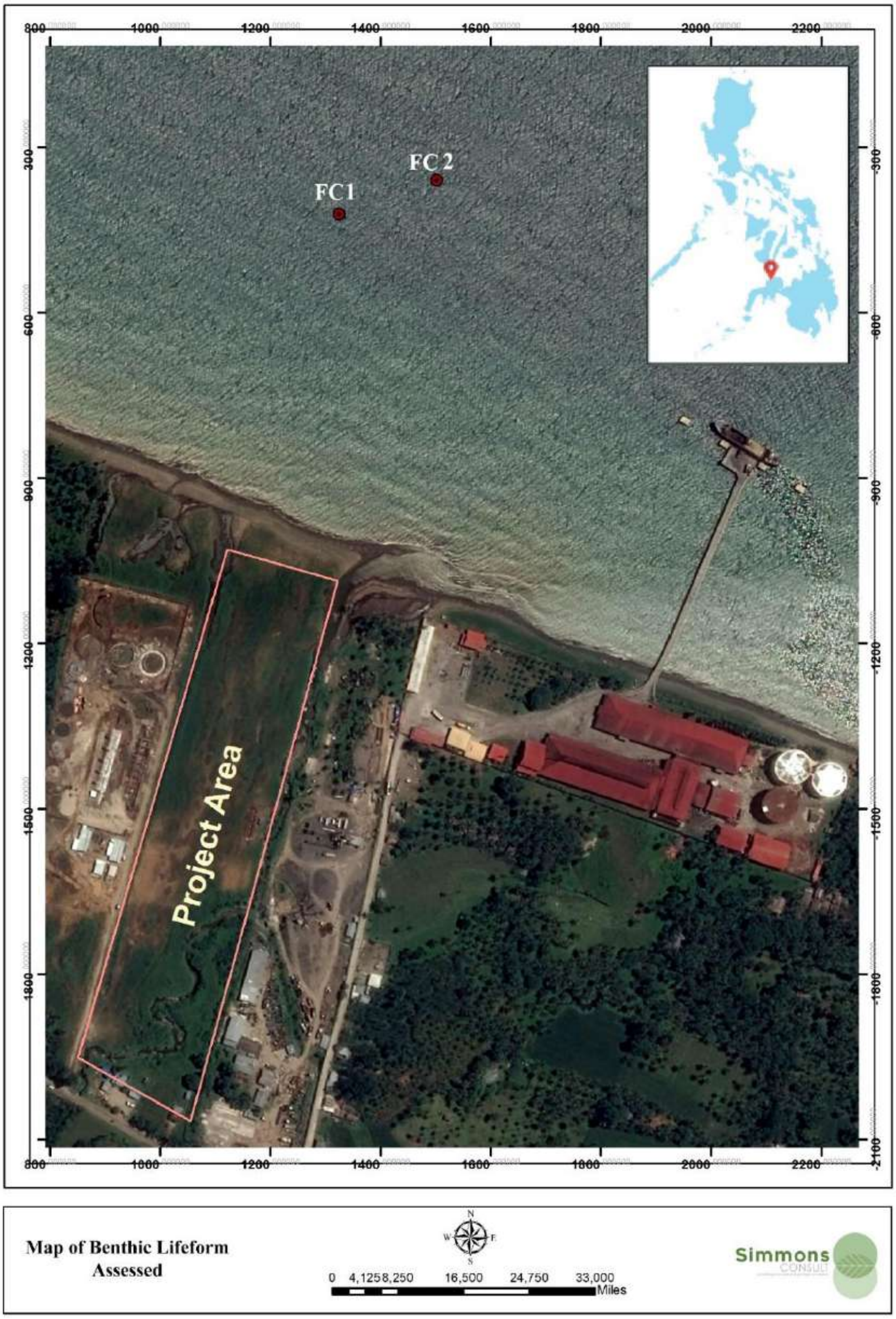


Figure 2-68. Sampling stations where benthic lifeform assessment was conducted.

Photo 2-LLL First dive at Station 1.

Presence of Benthic Lifeform

Major life forms near the proposed area were identified by percent cover. Major life forms identified were algae, patches of seagrass and the abiotic. No corals were identified in both areas whose substrate is composed of sand and silt. Algal assemblage usually a group of *Enteromorpha* sp. Abiotic cover includes sand and silt.

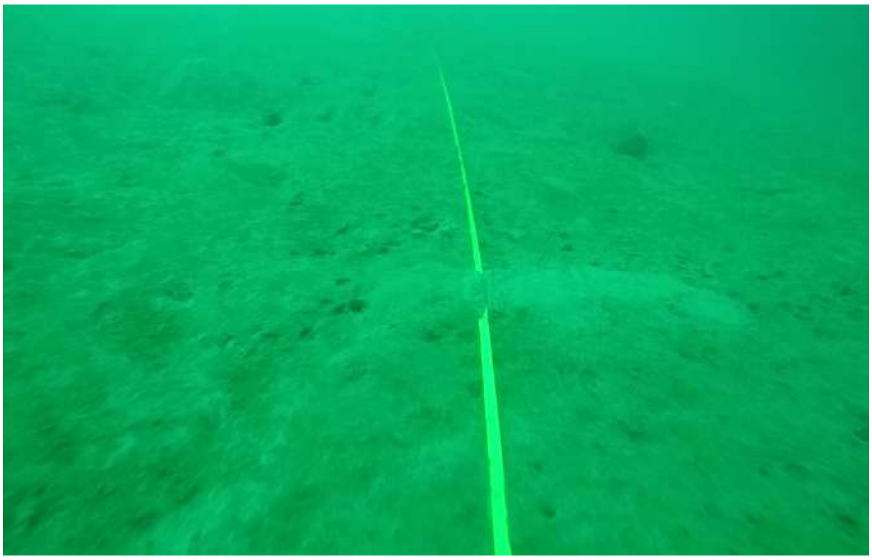


Photo 2MMM. Transect located in Station 1

Photo 2-NNN. Substrate in Station 1 which is composed of sand and silt.

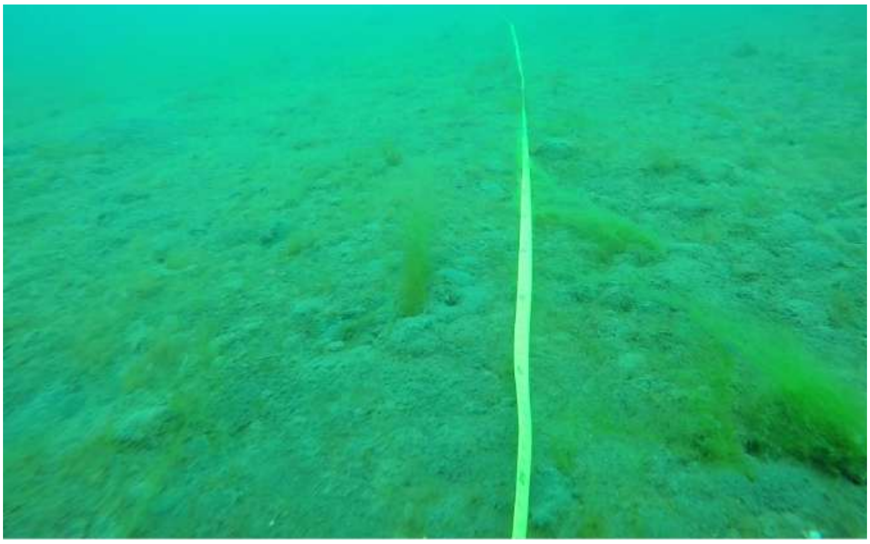


Photo 2-OOO. Transect in Station 2 .

Cover

The assessed areas are composed of abiotic mixture of sand and silt that covers 82% of the substrate. Followed by Algae that covers around 18 % only a species of algae *Enteromorpha* sp. is present in both stations covered.

Photo 2PPP. Substrate in Station 2.

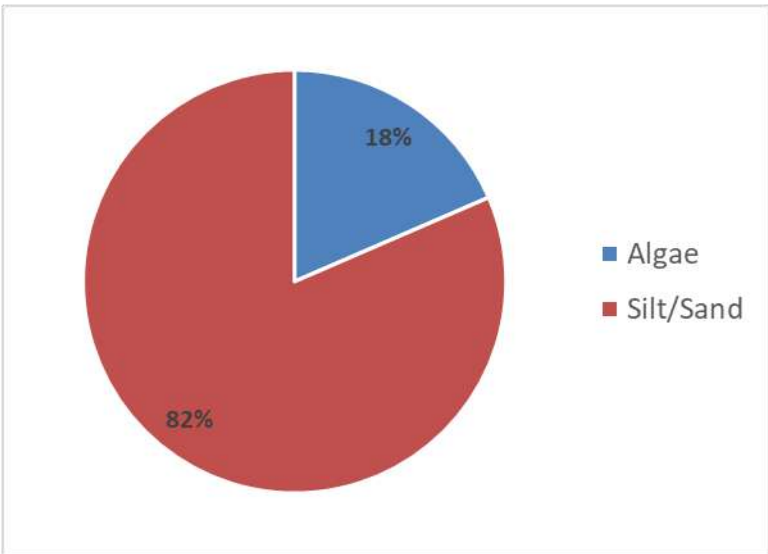


Figure 2-69. Average percent Cover of benthos.

Fish

Fishes, inhabitants of the reef occur in schools of up to thousands of individuals. Often identified based on their striking colors, shapes and patterns in their bodies. Fishes are major components of total biodiversity in the ocean and contribute to the overall value of coral reefs (Bellwood & Hughes, 23001). Their importance in the food chain is enormous that elimination or rapid decrease of them would create devastating effect, not just on the realm of marine ecology but to the overall economy of any archipelagic country such as the Philippines.

Reef fish assessment was conducted simultaneous with coral reef survey following the underwater fish visual census described in Uychiaoco et. Al (2001) with modification.

Photo 2QQQ. Fish Visual Census in Petra Cement

Sampling stations

Two (2) sampling stations each with 2 transects were laid in the area. The location of the sampling stations are the same with the coral stations mostly because most fish are present in coral areas.

Table 2-43. Stations for fish assemblage.

Station	Latitude	Longitude
FC 1	8°31'48.94"N	8°31'48.94"N
FC 2	8°31'44.23"N	123°13'11.57"E

Photo 2RRR. Station 1 near the adjacent gas depot's pier.

Photo 2SSS. Station 2, Petra Cement Inc.

Species Richness

A total of 38 fishes were counted in the fish survey and were identified into 12 species these species belonged to five (5) families: Labridae, Mullidae, Pomacentridae, Pomacanthidae and Synodontidae (see table below). The most abundant family belongs to Family Pomacentridae with 8 species. Most of the species identified were further classified into target, indicator and demersal fishes. Fishes classified into target species are those who are of high value and economically important as source of food while Demersal are those species which live and feed at the demersal or bottom part of the sea. A third classification called indicator species are species of fish which represents the condition and trait of the area or environment. In this study, no Indicator species were identified. In the figure below, the number of fishes classified as target and demersal were shown. In station 1, 19 species were classified as demersal while in Station 2 the number of demersal species was lower with 15. For target species Station 1 has about 4 species while none was found in Station 2. It should be noted that the coastal area has no coral assemblage that can be a habitat for fishes.

Table 2-44. Fish species identified in the coastal area of the project site.

Species	Family
Thalassoma lunare	Labridae
Parupeneus indicus	Mullidae
Amblyglyphidodon curacao	Pomacanthidae
Amphiprion frenatus	Pomacentridae
Amphiprion perideraion	Pomacentridae
Centropyge vroliki	Pomacentridae
Dascyllus trimaculatus	Pomacentridae
Pomacentrus amboinensis	Pomacentridae
Pomacentrus auriventris	Pomacentridae
Pomacentrus brachialis	Pomacentridae
Pomacentrus moluccensis	Pomacentridae
Synodus variegatus	Synodontidae

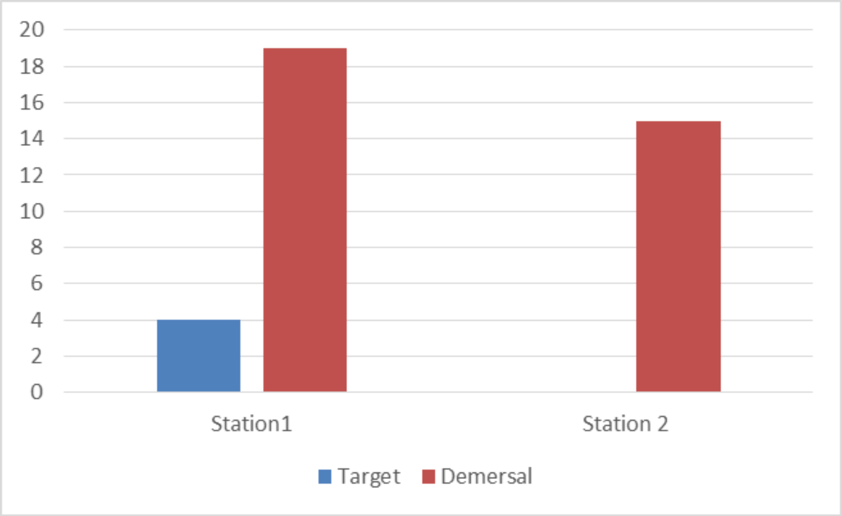


Figure 2-70. Total demersal and target fishes identified in the 2 sampling stations.

Fish Biomass

The total fish biomass estimates of the 38 individual fishes for the two (2) sampling stations is 1.59 grams/500m with total fish weight of 797.86 grams. Station 1 had a higher biomass of 1.54 g/500 than station 2 with 0.05 g/500m.

In all the coral transects done the absence of corals equals less number of reef fishes, because fish has nowhere to shelter. Only pelagic fish maybe present, but during the assessment, no presence was found.

Table 2-45. Fish biomass per station in the coastal area of the project site.

	ni	Weight	Biomass
		(grams)	gram/500
S2	**15**	**26.70**	**0.05**
S1	23	771.16	1.54

Plankton

Life in the sea can be divided into three basic groups: The benthos, the nekton and the plankton. The benthos are life in the sea bottom where corals and sponges are present; the nekton are pelagic swimming animals like fishes and whales while the plankton are drifting plants and animals in the water column. Phytoplankton are the single celled, photosynthetic microscopic organisms that are the most abundant primary producers present in both freshwater and marine environments. Zooplankton are the heterotrophic animal component of the plankton usually composed of copepods and larval stages of invertebrates. They are the primary consumers of Phytoplankton in the aquatic ecosystem and they serve as food for higher trophic levels especially fishes.

Three (3) sampling stations were done to assess the plankton community in the coastal area of the project site.

Table 2-46. Plankton sampling stations.

Station	Latitude	Longitude
Station 1	8° 31' 39.254" N	123° 13' 11.275" E
Station 2	8° 31' 39.436" N	123° 13' 7.447" E
Station 3	8° 31' 42.400" N	123° 13' 4.857" E

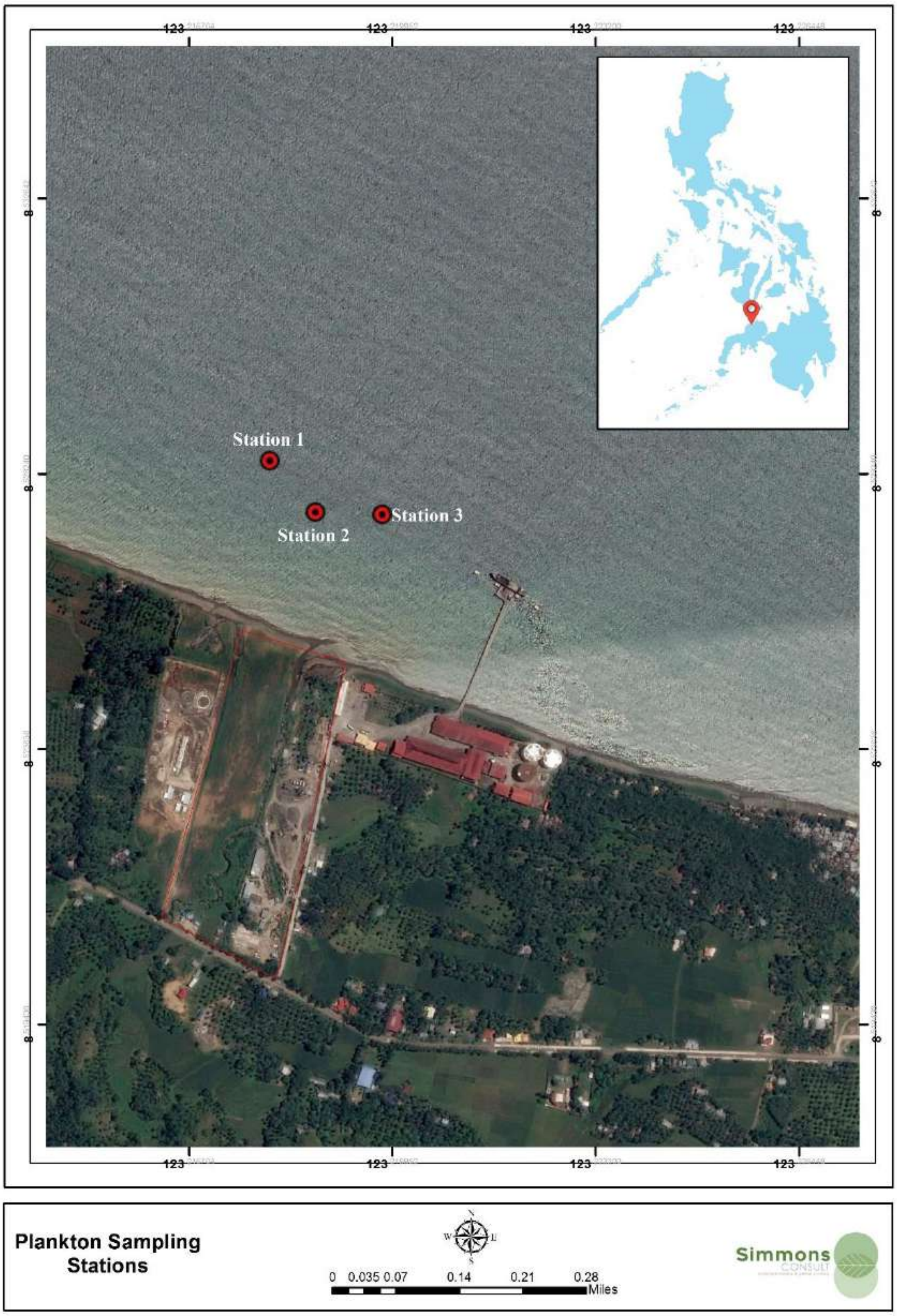


Figure 2-71. Map of the plankton sampling stations in Irasan.

Species Identified

Phytoplankton

A total of 8 species of Phytoplankton were identified in the coastal area of Petra Cement Inc. belonging to two Phyla, Phylum Baccillariophyta and Phylum Protozoa. Four species were under Phylum Baccillariophyta or commonly called as Diatoms; phytoplankton that have yellow-brown chloroplasts that enables them to photosynthesize. The species are *Biddulphia sp., Chaetoceros* sp., *Cosconodiscus* sp. and *Rhizosolenia* sp. There were also four species of phytoplankton belonging to Phylum Protozoa or commonly called Dinoflagellates due to the presence of a transverse flagellum. Compared to diatoms, dinoflagellates are able to grow under low nutrient waters and blooms in favorable nutrient conditions thus sometimes causing red tides that are harmful to marine life especially fishes. Phytoplankton belonging to dinoflagellates include Ceratium sp., *Dinophysis* sp., *Ornithocercus* sp.and *Peridinium* sp. the figure below shows the classification of Phytoplankton identified in the area with their corresponding Phyla and class.

Phylum Baccillariophyta

Class Bacillariophyceae

Biddulphia sp.

Chaetoceros sp.

Cosconodiscus sp.

Rhizosolenia sp.

Phylum Protozoa

Class Chromanadea

Order Dinoflagellida

Ceratium sp.

Dinophysis sp.

Ornithocercus sp.

Peridinium sp.

Phytoplankton identified in the coastal area of Petra cement inc.

Zooplankton

A total of fourteen (14) species of zooplankton were identified in the coastal area of Petra cement that belongs to 4 phyla: Arthropoda, Mollusca, Protochordata and Protozoa. Zooplankton that belonged to Phylum Arthropoda includes 4 species of copepods *Acartia* sp., *Calanus* sp. ,*Oncaea* sp. and Nauplius larva of copepods. Only a species of zooplankton under Phylum Mollusca was identified and it was a veliger larva of a gastropod. Also a species of Oikopleura was only identified under Phylum Protochordata. The phyla with the most number of species identified belongs to Phylum Protozoa that includes the three groups foraminiferans, radiolarians and tintinnids with 8 species.

P. Arthropoda

Class Crustacea

Acartia sp.

Calanus sp.

Oncaea sp.

Nauplius larva

P. Mollusca

O. Gastropoda

Veliger larva

P. Protochordata

Class Urochordata

Oikopleura sp.

P. Protozoa

Class Ciliata

Order Tintinnida

Amphilithium sp.

Amphorellopsis sp.

Favella sp.

Codonellopsis sp.

Parafavella sp.

Tintinnopsis sp.

Order Radiolaria

Ampilonche sp.

Order Foraminifera

Globigerina sp.

Classification of Zooplankton species identified in Petra cement.

Phytoplankton

Diatoms

Photo 2TTT. Coscinodiscus sp.

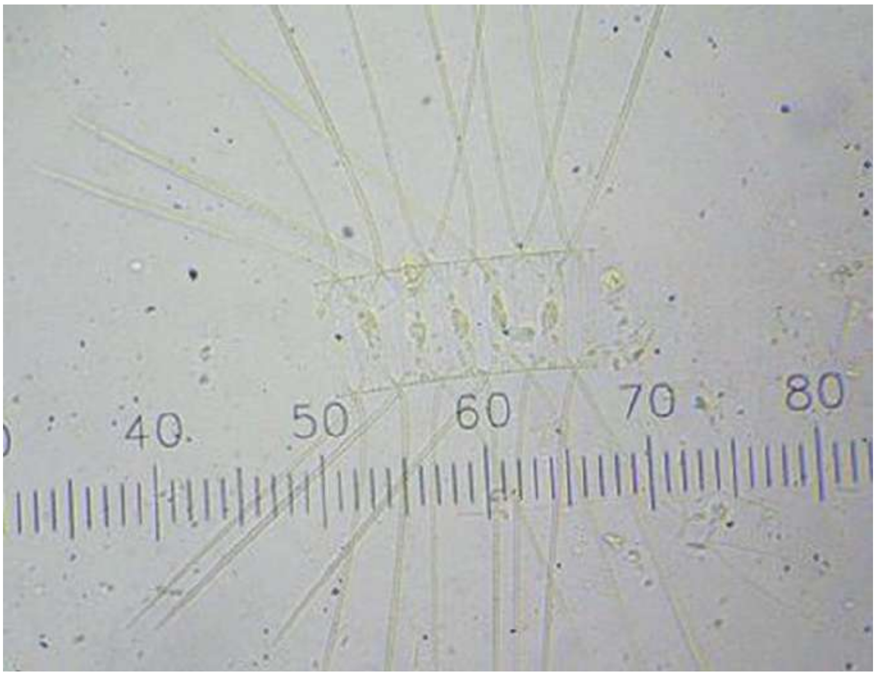


Photo 2UUU. Chaetocerus sp.

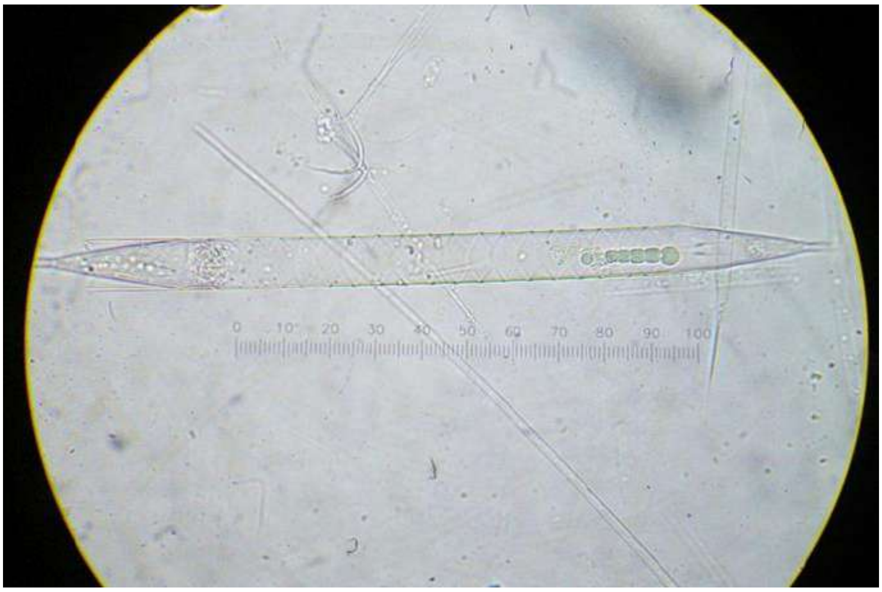


Photo 2VVV. Rhizosolenia sp.

Dinoflagellates

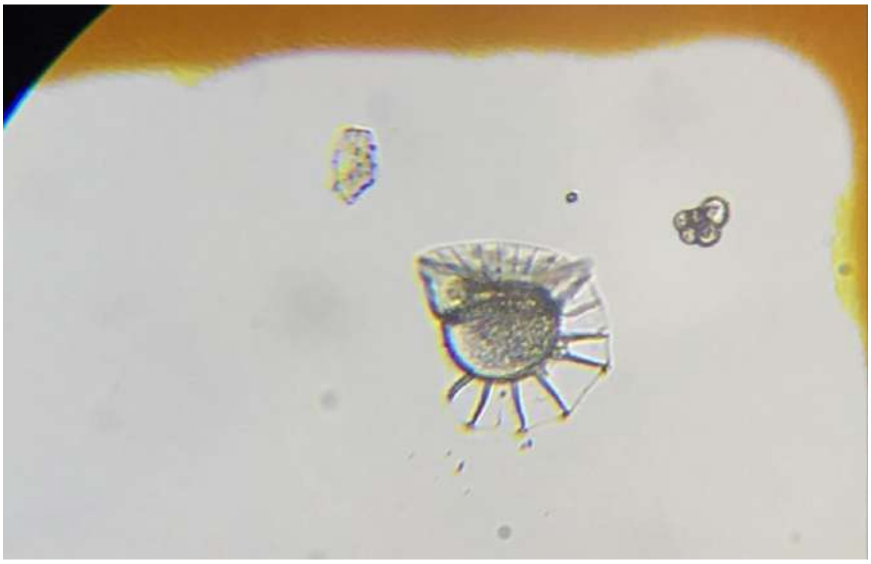


Photo 2WWW. Ornithocercus sp.

Photo 2XXX. Peridinium sp.

Photo 2YYY. Ceratium sp.

Zooplankton

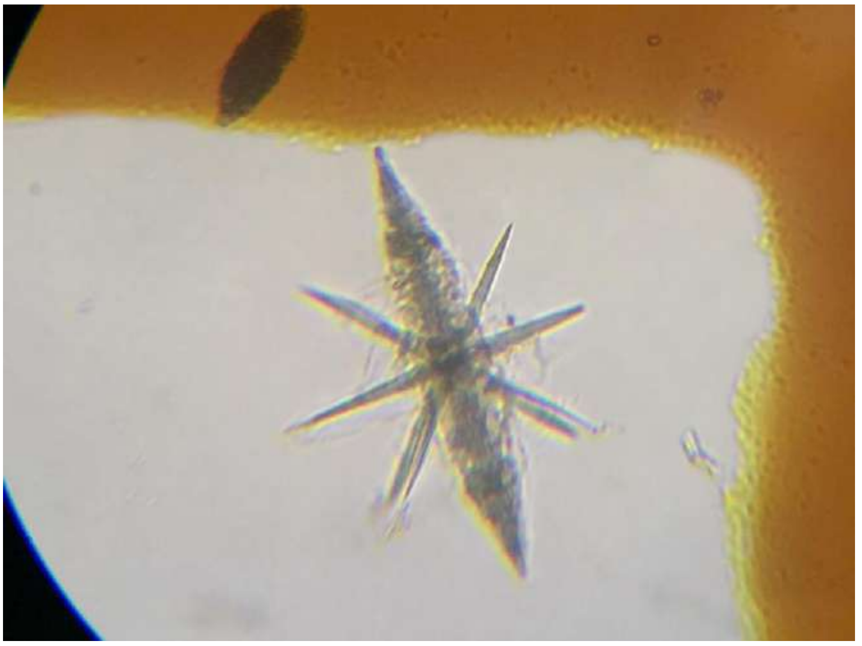


Photo 2ZZZ. Species of radiolarian Amphilonche sp.

Photo 2aaaa. Species of Tintinnid, Favella sp.

Photo 2bbbb. Veliger larvae.

Photo 2cccc. Acartia sp.

Photo 2dddd. Calanus sp.

Photo 2eeee Nauplius larva

Cell Density

Phytoplankton

Phytoplankton identified in the coastal area of Petra cement had average total cell density of 148 cells/10L. The station with the highest total cell density is station 2 with 176 cells/10L, followed by station 1 with 163 cells/10L and the least was in station 3 with 105cells/10L. The species with the highest cell density belongs to *Chaetoceros* sp. a diatom with 43 cells/10L followed by *Ceratium* sp. a dinoflagellate with a cell density of 36cels/10L. The lowest cell density belonged to diatoms *Biddulphia* sp. with 3 cells/10L followed by *Rhizosolenia* sp. with 5 cells/10L and *Bacteriastrum* sp. with 8 cells/10L .

Table 2-47. Phytoplankton Cell density per station in the coastal area of Petra Cement Inc.

Species	Station 1 (cells/10L)	Station 2 (cells/10L)	Station 3 (cells/10L)	Average Cell Density (cells/10L)
***Bacteriastrum* sp.**	0	6	16.5	8
***Biddulphia* sp.**		4.5	0	3
***Ceratium* sp.**	51	25.5	31.5	36
***Chaetoceros* sp.**	39	81	9	43
***Cosconodiscus* sp.**	6	19.5	12	13
***Dinophysis* sp.**	19.5	13.5	7.5	14
***Ornithocercus* sp.**	28.5	0	9	13
***Peridinium* sp.**	9	18	19.5	16
***Rhizosolenia* sp.**	7.5	7.5	0	5
Total Cell density	163	176	105	148

Zooplankton

The average total cell density of zooplankton in Petra cement is 187 cell/10L. The station with the highest cell density belongs to Station 2 with 224 cells/10L followed by station 3 with 206 cells/10L and the least Station 1 with 132 cells/10L. The species with the highest cell density are the Nauplius larva with 50 cells/10L followed by *Codonellopsis* sp. with 32 cells/10L and *Favella* sp. 22 cells/10L. Among the arthopods the nauplius larva had the highest cell density for all 3 stations but the species *Calanus* had the highest cell density among the adult copepod with 16 cells/10L. The zooplankton with the least cell density belongs to the radiolarian *Ampilonche* sp. with 1 cell/10L followed by the protochordate Oikopleura sp. with 4 cells/10L.

Table 2-48. Zooplankton Cell density per station in the coastal area of Petra Cement Inc.

Species	Station 1 (cells/10L)	Station 2 (cells/10L)	Station 3 (cells/10L)	Average Cell Density (cells/10L)
Acartia sp.	6	23	11	13
***Amphilithium* sp.**	0	6	8	5
***Amphorellopsis* sp.**	8	6	5	6
Ampilonche sp.	3	0	0	1
***Calanus* sp.**	18	24	6	16
***Codonellopsis* sp.**	23	20	54	32
***Favella* sp.**	3	8	54	22
***Globigerina* sp.**	0	12	2	5
Nauplius larva	38	60	53	50
***Oikopleura* sp.**	8	5	0	4
***Oncaea* sp.**	14	0	9	8

***Parafavella* sp.**	8	17	0	8
***Tintinnopsis* sp.**	0	24	0	8
Veliger larva	6	21	6	11
Total Cell Density	132	224	206	187

2.2.5.1 Threat To Existence And/Or Loss Species Of Important Local And Habitat

Based on the results of the marine ecology in the area, at the time the inventory and study was conducted, with the on-going development of port facility in the area, there are no important local and habitat species identified, therefore, no threat to existence being considered.

2.2.5.2 Threat To Abundance, Frequency And Distribution Of Species

Since the project entails grinding and mixing to produce cement finished products, machines area installed at the land area of the private property, there will be no identified threat in terms of frequency and abundance to any identified current species when the project becomes operational.

Seagrass

The seagrass species identified in this study was classified as least concern in the International Union for Conservation of Nature (IUCN) red list of threatened species.

Conservation Status

The seagrass species identified in this study was classified as least concern in the International Union for Conservation of Nature (IUCN) red list of threatened species.

Table 2-49. Conservation status of seagrass identified in the coastal area.

Species Name	Family	IUCN Conservation Status
Halophila ovalis	Hydrocharitaceae	Least Concern

<u>Macroinvertebrates</u>

Relative abundance

A total of 110 macroinvertebrates individuals were collected and were classified into 10 species. These species belonged to 5 classes and further in 3 Phyla. The most abundant macroinvertebrates identified belonged to Class Gastropoda which can be characterized by a single shell as represented by *Cypraea annulus* with 42% followed, Class Asteroidea where sea stars such as *Archaster typicus* were abundant with 26%. Class Anthozoa had a relative abundance of 18%, Class Echinoidea where species of *Diadema setosum* were most abundant. The least abundant macroinvertebrates were identified under Class Holothuroidea with 6%.

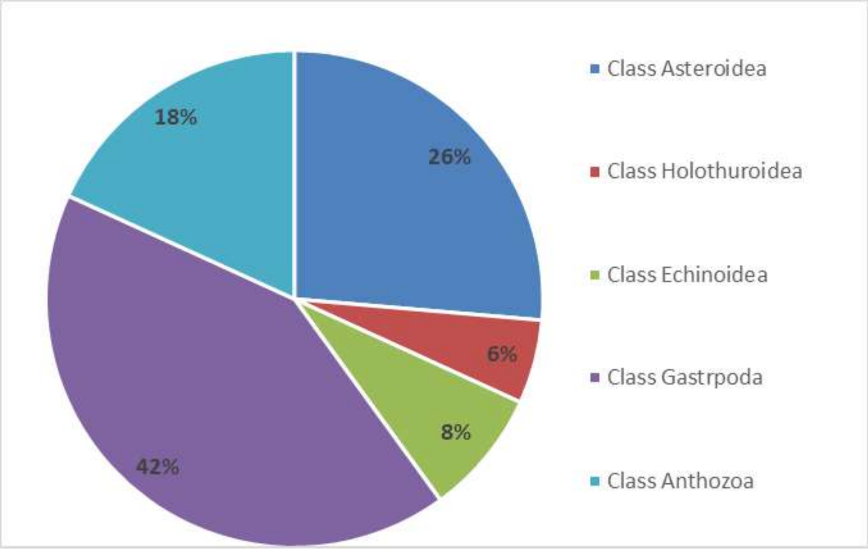


Figure 2-72. Relative abundance of macroinvertebrates per class in the coastal area of Petra

Conservation Status

The 10 species of macroinvertebrates identified in the area were not yet assessed in the IUCN red list.

Table 2-50. Macroinvertebrates identified in the coastal area near the project site.

Species Name	IUCN Conservation Status
Archaster typicus	not yet assessed
***Cerithidea* quadratum**	not yet assessed
Clanculus atropurpureus	not yet assessed
Cypraea annulus	not yet assessed
Cypraea eglantina	not yet assessed
Diadema setosum	not yet assessed
Polinices cumingianus	not yet assessed
Pterygia fenestrata	not yet assessed
Synapta sp.	not yet assessed
***Virgularia* sp.**	not yet assessed

Corals Assemblage/ Benthic lifeforms

Presence of Benthic Lifeform

Major life forms near the proposed area were identified by percent cover. Major life forms identified were algae, patches of seagrass and the abiotic. No corals were identified in both areas whose substrate is composed of sand and silt. Algal assemblage usually a group of *Enteromorpha* sp. Abiotic cover includes sand and silt.

Fish

Fish Abundance

The figure below is the fish abundance of the five families identified. The most abundant family of fishes belonged to Family Pomacentridae with 79% fishes followed by Labridae with 6% while the least abundant familes belong to Mullidae, Pomacanthidae and Synodontidae all with an abundance of 5% as shown in the figure below.

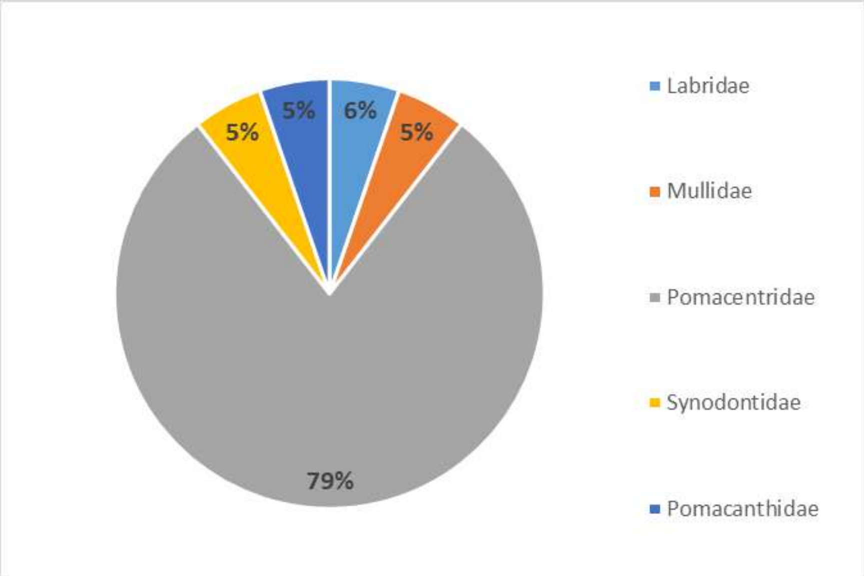


Figure 2-73. Relative abundance of fishes families.

Plankton

Relative abundance

Phytoplankton

Station 1

A total of 654 phytoplankton were counted in station 1 that were identified into 8 species. As discussed earlier phytoplankton identified composed of diatoms and dinoflagellates. The most abundant species of phytoplankton was the species *Ceratium* sp. a dinoflagellate with 31% followed by a diatom *Chaetocercus* sp. with 24% and *Ornithocercus* sp. with 17% relative abundance. The lowest phytoplankton relative abundance belonged to the diatom *Biddulphia* sp. with 2% followed by another diatom *Coscinodiscus* sp. with 4% and both dinoflagellates *Dinophysis* sp. and *Peridinium* sp. with 5% relative abundance each.

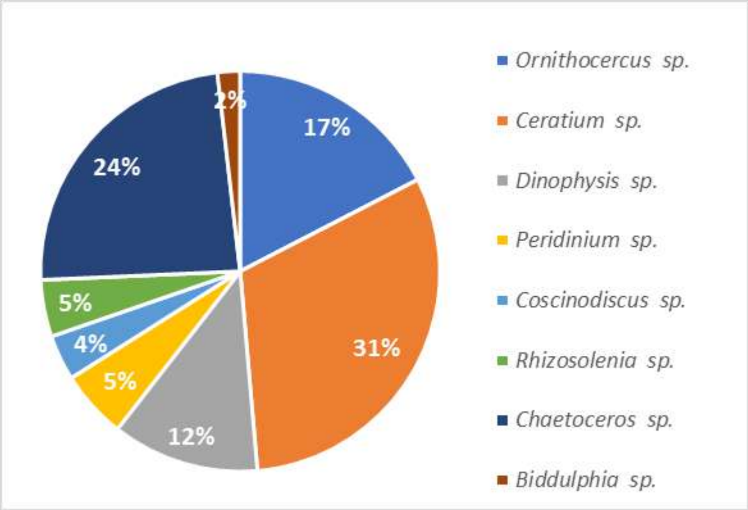


Figure 2-74. Relative abundance of Phytoplankton in Station 1 of the coastal area of Petra cement.

Station 2

A total of 702 phytoplankton were counted in station 2 that were identified into 8 species. Compared to Station 1, this station has more phytoplankton but still has the same number of species identified. The most abundant species is a centric diatom *Chaetocerus* sp. comprising 46% of the relative abundance for the whole station followed by *Coscinodiscus* sp. 11% and a dinoflagellate *Peridinium* sp. with 10% abundance. The lowest relative abundance for the whole station belonged to *Biddulphia* sp. and *Bacteriastrum* sp. whith both having a relative abundance of 3% followed by the only pennate diatom identified *Rhizosolenia* sp. with 4%.

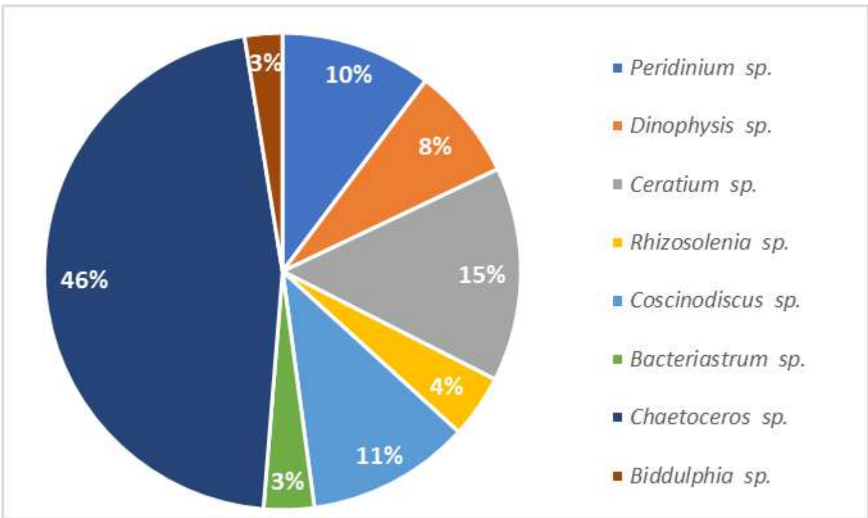


Figure 2-75. Relative abundance of Phytoplankton in Station 2 of Petra cement.

Station 3

A total of 420 phytoplankton were counted in station 3 that were further identified into 7 species. Compared with the other 2 stations this station had the least number of phytoplankton counted and the least species identified with only 7. The most abundance phytoplankton for this station belonged to *Ceratium* sp. with 30% followed by *Peridinium* sp. with 19% and *Bacteriastrum* sp. with 16%. The lowest phytoplankton species identified in this station belonged to *Dinophysis* sp. a dinoflagellate with 7% followed by *Ornithocercus* sp. with 8% and *Chaetoceros* sp. with 9%.

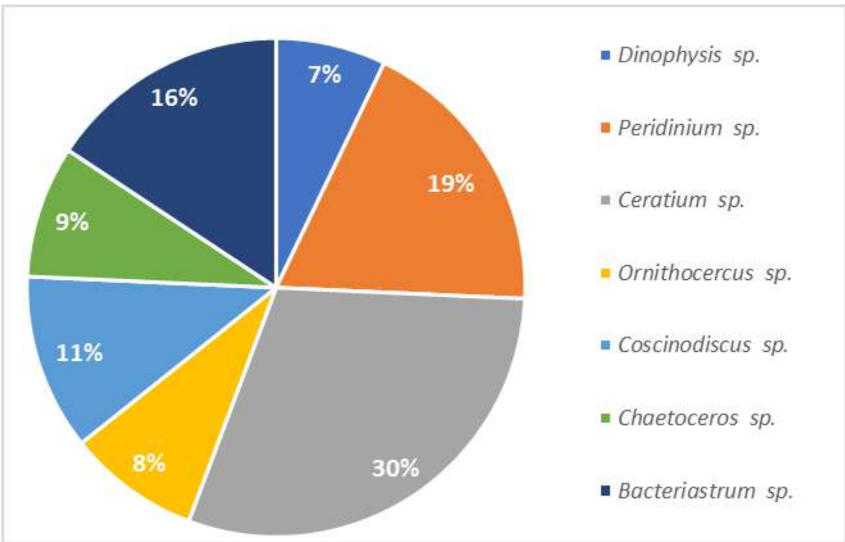


Figure 2-76. Relative abundance of Phytoplankton in Station 3 of Petra cement.

Zooplankton

Station 1

A total of 528 zooplankton were counted in station 1 that were identified into 11 species. The most abundant zooplankton in station 1 is under Phylum Arthropoda and identified as Nauplius larva the larval stage of most copepods with 28% followed by a protozoan tintinnid *Codonellopsis* sp. with 17% and another copepod *Calanus* sp. with 14%. The least abundant zooplankton in this station belongs to *Ampilonche* sp. the only radiolarian under Phylum Protozoa identified in the area with 2% followed by Acartia sp. with 4% and the veliger larval stage of gastropods with 5%.

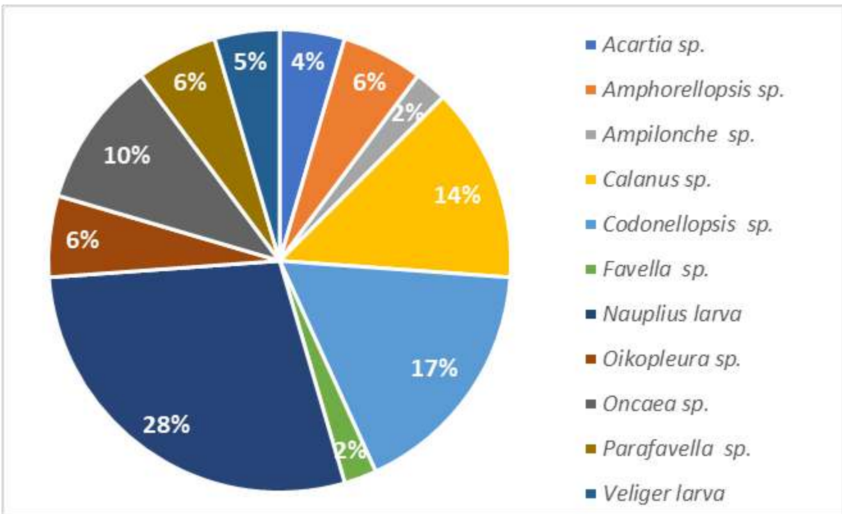


Figure 2-77. Relative abundance of zooplankton in Station 1 of Petra Cement.

Station 2

Zooplankton counted in Station 2 totaled to 894 and were identified into 12 species. The most abundant species of zooplankton identified in this station is under Phylum Arthropoda represented by Nauplius larva the larval stages of most arthropods under order Copepoda. The second abundant zooplankton identified in the station belongs to *Tintinnopsis* sp. again a protozoan under order Tintinnopoda and *Calanus* sp. with 11%.

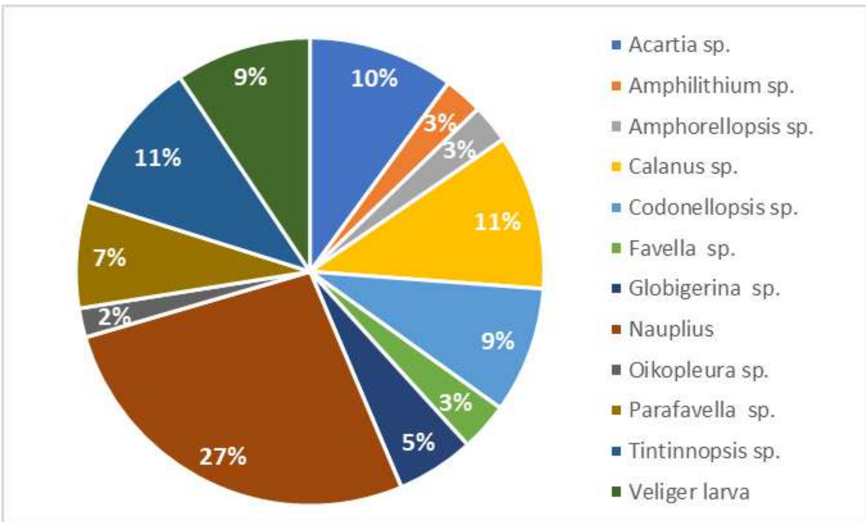


Figure 2-78. Relative abundance of zooplankton in Station 2 of Petra cement.

Station 3

A total of 660 zooplankton were counted in station 3 and were identified into 10 species. Among all the stations in the coastal area of Petra cement, station 3 had the least zooplankton species identified with only 10 and the second to Station 2 in terms of zooplankton counted. The most abundant zooplankton identified is *Codonellopsis* sp. a protozoan with 33% followed by Nauplius larvae with 32%. The least abundant zooplankton are *Favela* sp. and *Globigerina* sp. both with a relative abundance of 1%.

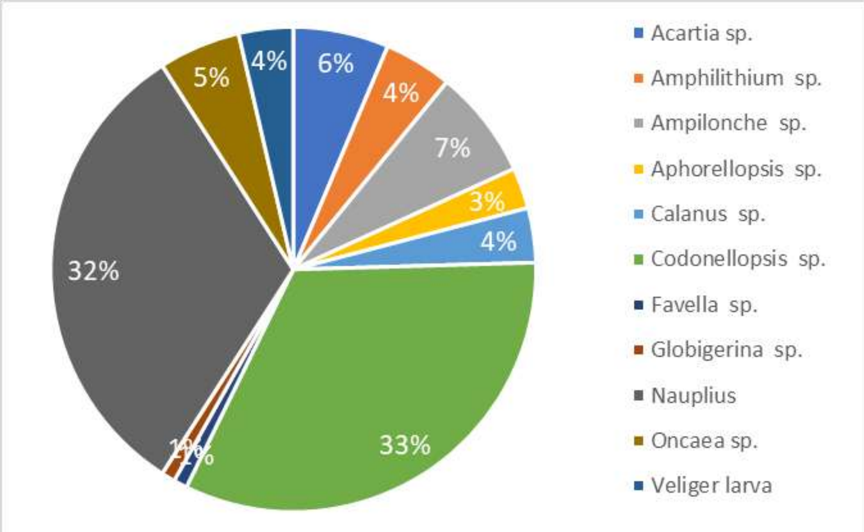


Figure 2-79 Relative abundance of zooplankton in Station 3 of Petra cement

IMPACT ASSESSMENT AND MITIGATING MEASURES

During Construction and Operation Phase

No significant identified impact for this particular section since no development shall be made onshore to be done by the proponent. During construction phase, all materials area acquired locally and transported by land while the raw materials for the production of finishing cement shall be transported thru the use of port facility under Agreement with the operator.

Mitigating Measures

Observed salvage zone and additional legal easement shall be implemented.
Observed proper disposal of solid wastes and hazardous wastes during the operation avoiding the sea and its salvage zone.

2.3 THE AIR

Currently, the project is under its land development or construction phase with completed barracks and field office only, other activities to be done includes construction of drainage and other utilities, roads, warehouses and others. The compact grinding machine has not been installed. No operation yet in terms of grinding for the purpose of production of finishing cement is made.

2.3.1 Meteorology/Climatology

2.3.1.1 Change In The Local Micro-Climate e.g. Local Temperature

The project will not contribute or predict negative impact to the local temperature considering the process involves merely grinding and mixing of pre-cooked materials. No heating nor cooking shall be done during the process. The use of grinding machine has a built-in in cooling system and air pollution control facilities.

Climate

According to the ***Climate Map of the Philippines*** based on ***Modified Coronas Classification (Figure 2-80),*** the Type-IV Climate prevails over the region embracing the project site**.** This type of climate is characterized by relatively more or less evenly distributed rainfall throughout the year.

Month Average Rainfall

Based on the 29-year (1981-2010) Climatological Normal computed by ***Philippine Astronomical, geophysical and Seismological Authority (PAGASA)*** from the records at Dipolog City Synoptic Station which is the nearest to the site ***(Table No. 2-51),*** the maximum rain period is experienced between the month of June and December with the highest precipitation occurring during the month of December, amounting to 380.90mm. The average number rainy days is 14days per year that bring an average annual rainfall amounting to 2,352.80mm/year. The average number of rainy days is corrected as 14days/month based on the total rainy days/year divided by 12months. The 2,352.80mm/year was the result from the total or summation of the rainy days per month in mm unit from the month of January to December. Moreover, the PAGASA data of Climatological Normal by month from 1981-2010 does not include the annual sum or total amount of precipitations in the data

Table 2-51 Climatological Normals by Month and By Selected Station 1981-2010
PAGASA Synoptic Weather Station, Dipolog City, Zamboanga Del Norte

Sampling Months	Jan	Fen	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	Ave
Amount of Rainfall (mm)	129.2	90.4	82.5	103.5	150.9	259.5	216.2	194.5	199.1	291.3	380.9	254.8	2,352.8	168
Number of Days	16	11	10	9	12	18	16	14	16	8	20	18	168.0	14.00
Max Temp (⁰C)	30.2	30.6	31.6	32.6	32.8	32.1	31.9	32.1	32	31.7	31.2	30.6		31.62
Min Temp (⁰C)	22.8	22.8	23.1	23.4	23.4	23	22..1	22.8	22.9	22.9	22.8	22.8		22.9
Mean Temp (⁰C)	26.50	26.7	27.4	28	28.1	27.6	27	27.5	27.5	27.3	27	26.7		27.28

Note: Climatological normals-period averages computed for a uniform and relative long period comprising at least three consecutive 10-year period.
Source; Philippine Atmospheric Geophysical and Astronomical Services Administration. Department of Science and Technology

Temperature

Mean daily temperature is 26.5°C but drops to a cool 22.90°C during the month of January. The warmest period is between the months of October to April that reaches up to 32.8°C. In addition, an average of 5 cyclones in 3 years that normally passes through the region of concerned.

Climatological Normals/Extremes

Climatological Normals

Climatological normals are period averages computed for a uniform and relative long period comprising of at least three (3) consecutive 10-year periods. It summarizes the average values of rainfall, temperature, and wind speed per month. ***Annex O attached is the Climatological Normal Values.***

Climatological Extremes

Climatological Extremes are a record of the highest and lowest values of climatological parameters such as temperature, daily rainfall, wind speed, and sea level pressures. The highest daily rainfall may be attributed to a monsoon that affected the study area. The extreme values of the highest rainfall from PAGASA station at Dipolog City are summarized in Table 2-52 while ***Annex O attached is the Climatological Extreme Values.***

Table 2-52 Summary of Climatological Extremes

Data of Highest Recorded Daily Rainfall	Daily Rainfall (mm)
12 November 1973	295.80
12 August 2001	287.60
19 February 2013	235.80

Source: Report Extracted from Hydrologic and Hydraulic Assessment Study, AMH Philippines, Inc, 21 July 2017

Windrose Diagrams

Windrose diagram is a graphical presentation that depicts a bi-variate frequency distribution table of wind speed and wind direction. It shows how much of the time that the wind speed is within a certain range, for each compass direction, using 16 points of the compass. The current available data for Dipolog City is from 1971-2000. The wind analysis for Dipolog City was taken from daily data for the period 1971-2000. The annual windrose diagram shows 34.4 percent of the time comes from the northeast with 33.5 percent ranging from 1-4 meters per second (mps), 0.90 percent in the range of 5-8 mps and 0.0 percent greater than 8 mps. Therefore, the pprevailing wind direction for the year is northeasterly (from the NE), with an average wind speed of 1.60 mps. Calm conditions were observed at 2.1 percent. **Table 2-53** shows the Annual Windrose Diagram of Dipolog City. ***Annex P shows the Wind Rose Analysis, 1971-2000.***

Table 2-53 Annual Wind Speed Direction, Dipolog City

Direction/Speed (mps)	N	NNE	NE	ENE	E	ESE	SE	SSE
CALM								
1-4	9.4	1.9	33.5	1.5	2.9	0.1	13.3	0.1
5-8	0.0	0.0	0.9	0.1	0.1	0.0	0.0	0.0
8-12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
>16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Source: Climate Data Section, CAB, PAGASA, CY2008

Table 2-54 Annual Wind Speed Direction, Dipolog City

Direction/Speed (mps)	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM									1.8
1-4	2.2	0.0	7.2	0.1	9.4	1.8	12.7	0.9	97.0
5-8	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	1.2
8-12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13-16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
>16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	2.2	0.0	7.3	0.1	9.4	1.8	12.7	0.9	100.0

Source: Climate Data Section, CAB, PAGASA, CY2008

Frequency of Tropical Cyclone

The follwiing are different cyclone classification under updated PAGASA definition and as 01 May 2015 ***(Figure No.2-81);***

- **TROPICAL DEPRESSION (TD)** – a tropical cyclone with maximum sustained winds of up to 61kilometers per hour (kph) or less than 33 nautical miles per hour (knots).
- **TROPICAL STORM (TS)** – a tropical cyclone with maximum wind speed of 62 to 88 kph or 34-47knots.
- **TYPHOON (TY)** – a tropical cyclone with maximum wind speed of 118 to 220kph or 64 – 120knots
- **SUPER TYPHOON (STY**) – a tropical cyclone with maximum wind speed exceeding 220kph or more than 120 knots

An average of 20 tropical cyclones normally enters the Philippine area of responsibility (PAR) annually.

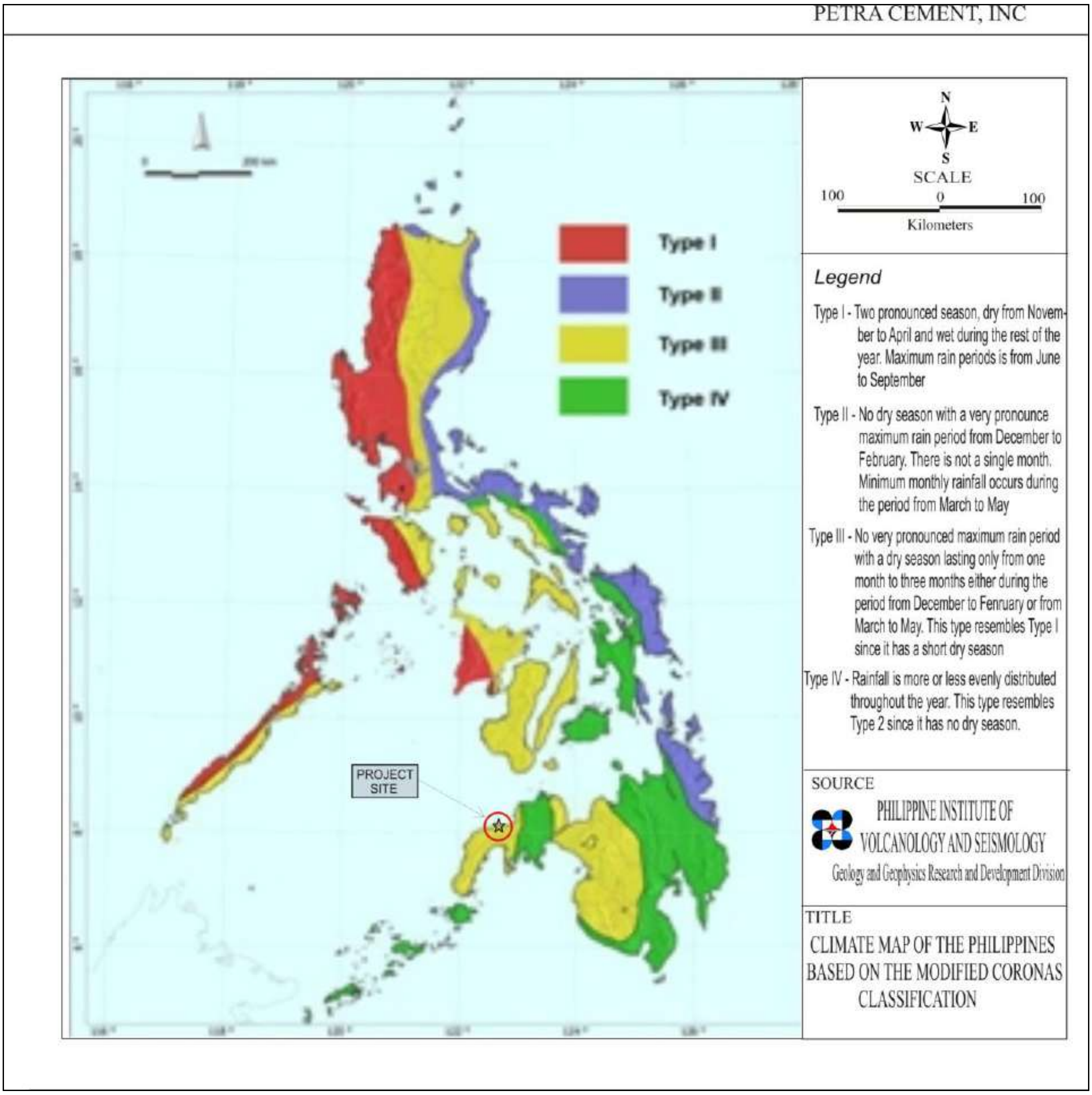


Figure 2-80 Climate Map

PETRA CEMENT, INC

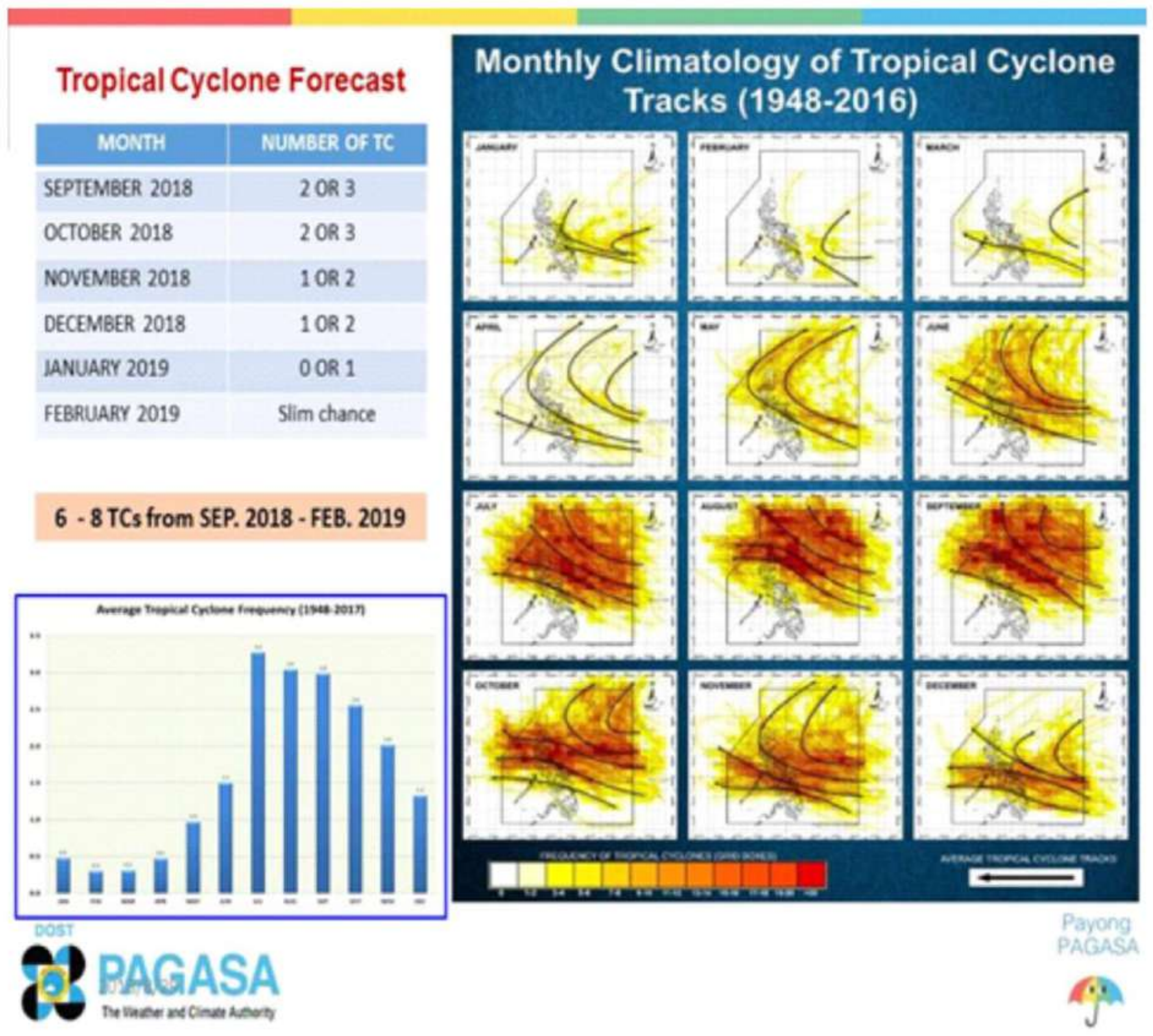


Figure 2-81 PAGASA Monthly Tropical Cyclone Forecast

IMPACT ASSESSMENT AND MITIGATING MEASURES

During Construction and Operation Phase

Mitigating Measures

Properly secured the warehouse and location of the raw materials and finished products and cover all materials with appropriate materials prior to the announcement of typhoon.

2.3.1.2 Contribution In Terms Of Greenhouse Gas Emissions (Or GHG Mitigation Potential)

The greenhouse effect is the popular term for one of the functions the atmospheres plays in the global ecosystem. The atmosphere is the earth's greenhouse. The present average temperature of the earth is about 15 degrees without the natural greenhouse effect.

It is a natural phenomenon that results from the presence, in the atmosphere of gases that traps infrared radiation emitted by the earth. Increases in levels of theses gases over the past 200 years threaten to enhance the greenhouse effect leading to global warming.

Main gases that caused the greenhouse effect called greenhouse gases as Carbon Dioxide (CO2), water vapor, methane, Nitrogen Oxide (NOx), these are both natural or artificial.

The contribution to greenhouse gas for the project is the use of Transportation which includes the movement of people and goods by cars, trucks, and other vehicles. The majority of greenhouse gas emissions from transportation are carbon dioxide (CO_2) emissions resulting from the combustion of petroleum-based products, like gasoline, in internal combustion engines. Relatively small amounts of methane (CH_4) and nitrous oxide (N_2O) are emitted during fuel combustion.

IMPACT ASSESSMENT AND MITIGATING MEASURES

During Construction and Operation Phase

During operation phase, the grinding machine during the start-up or heat to about 750^{0}C using its diesel is also expected to contribute to greenhouse gas.

Mitigating Measures

Fuel switching such as using renewable fuels such as low carbon biofuels and regular vehicle maintenance.

Use alternative power source such as solar power and other energy saving lights such as LEDS, etc.

2.3.2 Air Quality and Noise Quality

This report presents the procedures and results of the ambient air quality and noise level monitoring conducted on April 11 to 15, 2018 at Petra Cement, Inc. situated in Roxas, Zamboanga del Norte. BSI was commissioned to conduct the monitoring wherein Mr. Jonathan G. Ompoy, Mr. Herbenio E. Lagare, and Mr. Jehoshaphat L. Matandag conducted the ambient air quality and noise level monitoring.

The pollutants considered for the 24 hours ambient air quality monitoring were particulate matter less than 10 microns (PM_{10}), sulfur dioxide (SO_2), and nitrogen dioxide (NO_2) at four (4) designated sampling stations near the plant.

Methodology and Analysis

24-Hrs Ambient Air Quality Monitoring

The methods of sampling and analysis of PM_{10}, SO_2, and NO_2 for the ambient air quality monitoring were based on the DENR standards. The methodologies are discussed in this section and presented in *Table 2-55*.

Table 2-55 Methods of Ambient Air Sampling and Analysis

Parameter	Sampling Methodology / Analysis
Particulate Matter less than 10 microns (PM_{10})	High Volume – Gravimetric Method
Sulfur Dioxide (SO_2)	Bubbler – Pararosaniline Method
Nitrogen Dioxide (NO_2)	Bubbler – Griess-Saltzman Reaction Method

Reference: USEPA 40 CFR, Part 50

Particulate Matter less than 10 microns

Sampling of PM_{10} was carried out by using a high volume PM_{10} sampler. Ambient air was drawn at a controlled flow rate into a specially-shaped cyclone inlet where the larger particulates are inertially separated from PM_{10} size range. Each size fraction in the PM_{10} size range is then collected on a pre-weighed glass microfiber filter over the specified sampling period. The filter paper with retained particles was recovered after sampling and desiccated for 24 hours in the laboratory followed by accurate weighing using a calibrated mass balance. The net weight (mass gain) from the initial and final masses of the filter paper corresponds to the amount of PM_{10} collected. The concentration of PM_{10} in ambient air was determined from the ratio of total mass of PM_{10} collected and the total normal volume of air sampled.

Sulfur Dioxide

Sulfur dioxide in the ambient air was sampled using a handy gas sampler by aspirating air at a controlled flowrate into a solution of 0.04 M sodium tetrachloromercurate (TCM) through a glass midget impinger over the specified sampling period. The solution was then treated in the laboratory with formaldehyde and with a specially purified acid-bleached pararosaniline to form an intensely colored pararosaniline methyl sulfonic acid. The color intensity was measured spectrophotometrically at 548 nm and is directly related to the amount of SO_2 collected. SO_2 concentration was determined from the difference between the absorbance of the sample and blank, multiplied by the calibration factor, and divided by the total normal volume of air sampled.

Nitrogen Dioxide

Nitrogen dioxide in the ambient air was determined using Griess-Saltzman Reaction Method. Air was drawn using a handy gas sampler at a controlled flowrate into an azo dye forming reagent through a glass midget impinger over a specified sampling period. The absorption reaction produces a stable red-violet color. The color intensity was read by a spectrophotometer in a laboratory at 550 nm and is directly related to the amount of NO_2 collected. NO_2 concentration was determined from the difference between the absorbance of the sample and blank, multiplied by the calibration factor, and divided by the total normal volume of air sampled.

Sampling Observations

Meteorological observations such as wind direction and speed were recorded during the duration of the activity in order to correlate the interpretation of the gathered concentrations.

Wind Direction

Wind direction is the direction from which the wind originates. It is reported in the cardinal directions. The wind direction in a certain station is determined by observing the motion of the wind from field observation of objects such as trees, grasses, smoke, etc. using a compass as a reference.

Wind Speed

Wind speeds were recorded during the sampling activity using the Beaufort Wind Scale as a guide. Devised by Britain's Admiral Sir Francis Beaufort, this was one of the first scales used to estimate and report wind speeds via visual observations. ***Table 2-56*** details a brief categorization of the Beaufort wind forces along with the corresponding equivalent speeds, wind descriptions, and land observations.

Table 2-56. Beaufort Wind Scale

Force	Equivalent Speed (m/s)	Description	Land Observation
BF0	0	Calm	Calm; smoke rises vertically
BF1	1	Light Air	Direction of wind shown by smoke drift, but not by wind vanes.
BF2	3	Light Breeze	Wind felt on exposed skin. Leaves rustle, vanes begin to move.
BF3	4.5	Gentle Breeze	Leaves and small twigs constantly moving, light flags extended.
BF4	7	Moderate Breeze	Dust and loose paper raised. Small branches begin to move.

Cloud and Rain Description

The systems used to describe sky condition and rain description during the sampling period are outlined in ***Tables 2-57* and *2-58*,** respectively. These terminologies were adopted and used by the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA).

Table 2-57. Cloud Description

Sky Condition	Definition / Description
Clear or Sunny Skies	• State of the sky when it is cloudless, totally clear or with a few small light clouds visible. • Has a total cloud cover of less than one okta.
Partly Cloudy	• State of the sky is within 2-5 oktas total cloud cover or has between 30% to 70% cover of the celestial dome.
Partly Cloudy to at Times Cloudy	• Mostly partly cloudy but there are times when more than 70% of the celestial dome is covered with clouds.
Mostly or Mainly Cloudy	• The sky is mostly covered with clouds but with possible brief periods of sunshine. • The total cloud cover is between 6 to 8 oktas.
Cloudy	• The sky is covered with clouds between 6 to 8 oktas or has more than 70% cloud cover. • Predominantly more clouds than clear sky. • For a longer period during the day, the sun is obscured by clouds.
Overcast	• The sky is totally or completely covered with thick and opaque clouds, 8 oktas or around 100% cloud cover.

Source: PAGASA

Table 2-58. Rain Description

Rain Description	Definition / Description
Very Light Rains	• Scattered drops that do not completely wet an exposed surface regardless of duration.
Light Rains	• The rate of fall is from trace to 2.5 mm per hour. • Individual drops easily identified and puddles (small muddy pools) form slowly. • Small streams may flow in gutters.
Moderate Rains	• The rate of fall is between 2.5 mm to 7.5 mm per hour. • Puddles rapidly forming and down pipes flowing freely.
Heavy Rains	• The rate of fall is greater than 7.5 mm per hour. • The sky is overcast, there is a continuous precipitation. • Falls in sheets, misty spray over hard surfaces. • May cause roaring noise on roofs.
Monsoon Rains	• Heavy and continuous precipitation attributed to either the Southwest or Northeast Monsoon.
Occasional Rains	• Not frequent but is recurrent precipitation.
Widespread Rains	• Precipitation occurring extensively throughout an area.
Frequent rains	• Precipitation occurring regularly and often throughout the time duration.
Intermittent Rains	• Precipitation which ceases at times and re-occur again.

Source: PAGASA

2.3.2.1 Degradation Of Air Quality

Air Quality

24-Hrs Ambient Air Quality Monitoring

Four (4) designated sampling stations were assessed with PM_{10}, SO_2 and NO_2. The pollutant concentrations, as presented in ***Table 2-59***, complied with the DENR National Ambient Air Quality Guideline Values (NAAQGV) for Criteria Pollutants of 150 µg/Ncm for PM_{10}, 180 µg/Ncm for SO_2, and 150 µg/Ncm for NO_2 based on 24 hours averaging time.

Table 2-59 Measured Ambient Air Concentrations of PM_{10}, SO_2, and NO_2 (ug/Ncm)

Station	Location	Date / Time of Sampling	Coordinates	PM_{10}	SO_2	NO_2
A24-1	Between Vicente Lao Construction and Sea Oil Depot	April 11-12, 2018 / 1120H-1120H	8°31'30"N; 123°13'4.0"E	6.1	0.63	0.63
A24-2	Near Public Market and Bus Terminal, Roxas	April 12-13, 2018 / 1240H-1240H	8°31'9.0"N; 123°13'36"E	< 0.1	0.35	0.48
A24-3	Purok Madasigon, Upper Irasan, Near Anquit Residence	April 13-14, 2018 / 1257H-1557H	8°31'15"N; 123°12'32"E	0.7	0.63	0.70
A24-4	Brgy. Langitan, Sarah Compound	April 14-15, 2018 / 1810H-1810H	8°30'59"N; 123°13'53"E	2.2	0.58	0.80
DENR NAAQGV for Criteria Pollutants based on 24 hours averaging time				**150**	**180**	**150**

Note: The detection limit value of PM_{10} was used for the computation of non-detected concentration

Sampling observations during the monitoring as well as photo documentations are summarized in ***Table 2-60***. Moreover, the summary of results including the gathered meteorological data, laboratory certificate of analyses, and calibration records of the equipment used were attached in *Annexes Q*.

Table 2-60. Field Observations and Photo Documentations during Sampling

Station	Field Observations	Photo Documentations
A24-1 Between Vicente Lao Construction and Sea Oil Depot April 11-12, 2018 1120H-1120H	The monitoring station is located on a grassy open area between Vicente Lao Construction and Sea Oil Depot (approximately 150 meters from both areas). Construction activities were observed during sampling. Weather was warm and sunny during the day, while fair during the night. Cloud cover ranged from partly cloudy to mostly cloudy. Winds blow generally from the east at light air to light breeze conditions. No rainfall occurred during the monitoring. Air temperature ranged from 24.0 to 33.8ºC, with hourly readings averaging to 28.9ºC.	
A24-2 Near Public Market and Bus Terminal Roxas April 12-13, 2018 1240H-1240H	The monitoring station is located on a grassy open area near the public market and bus terminal (approximately 100 meters away from the national road). Weather was warm and sunny during the day, while fair during the night. Cloud cover ranged from clear to cloudy. Winds blow predominantly blow from the east at light air condition. No rainfall occurred during the monitoring. Air temperature ranged from 24.4 to 34.0ºC, with hourly readings averaging to 28.9ºC.	
A24-3 Purok Madasigon, Upper Irasan, Near Anquit Residence April 13-14, 2018 1257H-1557H	The monitoring station is located on a dusty ground partly covered in grass within Purok Madasigon, Upper Irrisan, near Anquit residence. One (1) light vehicle was noted passing by during sampling. Weather was warm and sunny during the day, while fair during the night. Cloud cover ranged from partly cloudy to cloudy. Winds blow predominantly from the south at light air condition. No rainfall occurred during the monitoring. Air temperature ranged from 24.0 to 35.0ºC, with hourly readings averaging to 29.8ºC.	

A27-4 Brgy. Langitan, Sarah Compound April 14-15, 2018 1810H-1810H	The monitoring station is located on gravel partly covered in grass within Brgy. Langitan, Sarah compound. Weather was warm and sunny during the day, while fair during the night. Cloud cover ranged from partly cloudy to cloudy. Winds blow generally from the east at light air condition. No rainfall occurred during the monitoring. Air temperature ranged from 24.2 to 33.0ºC, with hourly reading averaging to 28.6ºC.	

Baseline Conducted last April 28, 2016

Prior to site clearing activities, baseline for air quality parameters considered during the sampling is based on the standard guidelines of EMB last April 28, 2016 as shown in **Table 2-61**, for Total Suspended Particulates, Sulfur Dioxide and Nitrogen Dioxide. The monitoring was based on 60 minutes sampling period for each sampling point. A total of two stations are being monitored under the same parameters. The methods of analyses of air samples are in accordance with the applicable standards (DENR Administrative Order No. 14). The sampling was done inconformity with the National Ambient Air Quality Standards (NAAQS) of the Department of Environmental and Natural Resources (DENR).

Table 2-61 Baseline Air Quality and Noise Level Data

PARAMETER	UNIT	NAAQS	R ESULT		DISPOSITION
			ST'N. 1 8°31'28.54"N; 123°13'3.80"E	ST'N. 2 8°31'23.88"N 123°13'3.17"E	
Total Suspended Particulates	µg/Ncm	300	7.7	57.3	Passed
Sulfur Dioxide (SO_2)	µg/Ncm	340	<0.51	<0.51	Passed
Nitrogen Dioxide (NO_2)	µg/Ncm	260	2.2	3.4	Passed

Source: EIS Report for the Regional Issued ECC

Comparison of the Baseline on April 28, 2018 and the Monitoring Result on April 2018

The baseline was conducted for two (2) sampling stations identified as upwind and downwind while then the monitoring activity was conducted for four (4) sampling stations to consider areas near the community. Station 1 of the baseline and station A24-1 of the monitoring has the same location sites and results showed that all parameters are within the DENR Standards.

Air Dispersion Modelling

The model scenario utilized Tier 4 Sophisticated modelling using site specific Meteorological data the most refined modelling techniques (sophisticated models AERMOD ver 9.6 to assess the impact of contaminant emssions. AEROMOD ver 9.6 will utilize local meteorological data (Zamboanga PAGASA) based on the wind fields of the area and include terrain effects on the wind directions. Local meteorological data sets including site-specific paramaters, terrain data and meteorological characteristics should be used, as it more accurately reflects local conditions

Table 2-62 Summary of Uncontrolled Predicted 1-hr, 8-hr and 24-hr Ground Level Concentration

Parameter	Scenario	Averagin Time Hour	Distance meters	Direction	Conc, ug/NCm	Standard/GV ugNCM	Remarks
TSP	Uncontrolled	1	141	NW	662.34	300	Failed
		24	141	NW	152.66	230	Passed
		1 hr, 98th perc	141	NW	489.94	300	Passed
		24 hr, 98 perc	141	NW	104.61	230	Passed
PM_{10}		1	141	NW	101.24	300	Passed
		24	141	NW	23.33	230	Passed
		1 hr, 98th perc	141	NW	74.89	300	Passed
		24 hr, 98 perc	141	NW	15.99	230	Passed

Discussion of the Results

Uncontrolled Total Suspended Particulates (TSP)

The predicted uncontrolled TSP concentrations for 1-hour and 24-hour averaging times may have significant impact of short term NAAQSSSAPI Standards. Predicted short tem (1 hour) for uncontrolled Total Suspended Particulates (TSP) maximum ground level concentrations is 662.34 ug/Ncm and 489.90 ug/Ncm for 98th percentile located 141 meters Northwest (NW) from the air quality impacts sources. No identified residents within the impact area.

Uncontrolled Particulate Matter (PM-10)

PM_{10} Concentrations were based on US-EPA Emission Factor TSP to PM_{10} ratio of 15%. The predicted uncontrolled PM_{10} concentrations for 1-hour and 24-hours averaging time are within the DENR NAAQGV and NAAQSSSAPI Standards.

2.3.2.2 Increase In Ambient Noise Level

The same four (4) stations for air quality monitoring were measured for ambient noise level and the results are presented in **Table 2-63**.

As per NPCC Memorandum Circular 002 Series of 1980, the applicable standards for Class A areas (a section or contiguous area which is primarily commercial area) are 55 dBA and 50 dBA for daytime and evening, respectively. Moreover, the applicable standard for Class B areas (a section or contiguous area which is primarily used for residential purposes) is 65 dBA for daytime measurement.

Table 2-63 Ambient Noise Level Monitoring Results (dBA)

Station	Locat ion	Date / Time	Period	Noise Level	NPCC Standard
N1	Between Vicente Lao Cons. and Sea Oil Depot [B]	April 11, 2018/ 1110H-1120H	Daytime	61	**65**
N2	Near Public Market and Bus Terminal Roxas [B]	April 12, 2018/ 1230H-1240H	Daytime	56	**65**
N3	Purok Madasigon, Upper Irasan, Near Anquit Residence [A]	April 13, 2018/ 1247H-1257H	Daytime	48	**55**
N4	Brgy. Langatian, Sarah Compound [A]	April 15, 2018/ 1825H-1835H	Evening	52	**50**

A Class A - A section or contiguous area which is primarily used for residential purposes

C Class B - A section or contiguous area which is primarily commercial area

Discussion of the Result

The results indicate that the ambient noise level at station *N4* has exceeded the applicable NPCC standard.

The primary sources of noise are summarized in **Table 2-64**. The equipment calibration certificate of the noise meter used during the measurement is attached in ***Annex Q***.

Table 2-64 Primary Sources of Noise

Station	Location	Sources of Noise
N1	Between Vicente Lao Cons. and Sea Oil Depot [B]	Sea Oil station on-going construction
N2	Near Public Market and Bus Terminal Roxas [B]	Vehicular activities and birds
N3	Purok Madasigon, Upper Irasan, Near Anquit Residence [A]	Nearby community and animal calls (roosters and birds)
N4	Brgy. Langatian, Sarah Compound [A]	Nearby community and animal calls (roosters, dogs and birds)

2.3.2.3 Air Sampling Station

Air and Noise Sampling Map is presented in ***Figure 2-82 and Figure 2-83.***

IMPACT ASSESSMENT AND MITIGATING MEASURES

During Construction Phase

Possible Increase in Ambient Concentration of Air Pollutants

The concentration of dust is expected to increase especially at the initial stages of construction, site preparation and site grading. Wind action will tend to stir up dust from exposed surfaces specially during dry months. Likewise movement of construction vehicles will cause significant generation of dust. The dust plume produced during the construction site will be carried by the prevailing wind depending on the season.

Construction activities will also result in very slight increase in the ambient concentrations of NO_2,SO_2 and TSP from exhaust of construction vehicles. Natural dispersion of these exhaust pollutants will result in a very low ambient concentration.

Mitigating Measures

Watering or sprinkling of dry surfaces is the most common control techniques to minimize emission of fugitive dust. This should be strictly followed especially in cases where the wind speed is high and the ground surface quite dry.

Negative impact on air quality from heavy equipment to be used during construction is proportional to the number, type and size of the equipment but the emission by themselves do not result in exceedences of air quality standards.

<u>Possible Increase of Noise Generation</u>

Noise generation is expected to increase during the site preparation activities especially with the presence of construction equipment such as bulldozer, tractor, loader, truck and backhoe.

Mitigating Measures

All heavy equipment and machinery should be equipped with exhaust mufflers. More important, construction activities should maximize during daytime hours preferable between 7AM to 6PM. The construction site is away from populated area and thus, noise to be generated will not cause serious concern. The noise due to construction will be imperceptible and considered negligible in impact.

During Operation Phase

<u>Possible Increase In Concentration of Air Pollution</u>

Possible increase in air concentration of pollutants particularly Particulate Matter (PM_{10}), SO_2, and NO_2 during the grinding and mixing process.

Mitigating Measures

Properly maintained and functional built-in airt control measures facilities. Provision for tire bath for the ingress and agress of all types of vehicles.

<u>Possible Increase in Noise Generation due To Vehicles and Grinding</u>

Noise generation from transfer of materials and the grinding and mixing process motor vehicles and delivery trucks.

Mitigating Measures

Imposition of speed limits, install noise barrier and landscaping of the open areas with vegetative noise barriers could mitigate noise disturbance from vehicular traffic. Enclosing the property with fence or any appropriate materials to minimize the propagation of noise will be done and proper scheduling of deliveries.

<u>Possible Contribution to Climate Change</u>

Possible contribution to global greenhouse effect or climate change is expected for the use of power and equipment and vehicles due to use of diesel and gasoline. During day time especially the summer months from November to April where temperature is expected to rise both due to natural and artificial factors.

Mitigating Measures

It is recommended that the proponent should plant trees in the surrounding open space area and maintain the plants along the boundary of the property. Fuel switching as well as use of LED and other energy saving lights is also recommended.

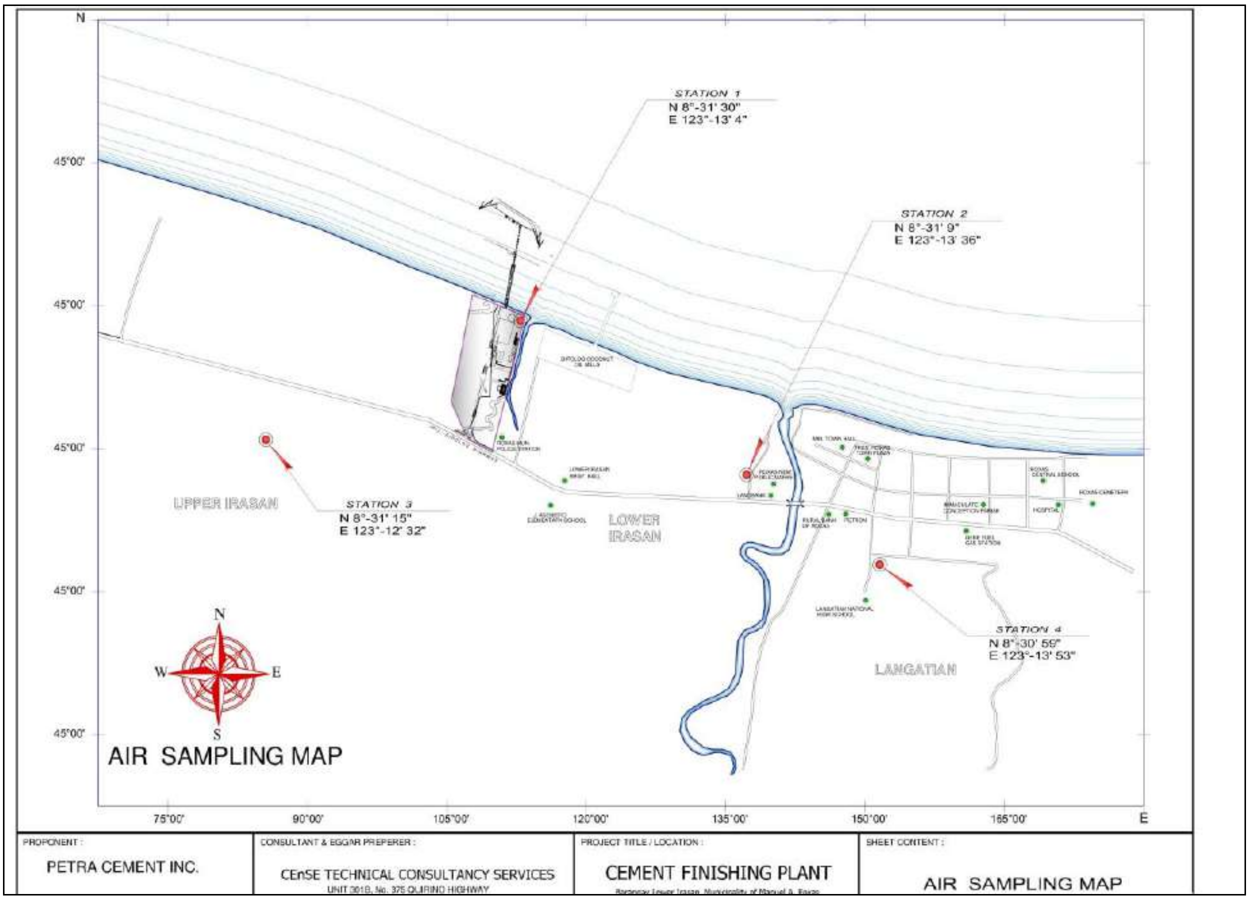


Figure 2-82 Air Sampling Map

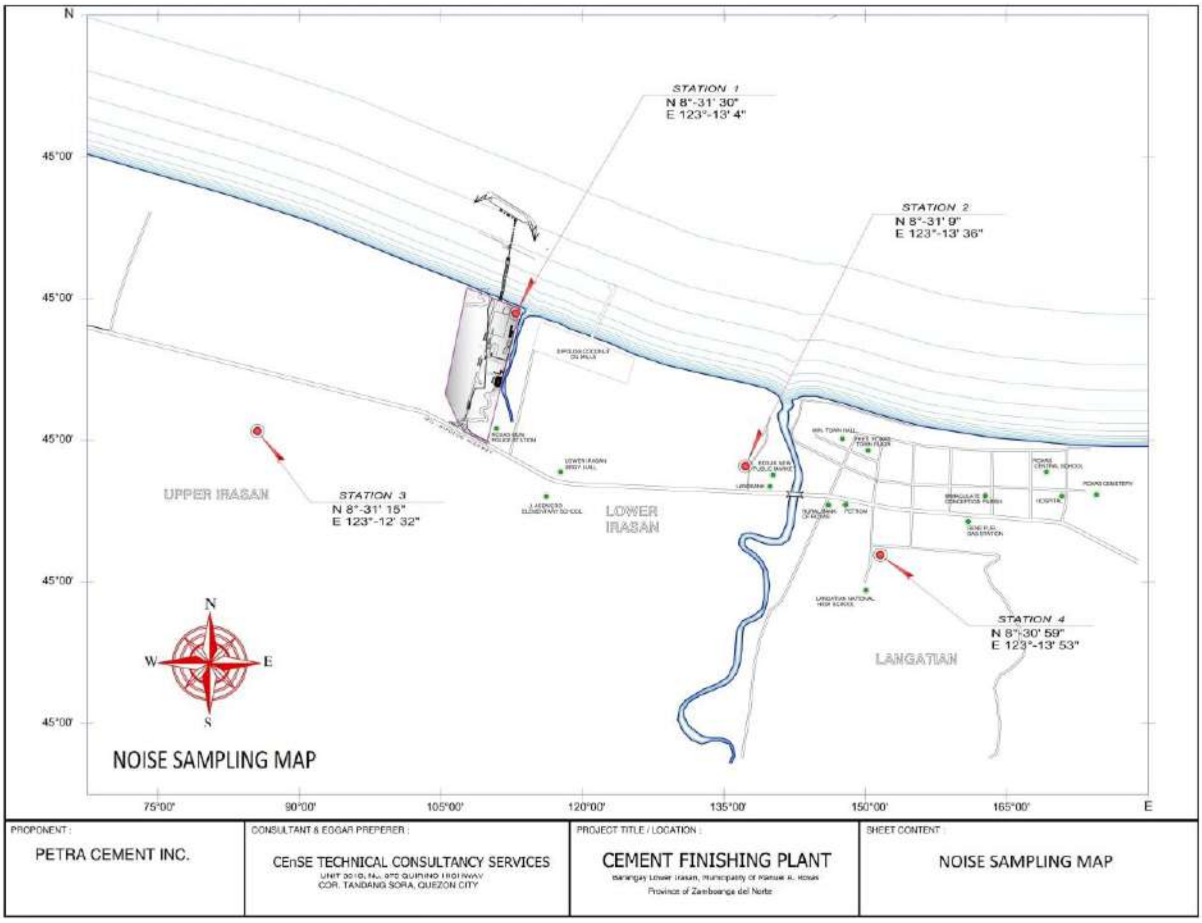


Figure 2-83 Noise Sampling Map

2.4 THE PEOPLE

This section presents the key baseline conditions of the project's site in terms of barangay profile such as demography, current status of the land, health profile and infrastructure and perception. Barangay profile taken from the Barangay Office of Lower Irasan was used, however, the barangay has no five (5) year plan yet which can help and assist the proponent in the formulation of the Social Development Program. Results of the perception survey was also used to determine the actual profile of the community. In addition, data from Philippines Statistics Authority (PSA) was used as an updated reference.

The potential impacts of the project's activities during pre-construction, construction, operations, and abandonment stage on these environmental aspects and their corresponding options for prevention, mitigation or enhancement are also assessed and discussed in this section.

Demography

Number of Household and Household Size

The total number of household is 398 and average household size is 4.91, *source: Philippine Statistics Authority (PSA), Barangay Population Data from 1990-2015*.

Land Area

Barangay Lower Irasan has a total land area of 367.70 hectares. This represents 2.35% of the total land area of the Municipality of Manuel L. Roxas. Of the total land area, 72.59% or 266.9001 hectares is devoted to agricultural land area such as coco land, corn land, rice land (unirrigated and upland rice, 26.99 % or 99.2397 hectares is classified under uncultivated land and only 0.42% or 1.5602 hectares is covered by residential area, source: *Barangay Lower Irasan Profile 2018*.

Population

In 2010, the total population of Barangay Lower Irasan is 2,551 and 2,790 as of August 1, 2015 and while Barangay Langatian in year 2010 has a population of is 4,064 and 4,203, *source: Philippine Statistics Authority (PSA), Barangay Population Data from 1990-2015*.

Population Growth Density

The population of Region IX increased by 1.21 percent annually, on average, during the period 2010 to 2015. By comparison, the rate at which the region's population grew during the period 2000 to 2010 was higher at 1.87 percent same thru with Barangay Lower Irasan.

Gender and Age Profile

There are more females than male in the barangay with ratio of 1:3. In terms of age profile, there are more children ages between 1-9 years old in the barangay. The average age in the barangay ranges 30-44 years old, *source: Barangay Profile of Lower Irasan, 2010*.

Literacy Rate, Profile of Educational Attainment

Majority of the population in the barangay had finished up to Elementary Level while the percentage of educational attainment decreases as it goes up to the highest level. Those who have graduated from elementary level mostly did not continue the secondary leve. Majority of the population has finished high school level and most of people in the barangay can read and write, *source: Barangay Profile of Lower Irasan, 2010*.

Settlement Map

Barangay Lower Irasan is composed of seven (7) Purok's namely: Purok Saging, Purok Lumboy, Purok Mansanilla, Purok Malunggay, Purok Tubo where the project is located, Purk Beans and Murok Kawayan, *source: Barangay Profile of Lower Irasan, 2010*.

See Barangay Settlement Map in Figure 2-84.

2.4.1 <u>Displacement of Settler/s</u>

There are no settlers that will be displaced in the proposed project area. The nearest residential area is about 50 to 100 meters from the site. The proposed project site is an idle land with grass cover, weeds and coconut trees in some areas.

Displacement/Disturbance of Properties

No properties that will be disturbed in the area considering that no settlers will be displaced.

Change/Conflict in Land Ownership

The property is a titled and private under the ownership of Petra Cement, Inc.

Change/Conflict Right of Way

The area is not being utilized as right of way by any of the nearby community.

Impact on Public Access

The project is bounded by the National Highway on the south where access shall remain to the public including the proponent.

2.4.2 <u>In-Migration</u>

During construction, there will be about 55 construction workers that will be visiting the site until the project is completed within 24 weeks or 6 months. When the finishing plant start to operate, there will have fifty six (56) personnel to work in the plant. The majority of which will be coming from the host Barangay (Barangay Irasan). The project will not significantly affect the in-migration pattern in the area.

Census of Population/Property that will be Displaced/Disturbed

No person nor property will be displaced nor disturbed due to the development of the cement finishing plant project.

Housing Ownership profile/Availability of Housing/Number of Informal Settlers

The project is located in a private property therefore no informal settlers are affected.

Proliferation of Informal Settlers

The proliferation of the informal settlers is unlikely to occur because of the coming of the project in the area.

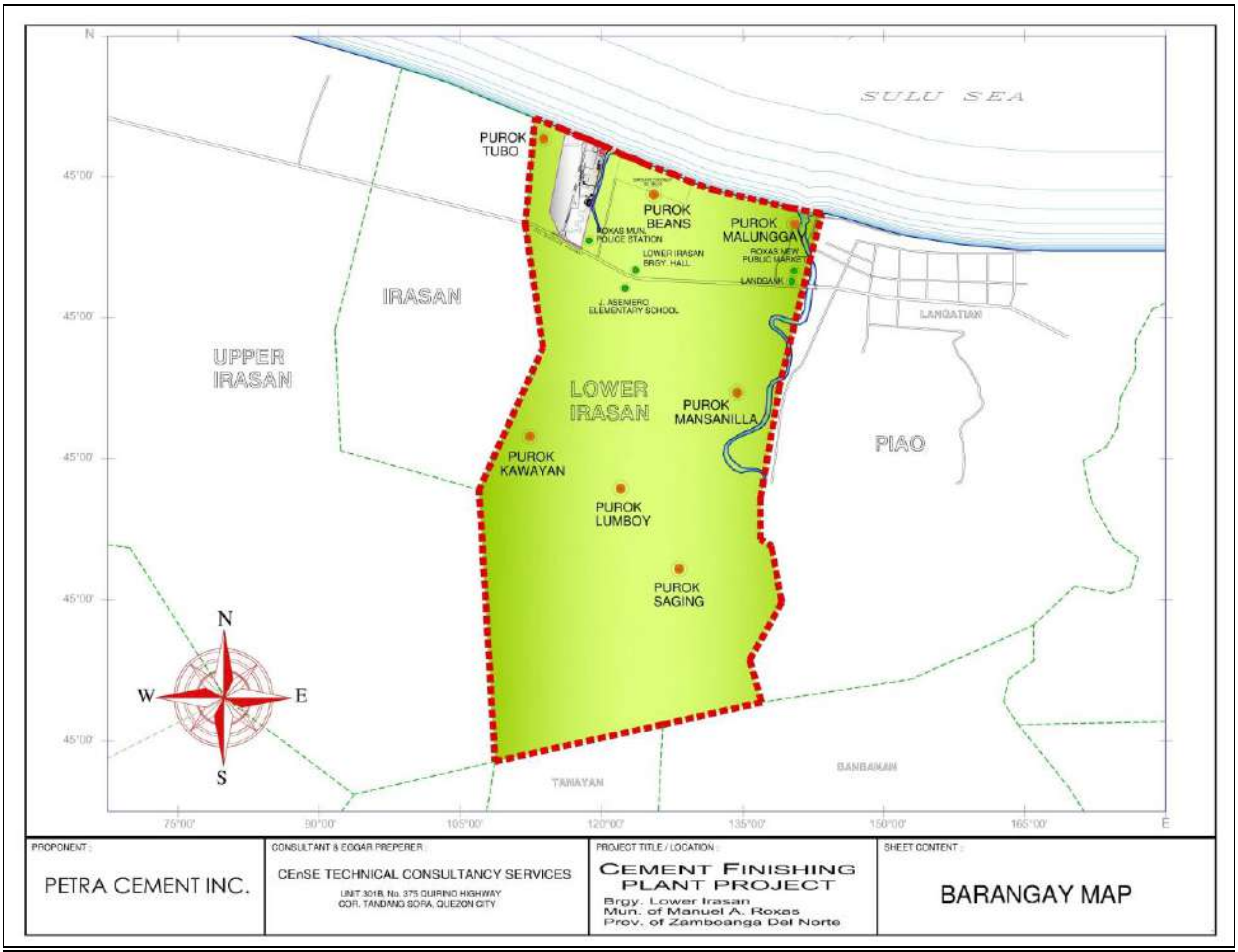


Figure 2-84 Barangay Settlement Map

2.4.3 Cultural/Lifestyle Change (especially On Indigenous People, if any)

There are no indigenous people at the project site and the project is not foreseen to significantly affect the Culture and Lifestyle of the people. On the other hand, with the increased revenue of the host barangay due to the tax payment from the cement finishing plant, more projects may be implemented that will improve the lifestyle of the people.

See attached Certification as Annex S.

2.4.4 Impacts On Physical Cultural Resources

There is no identified impact on physical and cultural resources in the area considering that the property was used to be a coconut plantation and the siting is located in an industrial zone as per Comprehensive Land Use Map of the Municipality of Manuel Roxas, Province of Zamboanga del Norte.

2.4.5 Threat To Delivery Of Basic Services/Resources Competition

Basic services may include supply of electricity, potable water, education (availability of public schools) and health services. Availability of these services will not be affected with the cement finishing plant project. Supply of electricity and water are available from the local service provider.

Water Supply

The potable water supply in the Poblacion and Barangays Langatian, Piao, Nabilid is from Municipal Water District, which is a semi-government institution. There are about 880 households using LWWA as source of water. All other barangays in the municipality are with developed spring, Deep wells, shallow wells and open spring as source of water supply. The site is served by Roxas Water District. Some buy water by pail and their drinking waters through a refilling water station in their nearby locations, *source: Official Website, Pres. Manuel A. Roxas Municipality*.

Currently, the site has an existing waterline served by the Local Water District. The estimated water consumption at full operation is about 12.50 cubic meters per day distributed to the workers, employees and the maintenance of the site. For the workers, it is estimated at 3.50 cubic meters per day, washing 5.0 cubic meters and others such as maintenance is 4.0 cubic meters.

Power Supply

The 31 Barangays' Power supply is exclusively supplied by the Zamboanga del Norte Electric Cooperative (ZANECO).

Other source of power supply in the hinter barangays of Tantingon and Marupay is "O Ilaw Ko Program" of the Department of Energy through Solar Power. Proposed Solar Power will be for barangay Canibongan, Moliton, portion of Capase, and Cape by Solar Power Technology (SPOTS) funded by the country of Spain, *source: Official Website, Pres. Manuel A. Roxas Municipality*.

Communication/Transportation

Communication in the municipality is quiet easy because of the presence of "Telepono ng Bayan" in almost all barangays and this Local Government Unit has its own Telecommunication Office that can accommodate domestic and international calls and equipped with a fax machine for messages. There are also payphones in some of the commercial establishments and cellular phones owned by private individuals and payphones using cards.

Transportation available in the municipality is in various types. In the poblacion, busses, vans, jeepneys and motor cabs are available. The Rural Transit Bus is the major transportation company operating in the area which has a coverage area from Dipolog City to Zamboanga City and other part of Mindanao. There are also private owned motorcycles, automobiles and other vehicles used. In the hinter barangays, jeepneys and motorcycles with extension called "Habal-habal" is their means of transportation and being commonly used.

The Municipal Port located at Barangay Nabilid accommodates only at present Cargo vessels from different places, *source: Official Website, Pres. Manuel A. Roxas Municipality*.

Peace and Order

Generally the area is currently has a peaceful and orderly situation and experience no significant disturbances, except from occasional drunken related squabbles, *source: Perception Survey Results March 2018*.

Recreational Facilities

The barangay has an existing Multi-purpose pavement (basketball court with lights and concrete bleachers. Municipal Plaza is located in Barangay Langatian which is about 2.0 km from the project site.

Public Safety and Crime Rate

The barangay government has twelve (12) Tanods for the purpose of keeping the peace and public safety of the residents. There were reported crime against person such as murder, homicide etc., crime against property such as robbery and theft and crime against chastity such as rape and abduction, *source: Barangay Profile of Lower Irasan, 2010*.

Food Security

Vast land of the barangay is agriculturally cultivated for rice, corn and coconut spreading at least 72.6% of the entire place and of which 51.3% is covered by coconut. Only 0.42% is devoted for residential area. Approximately 23% of the area is left uncultivated of unused residentially of agriculturally but portion of it might have been utilized for commercial and institutional purposes.

The property was used to be a coconut plantation, however, about 100 trees of coconut have already been cut. The number of trees cut in terms of economic value is very minimal or insignificant.

Since vast of the total land area is developed, planted with different kinds of permanent and temporary crops, this is being tilled by sixty-one (61) farmers/farm workers of the total labor force containing approximately 116 parcels of farmlands,. This gives a ratio of one (1) farmer/family has an average occupation of four (4) hectares.

Livestock is dominant in piggery and poultry due the animal dispersal program of the municipal government. Another source is from fishery and aquatic resources, the coastline of the barangay is about 2.0 kilometers who engaged in offshore fishing.

2.4.6 Threat To Public Health And Safety

The proposed project will involve construction of cement finishing plant operation facilities. During operation of the plant, it will have a potential to emit dust due to the nature of operation itself, poor maintenance of air pollution control facility and failure to effectively implement internal pollution control program. Noise will also be generated during site clearing with the use earth moving equipment such as dump trucks, etc. During construction, cement mixers, masonry and carpentry works will also generate noise. During operation, the noise will also be generated by the machine operation.

Health Profile

For this sub-section, the report is made on the illness by the respondents including themselves in the last five years, the common sickness encountered by the barangay and the medical practitioner or institutions that they had sought for medical assistance.

Local Health Resources

There is no hospital being established in the barangay, public or private. The health services available is only the preventive component which is being carried out by the Municipal Health Office through its Barangay Heath Section where a Municipal Health Officer (MHO) staff renders the services to the barangay folks on a weekly-visit basis.

Morbidity and Mortality Rates (Infants and Adult-5 Year Trend)

The barangay profile presented and Department of Health do not have data for this particular section. However, report on Health Status and Priority Status in Region IX conducted by Western Mindanao State University was used as a reference.

Maternal and Infant Mortality

In almost 10 years, some improvements in health indicators have been registered. For example, infant and child mortality rates have declined from 1996 to 2004. One notes that infant mortality dropped from 13.51 per 1,000 live births in 1996 to 9.09 per 1,000 live births in 2004. Mortality rates for children under five was also noted to go down, from 98.33 per 100,000 population in 1997 to 57.91 per 100,000 population in 2004. However, these figures must be viewed with caution due to underreporting of deaths.

On the other hand, maternal mortality rates have not been uniform across the years, exhibiting a see-saw situation, rising steadily in 1998 (108.18 per 100,000 live births) and decreasing or improving in 2002 (80.27 per 100,000 live births). Toward 2004, however, a rise to 102.99 per 100,000 live births is observed.

Table 2-65 Regional Mortality Areas

HIGH MORTALITY AREAS		LOW MORTALITY AREAS	
AREA	**RATE**	**AREA**	**RATE**
(Infant Mortality)		Zamboanga Sibugay	6.75
Dipolog City	21.11	Zamboanga del Norte	6.64
Dapitan City	18.07	Pagadian City	6.15
Zamboanga City	17.04	Zamboanga del Sur	3.37
(Maternal Mortality)		Zamboanga del Sur	94.43
Pagadian City	239.32	Zamboanga Sibugay	91.99
Dipolog City	137.68	Zamboanga del Norte	78.57
Zamboanga City	123.55	Dapitan City	56.24

Leading Causes of Illness and Death

Communicable diseases appear to be the major cause of illness or morbidity. Among the top 10 leading cause of morbidity 6 of which affect the respiratory system. Non-communicable causes emerge as well, like hypertension and injuries. The leading causes of morbidity are:

Table 2-66 Leading Causes of Morbidity

Causes	Number	Rate
1. Acute respiratory infection	88,565	3179.94
2. Influenza	46,407	1666.25
3. URTI / LRTI	33,389	1198.84
4. Bronchitis	32,403	1163.44
5. Diarrhea / Gastro-enteritis	32,329	1160.78
6. Pneumonia	23,495	843.59
7. Hypertension	21,954	788.26
8. Injuries (All forms)	19,284	692.40
9. Skin Disorders	15,965	573..23
10.TB (All forms	6,135	220.28

Source: CHD IX, 2004

Mortality, on the other hand, is mainly traced to non-communicable causes. It is interesting that injuries (especially caused by trauma, accidents, gunshot wounds, assault by sharp objects) take the lead in causing deaths in the region, indicative of the pervasiveness of violence in the area.

A 1999 research led by Dr. Fortunato Cristobal associate these trends to growing urbanization, with the specific circumstances of violence being traced to situations of kidnapping, loose firearms, illegal logging, drug-related cases, etc. Recent incidents of violence particularly in Zamboanga City would also be attributed to the exportation of family feuds and political enmities from nearby islands, leading city officials to declare a gun ban in the area. The following are the ten leading causes of death in Region IX.

Table 2-67 Ten Leading Causes of Mortality Region IX, 2004

Causes	Rate
1. Injuries	38.17
2. Cancer (All forms)	32.31
3. Pneumonia	30.69
4. Cardiovascular disease	28.47
5. Ischaemic heart disease	23.70
6. TB (All forms	22.65
7. Hypertensive disease	16.69
8. Disease of the kidney	13.71
9. Septicemia	10.79
10. Cerebrovascular disease	8.84

Common Diseases in the area including Endemic Diseases

The barangay has no record of common diseases including the endemic disease, for the purposes of this, the results of the perception survey conducted last March 2018 was used. Based on the results of the survey, the survey results the top three (3) show that cough is the common and usual sickness encountered by the respondents and their families, followed by fever and colds and LBM. There are also respondents who had encountered asthma, headache, tuberculosis, flu, stomach ache, ulcer, stroke, dengue, measles, anemic, UTI, fatigue and high blood and pneumonia.

Environmental Health and Sanitation Profile

Majority or 88% of the total household has access to safe and potable water supply, and the same are actually water-seal toilet users, *source: Barangay Profile of Lower Irasan, 2010.*

Based on the results of the perception survey, almost all the residents in Barangay Langatian, Lower Irasan and Upper Irasan uses the water sealed, flush and only few mention they use Antipolo type or the "buhos" type of toilet facilities while in terms of garbage disposal, all the respondents burn their garbage wastes at the backyard or through a garbage collector

2.4.7 Generation Of Local Benefits From The Project

Socio-Economic Profile

Main Sources of Income

Based on the results of the survey, majority are fishermen, followed by farmers, and vendors. There are laborers, fish vendors, motor cab drivers and are teachers. There are also laundry washer, livestock, helper, parlor, construction worker, barangay security officer, carpenter, employee, blacksmith, collector, call-in wilman, tricycle driver, mechanic, baker, OFW, factory worker, musician, barber, daycare worker, buy & sell and network marketing.

Employment Rate/Profile

The populace predominantly engaged in farming and fishing as means of earning money to sustain the family needs. Domestic force is also of major importance as this connotes unemployment. It has been observed that family members usually engaged in multi-occupational undertakings to earn extra income, *source: Barangay Profile of Lower Irasan, 2010*.

Poverty Incidence

In consonance with the Social Reform Agenda-Poverty alleviation Program of the government, the Municipal Government of Roxas, through Municipal Agriculture Office, offered short courses intended for manpower development through skills training and livelihood seminars whereby adults and out-of-school youths were given livelihood projects. The recipients/beneficiaries are mostly appropriate to their skills and initiated all their undertakings as agri-based gardening, animal dispersal and cooking, *source: Barangay Profile of Lower Irasan, 2010.*

Sources of Livelihood

Based on the results of the perception survey, the top three (3) sources of livelihood are fishermen, some are presently engaged into farming, while others are vendors. Others such as laborers, motor cab drivers, teachers, laundry washer, livestock, helper and parlor, *source: Perception Survey Conducted, March to April 2018*.

Commercial Establishments and Activities

There is no commercial establishment in the barangay area, however, there are few who engaged into small sarisari stores. Most of the grocery stores is located in Barangay Langatian.

Barangay Fiesta which celebrates every 12th of October in honor of the Hermosa Festival. The festival of the patron saint of the City of Zamboanga, Nuestra Señora del Pilar. Also known as the Fiesta Pilar month-long festival. They also celebrate the Feast of Lower Irasan, the festival of the patron saint of St. Joseph the Carpenter held every 1st of May. Another tradition is the Feast of Subanen Tribe, the festival of the patron saint Nuestra Señora dela Concepcion y del Triunfo which is held every 15th of July. This yearly festival of Subanen showcases different rituals as a form of thanksgiving like planting and harvesting, courtship, wedding, hunting, healing of sick and baptism. They also have the Buklog Festival which is held every 16th to 20th of April considered as the most significant of all Subanen religious rituals. The Buklog which also stands for ceremonial platform, is a thanksgiving festival of the Subanen. Buklog Festival is an ancient spiritual rite to offer gratefulness, and to honor the spirits of the water (malengma), the spirit of the forest (mamanwa), the spirit of the mountain (maninising palingkitan), to whom they pray for abundant harvest and protection from misfortune. And last is the Kalag-Kalag Festival celebrated every evening of 2nd of November the All Souls Day. Unique festival associated with Halloween. They also celebrate the Araw ng Roxas every July 1-4 yearly.

Banking and Financial Institution

There is no banking institution established in the barangay area nor cooperative engaging in economic undertaking extending financial services. The only private lending institution operating in the place is CE Lending Investors but this is just a small scale business ventures, it caters mostly motorcab operators, fish vendors and teachers, *source: Barangay Profile of Lower Irasan, 2010*.

The nearest government bank in the project area is located in Barangay Langatian which is about 1.5km west of the project site.

Enhancement Of Employment And Livelihood Opportunities

Initially there will be about 55 workers to construct the site and will last to a maximum of 24 weeks. Most of the workers will be employed coming from the host barangay. When the cement finishing plant operates, only fifty-six (56) personnel will be needed, most of which will be coming from the host barangay. Therefore, the proposed cement finishing plant operation will not impact on the demand for additional schools and health services in the barangay

Increased Business Opportunities And Associated Economic Activities

The project will bring in business opportunities during construction and operation phase associated with vending, selling of food where construction workers and plant operation workers need at least three meals a day, respectively.

Increased Revenue of LGUs

The contribution of the project in terms of revenue is associated with Revenue from Taxation such as real property tax, business tax, Non-Tax Revenue such as receipts from economic enterprise, fees and charges and Aids and Allotments from Internal Revenue Allotment (IRA).

2.4.8 Traffic Congestion

Infrastructure Profile

The Local Government Unit programs for provision of infrastructure and other support facilities and the development of municipal wharf is given the topmost priority. The development of Ports facilities and its expansion for at least two hundred meters towards the deep waters is the launching of well organized maritime activities. All barangays will be paved with access roads for faster and better mobility for both people and farm produced to major arterial roads of the municipality. All existing gravel and dirt roads will be repaired and maintained for all weather purposes. The construction of piped water system for all barangays identified for industrial development will be given priority, *source: Official Website, Pres. Manuel A. Roxas Municipality.*

Facilities

Barangay Lower Irasan has the following institutional building structures: Barangay Hall Concrete building and semi-concrete fence) with library, Day Care Centers, Sanguniang Kabataan Building, Multi-purpose pavement (basketball court with lights and concrete bleachers; Complete Elementary (Gov. Jose D. Asentero Elementary School); Barangay Public Market; Cockpit Arena and Vegetable Demo Farm.

Road Network/System

Table 2-68 Existing Road, Bridges and Spillways conditions

Roads	**Earth/Gravel (Kms.)**	**Concrete (Kms)**	**Asphalt (Kms)**	**Total (Kms**
National			10.30	10.30
Provincial	23.48	0.40		23.88
Municipal	107.70	1.40	1.50	3.70
Barangay	107.70	3.30	5.00	116.00
Total	131.98	5.10	16.80	153.88

BRIDGES	MUNICIPAL	NATIONAL	PROVINCIAL	TOTAL
RCDC		7		7
RCBC	4			4
BAILEY	2			2
TIMBER	2			2
SPILLWAY	*24			24
FOOTBRIDGE	1			1
TOTAL	9	7		

Existing Transportation/Traffic Situation

Since the selected project site is a rural area, the traffic situation in the area will not be affected by the cement finishing plant operation. The 55 construction workers will mostly be coming from Barangay Irasan. The road may become busy at times, during the delivery of construction materials but this will be temporary, up to 24 weeks.

During operation, the cement finishing plant may contribute to traffic volume during delivery of clinker and other raw materials. All of these activities will be undertaken during lean times especially the delivery of clinker which will be undertaken during evening to very early morning before 6:00AM.

2.4.9 Perception Survey Results

The perception survey was conducted to identify the present socio-economic profile of the pre-determined social impact areas and to know the level of awareness of the different people and their acceptance to the proposed project.

The survey was conducted last March 12-16, and April 25-26, 2018 from 8am to 8:30pm by Maria Fe Sumadig, Lilia Away, Ma. Eliza V. Feras, Mary Jeluz C. Dulaong, Nestor J. Fernandez. The identified direct impact area are the Barangays Lower Irasan and Upper Irasan where the project will be located. The survey team which is composed for five (5) members conducted a house to house interview. There were also residents who refused to be interviewed during the survey.

Social Impact Areas and Number of Respondents

The primary impact areas identified is approximately 5.7 hectares property of the project area. There are no affected residents or tenants inside the project area. The study team distributed questionnaires to communities of while doing the perception survey.

All in all, the study is a result of the unstructured on-on-one interviews. A total of two hundred forty three (243) respondents distributed to three (3) barangays. Based on the total respondents, 188 or 77.37% came from Barangay Lower Irasan, 5 or 2.06% came from Barangay Upper Irasan, 50 or 20.58% are from Barangay Langatian.

Responses Concerning The Project

In terms of level of awareness about the said project, out of 243 respondents 194 or 79.84% or majority of the respondents are aware of the proposed cement plant. And 28 or 11.52% % of the respondents did not knew that there would be a proposed project within the vicinity. There are 21 or 8.64% who did not mention or did not answer the specific question.

To where and how the information was gathered, the survey results showed that the top and second most which accounts for 128 or 66.32%, 12 or 6.22% said, they knew about the project through public hearing and barangay meeting, respectively, some 11or 5.70% said by "heresay" they got the information and there are 3 or 1.55% has seen the project location.

Personal View/Opinion Of The Cement Plant Project

The personal opinions and views of the respondent on the project based on the results of the survey may be in terms of positive impacts, negative impacts and indifferent reactions to the project. The following are the views of the respondent about the cement plant;

Table 2-69 Personal View/Opinion of the Respondents

Opinion	Barangay Lower Irasan	Barangay Upper Irasan	Barangay Langatian	Total	Total %
A. POSITIVE					
Employment	88	55	39	*182*	*65.23*
Income for the Brgy	1	0	2	*3*	*1.08*
Proper Waste Management	1	1	0	*2*	*0.72*
Cheaper Cement Price	37	0	5	*42*	*15.05*
Increase Economic Value	1	2	11	*14*	*5.02*
Road Widening	7	2	0	*9*	*3.23*
Concrete Roads	27	0	0	*27*	*9.68*
Total	*162*	*60*	*57*	*279*	*100%*
B. NEGATIVE					
Chemical Waste	4	0	5	*9*	*3.50*
Can Affect Lungs	11	1	1	*13*	*5.06*
Cement Dust	61	19	11	*91*	*35.41*
Harmful to Health	56	2	7	*65*	*25.29*
Air Pollution	6	0	23	*29*	*11.28*
Harmful to Plants/Animals	25	0	0	*25*	*9.73*
Proper Waste Disposal	0	0	1	*1*	*0.39*
None	15	2	7	*24*	*9.34*
Total	*178*	*24*	*55*	*257*	*100%*

Majority of the respondents of 182 or 65.23% expects that the project will give employment to the community, but there are 42 or 15.05% of the residents believed they can purchase or buy the cement for a cheaper price, 27 or 9.68% they are expecting that they will have a concrete roads in their barangay. Some 14 or 5.02% said it will increase their economic value.There are 9 or 3.23% votes for road widening, 3 or 1.08% believed that it will increase income for the barangay. There are some who said it will be an additional income to their barangay and proper waste management as 2 or 0.72%. And 91 or 35.41% identified negative opinion stated that about the cement dust

Recommendation About the Project

Issues from Lower Irasan

- Employment (Gusto namong makatrabaho sa planta sa semento)
- I am hoping to apply (Hope makaapply mi)
- Ensure project will not affect the health of the people (Maayo naman piro dili ba makadaut hantod sa tawo)
- They want the project for the children to continue to increase their economic value (Ipadayon jud ang proyekto para mga kabataan mo asenso ang atong barangay)
- I hope that people will not be affected by the project (Nga unta nga dili rata ma apiktuhan sa ilahang proyekto
- I hope that it will not give big impact due to cement dust (Hinaot unta nga dili maghatag ug dakong kadaot ilabi na ang abog)
- It is not okay since our occupation is at stake since the only main source of living is fishing (Dili maayo kay makadaot sa panginabuhi makasamot sa kalisod, kay walay laing gisalingan dagat.
- It is okay for me just make sure that the health of the people will not be affected during the operation of the plant. (Maayo unta nga dili makadaot sa katawhan kun magoperate na ang planta)
- I hope that it will not affect the health especially the children. (Dili unta makaapekto sa katawhan ilabi na sa mga bata)
- Thankful because I have a project. (Nagpasalamat mig dako. Natagaan mi ng proyekto)
- Thankful for the project (Pasalamat sa proyekto)
- Im afraid once the project operates it will affect our living in Pasil. (Manghinaot ko nga inig operate sa planta dili sa maapektuhan ang among pamuyo diri sa Pasil)
- Ensure permanent jobs (ayudan ug nay permanenteng trabaho)
- Please proper disposal of the project (ayuha ang pagdispose sa proyekto)
- It will increase and help the revenue of the barangay (makatabang gyud sa among barangay)
- It is a good idea for the benefit of the people within the barangay. (makinabang gyud ang tawo dili sa among barangay)
- Concrete barangay roads (sementuha ang among dalan sa among barangay)
- Just make sure that it will be good and beneficial to each and every resident of the barangay (Unta ang maong proyekto makatabang ng dunay maayong efekto sa namuyo sa palibot)
- Properly constructed (ayuha ang pagconstruct)
- We are hoping for bigger and better project for our people in the barangay.
- Improve the drainage system (ayuha gyud ang among drainage)

Issues from Upper Irasan

- Ensure no crops will be affected (ayuha na dili makadaot sa among tanom)
- Employment
- I want road cement from Tubo to Kawayan (Gusto kong masimento ang dalan Tubo to Kawayan up to Boundary)
- I am okay with the project
- Thankful because we have a cement plant in our barangay (Salamat kay naay proyekto diri sa among barangay)
- Please tell us once it is operational so people can prepare and provide us mask. (makaestorya sila kun magoperation na para makaready ang mga tawo mag issue ng mask)
- Proper waste disposal
- Secure the safety of the plant and it will not affect the health and proper disposal of waste not in the sea. (kinahanglan safety ang planta para dili makaapekto sa katawan, ang waste kinahanglan dili ilabay sa dagat.
- No news when this project will operate (wala na hulat sa kaunsa mo-operate)

- I hope that you could also put up health clinic, livelihood programs and scholarships as well (maghatod ng health center, clinic, livelihood programs ng scholarship program)
- Thankful because we can purchase cement at a lower cost (dakong salamat kay barato na ang semento)
- Can we request for cement for our basketball court (Ug tagaan mo kaming hinabang nga semento pra among basketball)

Issues from Barangay Langatian

- I hope the product you have will prosper because it will help jobless people and our economy. (Sana mapalago ninyo ang isang produkto na tinayo niyo dito sa amin at para makatulong sa mga taong walang trabaho at bukod pa doon nakatulong din kayo sa ekonomiya.
- What are the benefits of the inhabitants/people living and working on that company.
- To ensure the safety of the people and the plants near the factory.
- Employment

IMPACT ASSESSMENT AND MITIGATING MEASURES

During Construction

Generation of Employment

The project is not yet in its operational phase. There are forty seven (47) identified for skilled such as mason, carpenter, plumber, electrician and welders and non-skilled workers such as helpers and laborers. The proponent shall give priority to local residents:

The business community: This includes the public transport operators, suppliers, sari-sari stores, among others.

Generation of Business Opportunities

Business opportunities such as those related to construction materials and among others.

Mitigating Measures

Positive impact to the community and supplier with its multiplier effect.

Introduction of Construction Hazards

Hazards associated with construction activities will be introduced in the area. These hazards could lead to injury and sometimes fatalities as a results of construction equipment and transportation of construction materials.

Mitigating Measures

Health and safety program will be instituted within the construction site to minimize accidents caused by construction hazards.

Using the philosophy that prevention is better than cure the construction crew should be properly oriented with occupational health and safety procedures and guidelines to prevent the occurrence of accidents. Horseplays, misdeamors and other inimical acts should be prohibited.

The consumption of alcohol inside the project site should be banned at all times with severe sanctions on violators.

Safety devices (hard hats and safety shoes among others) shall be necessary as dictated by the nature of the construction work and the type of equipment to be used. The contractor shall be required to conduct operations in compliance with all safety regulations. All field personnel directly involved with the dangerous activity/operation must be thoroughly familiar with the safety rules and regulations governing the use of explosives. Any unsafe practices must be immediately reported and corrected to avoid accidents. A safety engineer should be appointed to oversee safety-related matter.

During Operation

Solid Waste Generation

During the operation phase of the project, it is expected that at least a total 28 kilograms per day of domestic waste coming from the workers are derived. Collection and disposal of these waste will handled by the Local Government Units (LGU), however, implementation of RA 9003 thru segregation or establishment of color coded garbage bins within the area is strictly enforced.

Possible Increase in Traffic

During operation of the plant about 20-30 trucks or related delivery trucks per day is expected, it is also expected that the same number of vehicles will be passing and entering the project excluding the visitors that are coming in. This will lead to increase in traffic volume not only in the roads within the site but also along the access road connecting the area along the main highway. Proper scheduling of trucks shall be established and at the same time provide for enough parking space for lining while waiting to be accommodated.

Increase Business Opportunities

Business opportunities such as carinderia, sari-sari store, among others will be encouraged and will continue to grow in the area.

Mitigating Measures

Positive impact to the community, brought about by the project should be property disseminated.

Promotes Livelihood Activity

With the operation of the project, livelihood to the unemployed community will be encouraged, these may be associated with food and other services.

Mitigating Measures

Impact is positive to the community and to the project including the implementation of the Social Development Management Plan.

Health and Safety of the People

Physical Hazard

Potential physical hazard is expected during operation related to operation and handling process

Mitigating Measures

Personal Protective Equipment are a must to reduce or eliminate the risks associated with the handling of materials.

The proponent shall have a readily available emergency and first aid kit device.

Contribution to Local and Regional Economy

Once fully operational, the proposed project will, on minimum, contribute to the local economy of Provincial, Municipal and Local through taxes and such cost of production as salaries and wages, local supplies and hauling services. The Province will get thirty five percent (35%) proceeds from taxes, among others accrue to the general fund of the National. The Municipality gets forty percent (40%) to the general fund of the municipality where the property is located and twenty five percent (25%) shall accrue to the Barangay.

Increase Revenue for the National Government

More sources of revenues in the form of taxes, income shares and other fees will increase the income of the government. The employment generated by the project will also increase the income tax base of the government. The National Government will benefit at least thirty five (35%) share of the taxes, among others.

During Abandonment

Plans for Removal or Disposition of Temporary Structures and Facilities

All temporary facilities installed during the construction phase of the project shall be dismantled or removed from the project site once the construction is completed.

Relocation and/or Termination Plans for Project Facilities

All heavy equipment used during the construction phase of the project will be pulled-out after project completion. Hired workers except for the permanent personnel of the Project Contractor will be terminated or maybe relocated to other projects of the company.

3.0 ENVIRONMENTAL MANAGEMENT PLAN

EMP – which essentially involves the measures required to protect and enhance the environment – is in line with the Proponent's adherence to sound environmental policies and to provide guidelines by which compliances with environmental laws and regulations may be ascertained.

It essentially involves various significant impacts during operation phase, i.e. generation, solid waste.

The aspects of an effective and complete Environmental Management Plan are:

- The identification of potential environmental impacts of the Project and formulation of corresponding Mitigating Measures;
- The Environmental Monitoring Plan;
- The Institutional Plan

3.1 IMPACT MANAGEMENT PLAN

Table 3-1 Impact management Plan (IMP) is the summarized tabulated form of the actual impact and mitigation measures and the proposed expansion.

Table 3-1 COMPARISON OF ACTUAL IMPACT AND MITIGATING MEASURES FOR THE EXISTING AND PROPOSED EXPANSION OF THE PROJECT

PROJECT ACTIVITIES	ENVIRONMENTAL COMPONENT LIKELY TO BE AFFECTED	POTENTIAL IMPACT	PROPOSED MITIGATING MEASURES	COST OF MITIGATING MEASURES OR ENHANCEMENT	PERSON RESPONSIBLE FOR THE IMPLEMENTATION	GUARANTEES (MOAs, ETC) CONTRACTS
PRE-CONSTRUCTION PHASE						
Environmental Aspect No. 1	LGU and National permit	• None	• Secure necessary permits and licenses	Part of the Planning and Design Cost	Petra Cement, Inc.	Secure Dredging Permit, LGU and ECC
Actual Measures Implemented		• ***All LGU Permit secured by the proponent*** • ***ECC in process for the expansion of the capacity***			***Petra Cement, Inc.***	***With Permits issued from LGU, Annex E*** ***With ECC issued by EMB-R9, Annex D***
	Project Site	•	• Preparation of Baseline Conditions of the site	Part of the Planning and Design Cost	Petra Cement, Inc.	Part of the EIS Study
Actual Measures Implemented		• ***Baseline for water and air conducted prior to site clearing and considered the monitoring results conducted in preparation for the expansion of the capacity*** • ***Hydrologic and hydraulic study for the drainage design*** • ***Geotechnical investigation study for the sub-soil surface and structural stability***			***Petra Cement, Inc.*** ***AMH Consulting Phil. Inc.*** ***Berkman System Inc.***	***Presented in Annex L, N and Q***
CONSTRUCTION PHASE						
Earthmoving works	**The Land**	• ***Solid waste generation***	• Temporary area for storage and segregation;	Php 0.10 M	Petra Cement, Inc.	Shall form part on the contractor's

PROJECT ACTIVITIES	ENVIRONMENTAL COMPONENT LIKELY TO BE AFFECTED	POTENTIAL IMPACT	PROPOSED MITIGATING MEASURES	COST OF MITIGATING MEASURES OR ENHANCEMENT	PERSON RESPONSIBLE FOR THE IMPLEMENTATION	GUARANTEES (MOAs, ETC) CONTRACTS
			• Implement Solid Waste Management system in accordance to RA 9003 such as segregation.			agreement
Actual Measures Implemented		• ***No Impact identified in actual***	• ***With existing color coded garbage bins*** • ***Minimal volume generated***	***None***	***Petra Cement, Inc.***	***As seen on site***
Earthmoving works due to backfilling up to 4.0 meters	**The Land**	• Flood and erosion	• Fills and embankments should be compacted to the maximum dry density. • Follow the provisions of the National Building Code and the Structural Code of the Philippines.	Php 1.00 M	Petra Cement, Inc.	Shall form part on the contractor's agreement
Actual Measures Implemented		• ***No impact***	• ***With existing Admin house and staff house made of light materials and container house***		***Petra Cement, Inc.***	***As seen on site***
Earthmoving works due to backfilling up to 4.0 meters	**The Land**	• Loss of existing vegetation and faunal species	• Implement tree planting and landscaping shall be restored by planting more trees and other fauna so that the lost flora will gradually return.	Php 0.100 M	Petra Cement, Inc.	Shall form part on the contractor's agreement.
Delivery of construction materials	**The Land**	• Traffic and Road Safety	• Implement traffic management system inside the property. • Access road along National Highway will install adequate signages with proper scheduled hours will be posted on strategic places for easy access and	Php 0.0200 M	Petra Cement, Inc.	Shall form part on the contractor's agreement.

PROJECT ACTIVITIES	ENVIRONMENTAL COMPONENT LIKELY TO BE AFFECTED	POTENTIAL IMPACT	PROPOSED MITIGATING MEASURES	COST OF MITIGATING MEASURES OR ENHANCEMENT	PERSON RESPONSIBLE FOR THE IMPLEMENTATION	GUARANTEES (MOAs, ETC) CONTRACTS
			provide personnel to manage or direct the vehicle going in and out of the premises.			
Earthmoving works including installation of drainage pipes	**The Water**	• Possible Flooding	• Increased the elevation at a minimum of 4.0 meters. • Proper drainage shall be constructed during construction to divert the flow of run-off to the creek • Construction of pile drives and rip-rap	Php 0.500 M	Petra Cement, Inc.	Shall form part on the contractor's agreement.
Actual Measures Implemented		• ***No Impact***	• ***On-going construction/installation of RCP pipes in preparation for the drainage system*** • ***Installation of pile drive***		***Petra Cement, Inc.***	***As seen on site***
Site Development Preparation and Installation of machines	**The Water** Surface water	• Siltation of Tanalan Creek • Loss of fresh water ecology • Water Quality of the creek	• Stockpile shall be placed away from the creek side • Immediate spreading and compaction of the fill materials shall be done and installation of sand bags at the critical area along the Tanalan Creek • Settling ponds shall be constructed to ensure that silts are gathered and collected at the pond with sand bags therefore only overflow clear water goes directly to the final outfall	Php 0.600 M	Petra Cement, Inc.	Shall form part on the contractor's agreement

PROJECT ACTIVITIES	ENVIRONMENTAL COMPONENT LIKELY TO BE AFFECTED	POTENTIAL IMPACT	PROPOSED MITIGATING MEASURES	COST OF MITIGATING MEASURES OR ENHANCEMENT	PERSON RESPONSIBLE FOR THE IMPLEMENTATION	GUARANTEES (MOAs, ETC) CONTRACTS
Actual Measures Implemented		• ***No Impact-check the trend of the quality of the creek***	• ***Conducted surface water sampling for upstream, midstream and downstream. Results showed that parameters are all within DENR standards***		***Petra Cement, Inc.***	***Results attached in Annex N.***
Site development activities-Domestic water requirement of the project	**The Water**	• Increase in Water Demand of 5.0 cubic meter per day	• The project is covered by the Local Water District, however, conservation of water is encourage such as rainwater collection	Php 0.050 M	Petra Cement, Inc.	Shall form part on the contractor's agreement
Actual Measures Implemented		• ***No Impact-under Local Water District***	• ***Minimal water consumption at the site***		***Petra Cement, Inc.***	***With Water bill***
Earthmoving works	**The Air**	• Dust Generation	• Water Sprinkling/spraying of open areas such as roadways	Php 0.240 M	Petra Cement, Inc.	Shall form part on the contractor's agreement
Actual Measures Implemented		• ***No Impact-monitor the air quality during construction***	• ***Conducted air sampling in the area***		***Petra Cement, Inc.***	***Results attached in Annex Q***
Excavation, grading and bulldozing	**The** Noise	• Noise pollution	• Proper maintenance and provide all equipment with muffler	Php 0.030 M	Petra Cement, Inc.	Shall form part on the contractor's agreement
Earthmoving works	**The People**	• Domestic waste • Construction Hazards • Employment	• Portalets shall be provided and maintained • Provide safety gadgets during working activities • Proper signage within the property area to identify the	Php 0.050 M	Petra Cement, Inc.	Shall form part on the contractor's agreement

PROJECT ACTIVITIES	ENVIRONMENTAL COMPONENT LIKELY TO BE AFFECTED	POTENTIAL IMPACT	PROPOSED MITIGATING MEASURES	COST OF MITIGATING MEASURES OR ENHANCEMENT	PERSON RESPONSIBLE FOR THE IMPLEMENTATION	GUARANTEES (MOAs, ETC) CONTRACTS
			on-going construction activity. • Use of PPE when inside the construction area • Provision of Safety Personnel and first aid kits • Implement occupational Health and Safety Protocol • Local Hirees			
Actual Measures Implemented		• ***No Impact***	• ***With three chamber septic tank*** • ***Implementing the use of PPE's when inside the premise*** • ***Hired two (2) Local Hirees***		***Petra Cement, Inc.***	***As seen on site***
OPERATION PHASE						
Operation of the grinding facility	**The Land**	• Generation of hazardous and non-hazardous wastes materials	• Practice waste segregation at source and waste reduction through reuse and recycling; • Conduct of IEC on solid waste management to all employees including posting of signages and provision of properly-labelled waste bins; • Segregation of non-hazardous and hazardous materials; • Non-hazardous wastes will be disposed in the local government disposal area; and	Php 0.500 M	Petra Cement, Inc.	Coordinate with the accredited hauler with Hauling Permit and secure Hazardous Waste Generators ID. Compliance to RA 9003 and RA 6969

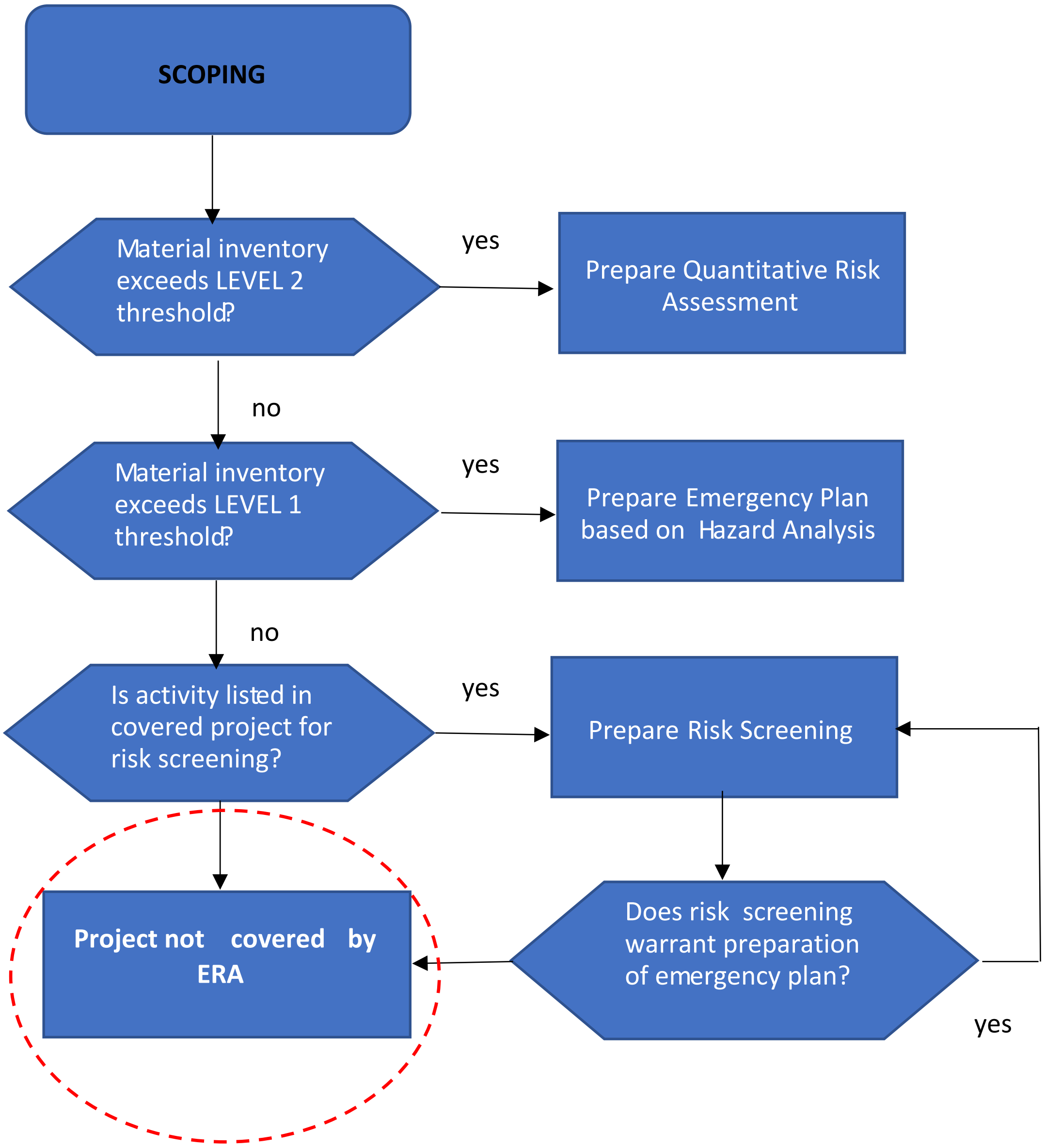
PROJECT ACTIVITIES	ENVIRONMENTAL COMPONENT LIKELY TO BE AFFECTED	POTENTIAL IMPACT	PROPOSED MITIGATING MEASURES	COST OF MITIGATING MEASURES OR ENHANCEMENT	PERSON RESPONSIBLE FOR THE IMPLEMENTATION	GUARANTEES (MOAs, ETC) CONTRACTS
			• Hazardous wastes such as used oil, used batteries, busted bulbs, expired chemicals and laboratory wastes will be stored onsite and hauled and treated offsite by a 3rd party DENR-registered waste treater			
Washing and cleaning activities	**The Water** **Surface Water**	• Possible impact on the quality of the creek due to improper domestic wastewater discharge • Accidental Oil Spill	• With Provision for purifying septic tank for treatment of domestic wastewater • Provision for STP • Properly maintained Settling Pond • Provision for oil and water separator • Provision for tire bath for entry and exit of vehicles	Php 0.300 M	Petra Cement, Inc.	Secure Discharge Permit (DP)
Loading and Unloading of materials	**The Water** **Marine Water**	• Possible impact on the quality marine water due to spill	• Observe salvage zone	Php 0.300 M	Petra Cement, Inc.	Secure Discharge Permit (DP)
Operation of cement grinding machine – maximum operating in 16 hours	**The Air**	• Dust Generation • Increase in Particulate Matter and TSP	• Installation of 3 units Baghouse and Properly maintained dust control facility • Monthly replacement of filter bags • Secure Permit to Operate	Php 0.050 M	Petra Cement, Inc.	Secure Permit to Operate (PTO)

PROJECT ACTIVITIES	ENVIRONMENTAL COMPONENT LIKELY TO BE AFFECTED	POTENTIAL IMPACT	PROPOSED MITIGATING MEASURES	COST OF MITIGATING MEASURES OR ENHANCEMENT	PERSON RESPONSIBLE FOR THE IMPLEMENTATION	GUARANTEES (MOAs, ETC) CONTRACTS
During power interruption	**The Air**	• Increased in CO and NOx	• Proper location with exhaust of the genset • Secure Permit to Operate and conduct yearly emission testing • Regular maintenance of the genset	Php 0.050 M	Petra Cement, Inc.	Secure Permit to Operate (PTO)
Operation of cement grinding machine – maximum operating in 16 hours	**The** Noise	• Noise pollution to the workers and community	• Proper maintenance and provide all equipment with muffler • Provision for noise barrier	Php 0.020 M	Petra Cement, Inc.	Compliance to Noise Level standards
Operation of the Plant from production, office works, security and utilities	**The People**	• Employment • Construction Hazards	• Prioritize Local Hirees • Provide safety gadgets during working activities • Proper signage within the property area • Use of PPE when inside the construction area • Provision of Safety Personnel and first aid kits • Implement occupational Health and Safety Protocol	Php 0.050 M	Petra Cement, Inc.	Compliance to DOLE and Safety Standards
ABANDONMENT PHASE						
Demobilization works and removal of the machines	**The Land**	• Landform Disturbance	• Properly maintained landscaping and trees planted	Php 0.200 M	Petra Cement, Inc.	Part of the contractor's agreement
Termination of Contractors and employees	**The People**	• Employment	• Inclusion in the contract the time and duration of the work	Php 0.010 M	Petra Cement, Inc.	Part of the Proponent commitment

4.0 ENVIRONMENTAL RISK ASSESSMENT (ERA) AND EMERGENCY RESPONSE POLICY AND GUIDELINES

Environmental Risk Assessment (ERA)

The proposed expansion of the cement finishing plant will not involve processes that are required for risk screening (i.e., as specified in Annex 2-7e of DAO 2003-30 Procedural Manual). It will also not store hazardous materials in excess of the amount can be accommodate by the area.



Risk Associated During Operation of the Plant

The main environmental or ecological risk in cement finishing plant operation is the accidental discharge of dusty air to the atmosphere, without passing through the air pollution control facility. As mitigating measure, the facility is properly designed to contain the emission by encapsulating the dust collector area, and besides, there will be three (3) units of dust collector that are readily installed to ensure that there will be no significant dust emission directly into the environment in case of any process deviation. ***Plant layout showing the barricaded/encapsulated production area is attached on the Appendix F.***

Regarding water pollution control, the proponent will make sure that once the septic tanks are already full, they will contact DENR accredited haulers/treaters of sewage water to avoid discharging wastewater into the creek/river.

Another risk in the project is when the hazardous wastes are not properly hauled, treat and disposed. In this case, the proponent will ensure that there will be a constant assistance of DENR accredited hazardous waste transporter, treater and disposal facility. Internal hazardous waste management program in compliance with RA 6969 also known as An Act to Control Toxic Substances and Hazardous and Nuclear Wastes will also be implemented.

Aside from having encapsulated production area to minimize noise dispersion coming from the plant operation, the proponent will provide high quality ear muff to all the personnel involve on the process. Strict implementation of wearing personal protective equipment while inside the production area will be observed from time to time. The said ear-muff has the noise cancellation feature wherein the personnel will be able to hear clearly only the human voice, while the plant operation noise will be extremely minimized. To ensure high efficiency of production area encapsulation, high-grade insulation material will be added on the production wall surface.

Furthermore, an internal regular noise level monitoring will be done by the Pollution Control Officer in order to justify the encapsulation efficiency as well as the protection of personnel from hazardous and excessive noise. Any abnormalities observed on the said monitoring will be immediately reported to the Managing Head and corrective action will be placed the soonest possible.

Risk Associated By Natural Calamity and Hydrologic Hazard such as Tsunami, Flood and Storm Surge

Flooding (Overflowing)

The proposed site is relatively a flood prone area due to the fact that the site is located adjacent to the coastal zone. The difference in elevation between the proposed project site ground surface and the current river water level ranges from 3.0m to <1.0m in the beach front. Height of the river water dramatically rises to cause overflowing from the river bank especially in times of extreme weather condition and intense precipitation. Based on the ***Mines and Geosciences Bureau (MGB)*** published flooding and landslide susceptibility map in 2010 suggests that the site is indeed prone to moderate to high flooding hazard.

Tsunami

The effects of possible tsunami occurrences that could reached the project may have a major effect based on the presently published Tsunami Map prepared by Phivolcs in 2007. As gleaned from the map, it appears that in case of Magnitude 8.0 earthquake from the Sulu Trench, a 3meter high tsunami will reached the western coasts of Zamboanga, and may result in a tremendous devastation could be expected particularly in Dipolog City. At the project site, such waves were predicted to force inland several kilometers from the shoreline. This natural hazard likewise reflects the damages it may inflict at the project site.

Strom Surge

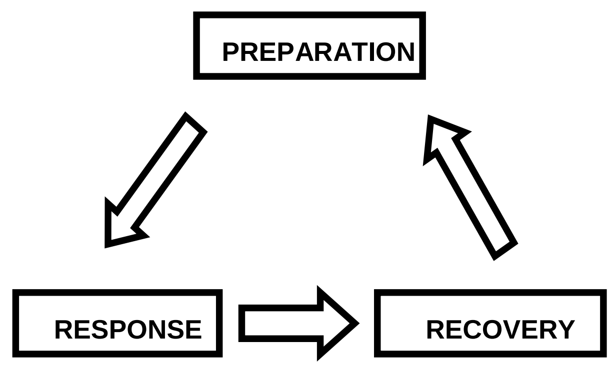
A **storm surge**, **storm flood** or **storm tide** is a coastal flood or tsunami-like phenomenon of rising water commonly associated with low pressure weather, the severity of which is affected by the shallowness and orientation of the water body relative to storm path, as well as the timing of tides. It is a measure of the rise of water beyond what would be expected by the normal movement related to tides.

Emergency Response Policy and Guidelines

Emergencies are unforeseen events or episodes that are caused by natural forces and circumstances that may result to negative effects to people, property, and the environment. Fires and earthquakes are immediate concerns for the proposed Cement Finishing Plant Project.

The proponent will devise and implement Emergency Response Plans (ERPs) to avert or decrease the likelihood of accidents from occurring. It will also provide the proponent to the appropriate strategy on responding to critical situations, which will minimize loss of life and property, and finally, on doing the necessary recovery efforts should an emergency does happen. This principle is summarized in Figure below or the Emergency Response Plan diagram, and further discussed in preceding **Table 4-1**.

Figure 4-1 Emergency Response Plan Diagram



Preparedness - is the development of actual action plans should an emergency happens, and elimination or avoidance of hazards from happening or occurring.

Response - is the execution of the plans and procedures during an actual emergency event

Table 4-1. Emergency Response Plan

PREPARATION	RESPONSE	RECOVERY
A. Fire		
• Orientation and training of person on fire safety • Conduct regular fire drills • Installation and regular testing of fire-fighting devices (i.e. fire hoses, fire extinguishers, smoke detectors, sprinkler system) • Electrical equipment and lines are inspected and replaced as necessary for any defects or malfunctions • All flammable items are secured in proper containers and storage facilities • A 'no-smoking' policy will be implemented in the whole project area or a safe zone for smoking personnel and occupants will be designated	All personnel are advised not to panic to prevent further injuries Personnel are advised to follow emergency evacuation procedures Report immediately any presence of smoke, sparks, or open flame to authorized personnel If the fire can still be contained, use fire extinguishers immediately Disconnect electrical or fuel connections, and shut-down all affected equipment If possible, remove all flammable materials from the fire scene from getting contact	• Avoid returning to the fire scene, as long as necessary, unless declared for safe entry • Check all personnel to find out if there are injuries or trapped/injured persons that may need assistance • Report any important incidents that require immediate attention • Secure important items and equipment from unauthorized access from outsiders, after the building is declared safe for re-entry • If the fire damage is minimal, or facility is recoverable, make necessary corrective
• Emergency numbers and communication equipment are placed in conspicuous areas for easier notification • Emergency exits and evacuation procedures shall be put in place, and kept free from any obstructions • Regular maintenance of genset and other related equipment	For responders, wear the proper protection attire (i.e. fire suit, boots, breathing apparatus) Avoid using or pouring water over fuel or alcohol fires, and electrical fires	measures to prevent the accident from re-occurring
B. Earthquakes		
• Make necessary preparations, which includes equipment and facility checks to prevent injuries in an event or an earthquake • All loose items must be secured to prevent falling • Heavy materials are placed near the ground • Flammable items are stored in designated safe areas • Personnel are familiarized to safe locations, emergency response equipment and evacuation routes	•All personnel and •administrative officers are •advised not to panic to prevent •further injuries Personnel are •advised to protect themselves by getting under sturdy structures Personnel are advised to stay away from sharp, flammable, or heavy items Personnel are advised to prepare immediate evacuation of the facility if necessary All gas and electric equipment are shut down	If there are no threats of aftershocks, check other personnel that may be trapped, injured, or needs further assistance Avoid returning to the facility if it is deemed structurally unstable, or declared unsafe Check for possible fires and advice authorities for appropriate response Secure important items and equipment from unauthorized access from outsiders, after the building is declared safe for re-entry Inspect the facility for any major structural defects, cracks, and unstable items, other potential hazards

		▢ If the earthquake damage is minimal, or facility is recoverable, make necessary corrective measures to prevent the further hazards from affecting personnel and property
C. Occupational Hazards		
• Formation of emergency response teams for each department • Provision of first-aid kits and emergency equipment on critical areas • Regular supervision of production personnel especially on the operation of machinery • Training of personnel on proper equipment handling and other safety practices • Posting of safety reminders on critical areas and equipment • Provision of safety features such as adequate lighting, guide rails, and safety signage	Report immediately any accidents, especially those considered life-threatening Immediate application of first-aid Removal of the affected personnel on the accident site Bring the affected personnel to the nearest first aid station or hospital if necessary	• Perform corrective measures on equipment and procedures • Provision of additional safety procedures, equipment, and training
D. Risk Associated During Operation of the Plant		
Dust Pollution due to malfunctioning of Air Pollution Control Device • Proper Training of Pollution Control Officer (PCO) • Monthly replacement of the filter bag • Ensure back-up filter bag available at the site *Water Pollution due to spilled domestic wastewater* • Regular siphoning or desludging of septic tank • Regular inspection of the outfall • Memorandum of Agreement (MOA) with accredited hauler and treater	• Immediate replacement and temporary shutdown of the operation • Report immediately to the management • Funds should be made available always	• Perform corrective measures on equipment and procedures • Provision for back up air pollution control device
E. Risk Associated By Natural Calamity and Hydrologic Hazard such as Tsunami, Flood and Storm Surge		
• In case of typhoon, listen to the radio, media on the update of the storm • Removal of cement bag stacks and other raw materials • Announcement to all workers and employees on the weather update • Conduct disaster prepared drill • Removal and relocation of important documents in the office • Distribution of safety gears, gadget and other emergency kits	• All personnel and administrative officers are advised not to panic to prevent further injuries Personnel are advised to protect themselves by getting under sturdy structures • Personnel are advised to stay away from sharp, flammable, or heavy items Personnel are advised to prepare immediate evacuation of the facility if necessary	• Avoid returning to the facility if it is deemed structurally unstable, or declared unsafe • Secure important items and equipment from unauthorized access from outsiders, after the building is declared safe for re-entry

5.0 SOCIAL DEVELOPMENT PLAN/FRAMEWORK (SDP) AND IEC FRAMEWORK

5.1 SOCIAL DEVELOPMENT PROGRAM (SDP)

Table 5-1 Social Development Plan (SDP) and Actual Implementation

Concern	Responsibility Community Member/Beneficiary	Government Agency and Services	Proponent	Indicative Time	Source of Fund
Recruitment Activities- Employment generation benefits from the project	One (1) Technical Qualified Person	Barangay Office-Proper coordination	Contractor/ Proponent	• Construction • Operation	Proponent
Livelihood seminars vegetable raising or livestock; fish or dried fish production, providing seed money in the form of loans on easy terms	Barangay Lower Irasan For poor households, senior citizen and women	LGU – Barangay Office TESDA	Community Relation Officer (CRO)	• Construction • Operation	LGU- Municipal and Barangay With assistance of the proponent
Health and Nutrition Medical Mission, Dental Mission, Eye Check-up and Feeding Program	Barangay Lower Irasan	LGU – Barangasy Office MHO and BHO	Community Relation Officer (CRO)	• Operation	LGU- Municipal and Barangay With assistance of the proponent
Education and Safety Trainings for Emergency Response Team such as CPR, First-Aid, etc.	Barangay Lower Irasan	LGU – Barangasy Office MHO and BHO	Community Relation Officer (CRO)	• Operation	LGU- Municipal and Barangay With assistance of the proponent
Education Supply of educational/learning materials to pre-school children Provide Footbridge for the Elementary Students	Barangay Lower Irasan	LGU – Barangay Office DepEd, MHO	Community Relation Officer (CRO)	• Construction • Operation	LGU- Municipal and Barangay With assistance of the proponent
Education Assistance to Scholarship Program	Barangay Lower Irasan	LGU – DepEd	Community Relation Officer (CRO)	• Construction • Operation	LGU- Municipal and Barangay With assistance of the proponent
Environment and Sanitation Maintenance of barangay roads and drainage system	Barangay Lower Irasan	LGU – Barangay Office, Barangay Tanod	Community Relation Officer (CRO)	• Construction • Operation	LGU- Municipal and Barangay With assistance of the proponent Proponent
Health and Sanitation – Operation Linis	Barangay Lower Irasan	LGU – Barangay Office, Barangay Health Workers	Community Relation Officer (CRO)	• Construction • Operation	LGU- Barangay With assistance of the proponent
Peace and Order – Purchase of Uniforms of Barangay Tanod	Barangay Lower Irasan	LGU – Barangay Office, Barangay Tanod	Community Relation Officer (CRO)	• Construction • Operation	LGU- Barangay With assistance of the proponent
Skills Training Program- Construction Workers such as carpenter, welder, mason, etc. in coordination with TESDA	Barangay Lower Irasan Barangay Upper Irasan Barangay Langatian	LGU – Barangay Office, Barangay Tanod	Community Relation Officer (CRO)	• Construction • Operation	LGU- Barangay With assistance of the proponent
Tourism – Feast of Lowe Irasan every May 1 in Honor of St. Joseph the Carpenter Celebration of Fiesta every October 12 I Honor of Hermosa	Barangay Lower Irasan	LGU-Barangay	Community Relation Officer (CRO)	• Construction • Operation	LGU- Barangay With assistance of the proponent

Festival Buklod Festival very April 16 to 20 Mutya ng Roxas 2018	Municipality of Roxas	LGU – Roxas	Management		Proponent-One time Only
Infrastructure – Road concreting works to unpaved areas in Sitio Tubo	Barangay Lower Irasan	LGU –Municipality of Roxas and Barangay	Community Relation Officer (CRO)	• Construction • Operation	LGU- Municipal With assistance of the proponent
Actual Implementation- Donations to Fiesta ***Environment Month Sponsor***	***Barangay Lower Irasan*** ***Municipality of Roxas***	***LGU-Barangay*** ***LGU-Roxas***	***Community Relations Officer (CRO)*** ***Management***	***Construction*** ***June 2018***	***Proponent*** ***Proponent***
Spiritual-Provide donations to church	Barangay Lower Irasan	LGU - Barangay	Community Relation Officer (CRO)	• Construction • Operation	Proponent
Actual Implementation – Relocation of the Church	***Lower Irasan***	***Barangay and Parish Priest***	***Community Relation Officer (CRO)***	***Construction Phase***	***Proponent***
Disaster Preparedness – Conduct seminar on disaster preparedness and emergency response such as flooding, tsunami, earthquake, etc.	Barangay Lower Irasan Barangay Langatian Barangay Upper Irasan	LGU – Municipal and Barangay	Community Relation Officer (CRO)	• Construction • Operation	Proponent

5.2 INFORMATION AND EDUCATION CAMPAIGN (IEC)

Table 5-2 Information Education Campaign (IEC)

Target Sector	Major Topics of Concern In Relation to the Project	IEC Scheme/ Strategy/ Methods	Information Medium	Indicative Timeframe	Indicative Cost
PRE-CONSTRUCTION ACTIVITIES					
1. Barangay Office	a. Submission of project Description in connection with the Public Consultation/Scoping part of the ECC application	Proponent Driven-coordination with the concerned barangay. Public scoping was part of the initial introduction	Letter Request	Simultaneous with the preparation of the EPRMP Study	P 50,000.00
2. Municipal Office	a. Submission of letter and plan in connection with application for ECC application. Also in preparation to secure LGU permits	Proper Coordination Through Sangguniang Hearing Session	Letter Request	Simultaneous with the preparation of the EPRMP Study	P 50,000.00
4. Community Residents and other stakeholders	a. Consultation June 1, 2016 b. September 14, 2016 c. September 26, 2016	Letters, Tarpaulin Posting and Presentation in a form of forum or meeting	a. EMB R9, Lower Irasan and PENRO b. Barangay, PENRO, MENRO, LGU c. LGU Roxas, Naga and MENRO	Simultaneous with the preparation of the EPRMP Study	P50,000.00
DURING CONSTRUCTION					
1. Barangay Office	a. Posting of Job Requirements	Coordination with the Barangay	Public Address in the Barangay	At least one (1) month before the start of construction	P0.2M/month expected salary of the workers
DURING OPERATION					
1. Multi-Sector Group-Barangay, NGO, Government Office-LGU	a. Creation of Multi-Partite Monitoring Team (MMT) for monitoring of Environmental Management Plan (EMP), monitoring of actual impacts	a. Invitation Letters b. Coordination Group meeting	a. Memorandum of Agreement (MOA)	During Operation	P50,000/ Per quarter/ meeting
2. Public Information through Billboard/ tarpaulin on the Social Development Program (SDP) such as assistance medical mission, feeding program, etc,	a. Proper coordination with the barangay office	a. Billboard/ tarpaulin	Posters/ Tarpaulins	During Operation	P10,000

5.1.1 Discussion of Social Development Plan (SDP)

Social Development Plan (SDP) aims to address the socio-economic issues and concerns relevant to the proposed expansion of the project. Based on the results of the Public Consultation, Perception Survey and coordination with the Barangay Lower Irasan Office in terms of the Social Development Plan of the barangay, job opportunities are most likely important issue in the barangay.

The Social Development Plan (SDP) is the proponent's initiative based on the results of the perception survey since the barangay has no prepared five (5) year plans and program. There are two (2) types of programs that the proponent proposes, Livelihood programs and Environment, among others are the program of the barangay.

The beneficiaries of the SDP are the communities and other stakeholders and identified programs will be implemented during pre-construction, construction and operation phase of the project in partnership with local government units. The implementation of the company's Corporate Social Responsibility (CSR) shall be handled by the Community Relations Officer.

Barangay Program: Coordination with the Barangay Office for the incoming plans and program such as Health, Nutrition, Education, Safety, Peace and Order, Tourism and Infrastructure.

Recruitment Activities: During pre-construction phase, the proponent shall hire at least 55 construction workers both skilled and non-skilled qualifications. During Operation phase, about fifty six (56) is needed for the operation of the plant, in the event of hiring or replacement of qualified skilled and unskilled workers, proper coordination shall be done to the Barangay Office for posting of hirees.

Training and Seminars: the proponent in coordination with the LGU shall conduct a seminar and training in terms of livelihood and skills training which the proponent may assist to be implemented for the project during operation phase. Security and safety measures training as part of the peace and order program shall also need to be implemented.

5.2.1 INFORMATION EDUCATION FRAMEWORK

Presented in ***Table 5-2*** is the Information Education Framework Plan of the proponent during pre-construction, construction and operation phase of the project.

5.2.1.1 Goals

The implementation of the Information Education Plan aims for the following:

a. To institutionalize environmental management and sustainable development concerns in the development structures, policies and programs of the corporation;
b. To promote that the project is one that recognizes the synergy and reconciliation of environmental management and economic development;
c. To mobilize active advocacy from identified stakeholders.

5.2.1.2 Specific Objectives

a. To make information accessible to all sectors of the community;
b. To increase the level of awareness and understanding about the project;
c. To encourage upgrading of skills of various groups for future development;
d. To mobilize multi-sectoral participation in and support for sustainable development initiatives of the proponent.

5.2.1.3 Components of the Program and Plan

The program consists of the identification of target sector, major topics of concerns pertaining to the project, scheme and its strategy, medium of information, the indicative timeframe and the cost of the activity.

6.0 ENVIRONMENTAL COMPLIANCE MONITORING

6.1 ENVIRONMENTAL PERFORMANCE

Permits and Licenses

The proponent secured Barangay and Municipal Resolutions, attached in ***Annex E***.

Business Permit has been secured, attached in ***Annex E***.

Tree Cutting Permit issued by Philippine Coconut Authority (PCA) for cutting of 100 Coconut Trees, attached in ***Annex M***.

Compliance to the Conditions of the ECC

Table 6-1 ECC Compliance to Conditions

CONDITIONS		STATUS	REMARKS
Environmental Management	1. Conduct an effective Information, Education and Communication (IEC) Program to inform educate all stakeholders, especially its contractors, workers, and local residents about the mitigating measures embodied in its IEEC, the conditions stipulated in this Certificate and the environmental and human safety features of the project for greater awareness, understanding and sustained acceptance of the project. The program shall be submitted to EMB Regional Office on an annual basis;	Complying	Proponent has assigned community officer to regularly coordinate with LGUs
	2. An Environmental Officer (EO)/Pollution Control Officer (PCO) must be appointed to handle environmental impact management related aspects of the project as specified in the Environmental Impact Management Plan (EIMP). The EO/PCO shall: a. Monitor actual project impacts vis-à-vis the predicted impacts and management measures in the EIA document. b. Submit semi-annually an ECC Compliance Monitoring Report (CMR) to EMB-IX, wherein each second or yearend report shows the summary of cumulative performance of Proponent against previous years requirement and commitments.	Complying	PCO assigned in the area is Mr. Joel Caballero, regularly submits CMR's and SMR's
	3. The proponent shall submit and Abandonment Plan to the EMB-IX at least one year prior to the projects abandonment. The plan shall include rehabilitation measures clean-up, remediation of areas affected by the	Not yet applicable	For Compliance when applicable

	project and proposed alternative projects in the area.		
General Conditions	4. This Certificate covers the construction and operation of a cement/non-metallic mineral processing plant project with a production rate of less than 50,000 metric ton/year within the 52,727.00 square meters lot registered under the TCT No. T-27983 technically described as 08^0 31'15.62" N Latitude; $123^0$13'1.94" E Longitude to be located in Barrio Irasan, Roxas, Zamboanga del Norte, Region IX. 5. The plant operations shall conform with the provisions of RA 6969(Toxic Substance and Hazardous and Nuclear Wastes Control Act of 1990), RA 8749 (Philippine Clean Air Act of 1999), RA 9003 (Ecological Solid Waste Management Act of 2000), and RA 9275 (Philippine Clean Water Act of 2004) and other relevant policies, rules and regulations;	Complying	The project is confined in the approved land area covered by the TCT. Land development is currently on-going, no operation yet in terms of production. The proponent has a pending application for the increase in capacity production to 1,2M/yr
	6. That all required permits/clearance from concerned government agencies shall be secured prior to project implementation;	Complied	All LGU permits were secured
	7. That a Continuous Opacity Monitoring System (COMS) shall be installed if the PM_{10} and the Total Suspended Particulates (TSP) emission will exceed the 100 ton/year pursuant to RA 8749 (Clean Air Act of 1999);	Not Yet applicable	For compliance when operation
	8. That the entire mixing operation shall be conducted inside an enclosed system shall be used for the loading, unloading, handling, transfer or storage of cement and/or other dusty raw materials;	Not Yet applicable	For compliance when operation
	9. That any raw materials shall be cleaned up by dry sweeping. Water should not be used in the process of cleaning up spills except where the area drains to an effective wastewater treatment facility;	Not Yet applicable	For compliance when operation
	10. That all silo and weighing scale vents shall be fitted with fabric filtering systems to collect dust, including the provision of sufficient lighting near cement silo filter exhausts to observe visible emissions performance during fills that occur during non-daylight hours;	Not Yet applicable	For compliance when operation
	11. That dust emissions due to vehicle travel shall be minimized by vehicle wheel cleaning before leaving the site (i.e dry cleaning or the wheel and truck wash facilities at site exits),	Not Yet applicable	For compliance when operation

	and vehicles used to deliver materials must be properly covered, including posting of vehicle speed limits;		
	12. That noise and other forms of nuisance emitted during project implementation shall be adequately controlled/isolated within the project site;	Not Yet applicable	For compliance when operation
	13. That resolution of complaints against noise as result of project implementation/operation shall be responsible of the LGU concerned;	Not Yet applicable	For compliance when operation
	14. That fire control devices shall be provided at conspicuous and high-risk areas of the project site;	Not Yet applicable	For compliance when operation
	15. That Multipartite Monitoring Team (MMT) composed of representative(s) from the proponent, EMB-IX, Non-Government Organization (NGO), Local Government Units (LGU'S) and other Government agencies concerned shall be organized through a Memorandum of Agreement (MOA) within 60 days from receipt of the ECC. It shall primarily oversee the compliance of the proponent with the Environment Management Plan (EMP), other commitments and mitigation measures that are contained in the EIA documents and the ECC conditions;	Not Applicable	Due to DAO 2017-15, the project is no longer covered by the MMT, however, an initial meeting was convened for the formation of such.
	16. That the project activities shall not adversely affect or endanger any public or private structures, real properties and flora/fauna within the surrounding vicinity of the project;	Complying	The project is confined in the area covered.
	17. That the proponent shall be held accountable for any damage to life and/ or property which may result from project implementation and shall pay just and reasonable compensation to aggrieved parties;	Noted	Noted
	18. Planting of appropriate tress species shall be planted along the perimeter to serve as noise, vibration and dust buffer zone. To ensure its compliance in Information Plan should be submitted six (6) months after project implementation highlighting, the number and type of species of trees planted, area covered among others;	For Compliance	The project is still under land development activities
	19. A billboard containing this message 'Notice to the Public, This Project (Name of the Project) of (Proponent Name) has been issued an Environmental Compliance Certificate (ECC Number) by the Environmental Management Bureau of the	Complied	Billboard was posted at the entrance of the site

	Department of Environment and Natural Resources, Region IX, on (June 21, 2016)." This billboard must be installed at all entry and exit points and at all perimeters of the project facing the road to inform the general public within thirty (30) days from the receipt of the certificate. A copy of the certificates shall also be posted by the Proponent at the barangay bulletin board of the affected barangays within thirty (30) days from receipt of the certificated. An accomplishment report which shall include picture verification of compliance to the posting of notices and the billboards shall be submitted to this Office within ninety (90) days from receipt of the Certificate;		
	20. This Certificate shall be automatically revoked if the project has bot commenced within the period of five (5) years from the issuance hereof and/or no request for extension within the three (3) months allowance from the expiration of its vitality, provided that, no significant change/s in the project area's baseline environment which makes the approved Environmental Management Plan (EMP) inappropriate.	Not Yet applicable	For compliance when applicable
Restrictions	21. No activities shall be undertaken other than what were stipulated in the IEEC. Should there be any expansion of the project beyond the project description or any change in the activity or transfer of location shall be subject to a new Environmental Impact Assessment; and	Noted	Noted
	22. In case of transfer of ownership of this project, these same conditions and restrictions shall apply and the transferee shall be required to notify the EMB-IX Regional Office within fifteen (15) days from the transfer of ownership to allow the necessary changes brought about by such transfer.	Not Yet applicable	For compliance when applicable

Complied initially with the formation and creation of the Multi-Partite Monitoring Team (MMT), attached in ***Annex T***.

Regular submission of the Compliance Monitoring Report (CMR) and Self-Monitoring Report (CMR), attached in ***Annex J***.

Social Development Commitment

Currently employed a total of two (2) from Barangay Lower Irasan.

Tourism and Festivals

Donated and provided in financial assistance during Town and Barangay Fiesta.

Relocated and constructed new Church.

Environment

"Adopt-an-Estero Program"

The proponent participated in an "Adopt-An-Estero" Program of the DENR which encourages the participation of private/business sectors, academe and other government agencies and Local Government Units (LGU's) to help in the rehabilitation of the esteros and waterways through clean-up and other activities.

A Memorandum of Agreement (MOA) is attached in ***Annex U***.

6.2 SELF-MONITORING PLAN

Continuous submission of the Semi-annual report shall be submitted to the DENR Region IX office showing the actual implementation of the Environmental Management Plan, Social Development Plan (SDP) and Information Education Campaign (IEC). Likewise, the proponent shall monitor compliance to the following:

- Compliance to Republic Act 9003, Ecological Solid Waste Management Act.
- Compliance to Republic Act 9275, Clean Water Act of 2000.
- Compliance to Republic Act 6969, Hazardous Wastes
- Compliance to Republic Act 8749, Clean Air Act
- Compliance to PD 1586 and the conditions stipulated in the ECC

6.3 MULTI-SECTORAL MONITORING FRAMEWORK

The project had convened the formation of the Multi-Partite Monitoring Team (MMT) with members of the MMT are from the Local Government Units, Barangay Lower Irasan, Municipality of Manuel A. Roxas and Provincial Government of Zamboanga del Norte, MPDO of Manuel A. Roxas, Non-Government Organization (NGO), PCAPI Region 9 – ZDN, ZN FePA, and Department of Health (DOH). The objective of MMT is to monitor the implementation of the IMP and the EMP of the project and reports the same to the concerned government agency. A Memorandum of Agreement (MOA) was drafted is attached in ***Annex T***, however, the issuance of DAO 2017-15 Section 16/16.1, Rationalization of the Multi-Partite Monitoring Team (MMT).

6.4 ENVIRONMENTAL GUARANTEE AND MONITORING FUND and COMMITMENTS

There is already an allocation of Environmental Guarantee Fund (EGF) in a form of Trust Fund and Cash Fund in the amount of One Hundred Thousand Pesos (Php 100,000.00) and Fifty Thousand Pesos (Php 50,000.00), respectively. The EGF shall be used in the event of any environmental related issues that may arise during the operation of the project such as damage to the Tanalan Creek, Marine Water and extreme dust impact to the community brought about by unforeseen damage of WTF and air pollution control device.

The Environmental Monitoring Fund (EMF) is in the amount of One Hundred Thousand Peso (Php 100,000.00) to cover the monitoring expenses for the project. The replenishment of the EMF and EGF shall be done when the funds are below 50% of the amount allocation.

Draft MOA for the Creation of the MMT as show proof of compliance is attached in ***Annex T.***

Table 6-2 Summary of Matrix of Environmental Monitoring Plan

ENVIRONMENTAL ASPECT PER PROJECT PHASE	POTENTIAL IMPACT PER ENVIRONMENTAL SECTOR	PARAMETER TO BE MONITORED	SAMPLING & MEASUREMENT PLAN			Lead Person	Annual Estimated Cost	EQPL MANAGEMENT SCHEME					
								EQPL RANGE			MANAGEMENT MEASURES		
			Method	Frequency	Location			Alert	Action	Limit	Alert	Action	Limit
I. PRE-CONSTRUCTION PHASE	NA	NA											
II. CONSTRUCTION PHASE													
	The Land-Construction Debris and materials	Volume of debris	Checking	Daily	Project Site	Contractor	Part of the construction cost	Build-up stockpile area	Designated area exceeded with over filled debris and becomes eye sore	Volume of construction debris	Call the attention of the contractor	Coordinate with the LGU for hauling	Voluntary removal of the debris
	The Land- solid waste generated by the workers	Quality and quantity of solid waste generated	Checking	Daily	Project	Contractor	Php 6,000 Per month	Build-up garbage area	Presence of flies and emission of foul odor	Worsening foul odor and insects/flies are present in the project site	Call the attention of the contractor	Coordinate with the LGU for collection	Coordinate with the LGU for regular collection. Fumigation shall be done by the proponent
	The People-Safety of workers	Safety rules and regulation	Checking	Daily	Project Site	Contractor	Part of the construction cost	Observed none wearing of PPE's	Observed habitual none wearing of PPE's	Accident happen	Talk to the contractor re: Safety Rules and regulation	No work without PPEs	No work without PPEs
III. OPERATION PHASE													
	The Land- Re-greening of the open area	Number of trees/plants/ shrubs planted	Observation	Monthly	Buffer Zone and Open	PCO	Part of the landscape cost	Plant leaves starts to change color	Plants becomes brown color	Plants begin to die	Regular irrigation of the plants	Re-planting or replacement	Irrigation and Replanting

					areas							of plants	
	The Land-Volume of solid waste generated by the plant	Quality and quantity of solid wastes	Observation	Daily	The Site, MRF and storage area	PCO	Part of the operating cost	No garbage collection has been observed on the assigned day	No garbage collection has been observed for the week	Presence of flies and other insects and emission of foul odor	Coordinate with LGU for collection Strictly Implement RA 9003	Strictly Implement RA 9003 and coordinate with LGU for hauling and disposal	Strictly Implement RA 9003 and coordinate with LGU for hauling and disposal. Fumigation shall be done
	The Land-volume of hazardous wastes generated such as used oil, empty cans of paints, container paints, busted fluorescent lamps	Quality and quantity of hazardous wastes	Checking	Monthly	Storage Area	PCO	P6,000	Several storage or container present in the are	Storage area is almost full	Observed storage area is over filled	Coordinate with accredited hauler and treater. Strictly Implement RA 6969	Immediate hauling and. Strictly Implement RA 6969	Regular hauling and. Strictly Implement RA 6969
	The Land-Traffic generation due to incoming and outgoing vehicles	Traffic Flow in the vicinity	Observation	Daily	Project	Guard	Part of the salary of the assigned guard	Slow moving flow of traffic	Lined up vehicles and hearing blowing of horns	Traffic Congestion	Assign Traffic Personnel	Designate Temporary parking area	Presence of traffic personnel at the site
	The Air - due to operation of the Grinding Machine	PM_{10} TSP NO_2 SO_2 PM_{10} TSP NO_2 SO_2 PM_{10} NO_2 SO_2 PM_{10} NO_2 SO_2	Sampling	Semi-annual	Station 1-Site Station 2-Market Station 3-Upper Irasan Station 4 - Langatian	PCO	P30,000 per year	5.18 ug/Ncm 6.55 ug/Ncm 0.54 ug/Ncm 0.54 ug/Ncm <0.1 ug/Ncm 48.7 ug/Ncm 0.41 ug/Ncm 0.29 ug/Ncm 0.59 ug/Ncm 0.70 ug/Ncm 0.63 ug/Ncm 1.87 ug/Ncm 0.68 ug/Ncm 0.49 ug/Ncm	6.1 ug/Ncm 7.7 ug/Ncm 0.63 ug/Ncm 0.63 ug/Ncm <0.1 ug/Ncm 57.3 ug/Ncm 0.48 ug/Ncm 0.35 ug/Ncm 0.70 ug/Ncm 0.70 ug/Ncm 0.63 ug/Ncm 2.20 ug/Ncm 0.80 ug/Ncm 0.58 ug/Ncm	150 ug/Ncm 300 ug/Ncm 150 ug/Ncm 80 ug/Ncm 150 ug/Ncm 300 ug/Ncm 150 ug/Ncm 180 ug/Ncm 150 ug/Ncm 150 ug/Ncm 180 ug/Ncm 150 ug/Ncm 150 ug/Ncm 180 ug/Ncm	Check Bag house	Immediate replacement of filter	Monthly replacement of filter bag

	The Noise- due to operation of the Grinding Machine	Decibel	Sampling	Semi-annual	Station 1- Site Station 2- Public Market Station 3- Upper Irasan Station 4 - Langatian	PCO	None	51.8 dB 51.8 dB 40.8 dB 44.2 dB	61.0 dB 61.0 dB 48.0 dB 52.0 dB	65 dB 65 dB 55.0 dB 50.0 dB	Check noise barrier	Immediate repair	Regular maintenance
	The Water- Volume of Domestic Wastes generated by the operation	BOD nitrate, phosphate, ammonia, fecal coliform, Oil and Grease and Surfactants	Sampling	Quarterly	Outfall- STP (Effluent)	PCO	P20,000	BOD-42.50 O & G-4.25 Nitrates-11.9 Phosp-0.85 Ammo-0.425 FCol-340 Surfactant-4.25	45.00 4.5 12.6 0.90 0.45 360 4.50	50.00 5.0 14 1.0 0.50 400 5.0	When the flow becomes slow and can smell foul odor	Conduct siphoning or de-sludging	Implement RA 9275 Provide additional chamber Secure Discharge Permit
	The Water- Quality of Surface Water (Tanalan Creek)	pH, Temperature BOD COD TSS Oil and Grease Total Coliform pH, Temperature BOD COD TSS Oil and Grease Total Coliform pH, Temperature BOD COD TSS Oil and Grease Total Coliform	Sampling	Quarterly	Upstream (SW1) Midstream (SW2) Downstream (SW4)	PCO	P20,000	7.65 25.92 2.55 mg/l 5.10 mg/l 4.25 mg/l 0.85 mg/l 1.95 $\times 10^4$ MPN/100ml 7.39 25.92 2.55 mg/l 5.95 mg/l 4.25 mg/l 0.85 mg/l 1.95×10^3MPN/100ml 7.48 26.01 2.55 mg/l 4.25 mg/l 4.25 mg/l 0.85 mg/l 1.95 $\times 10^4$	9.0 30.5 3.00 mg/l 6.00 mg/l <5.0 mg/l <1.0 mg/l 2.3×10^4MPN/100ml 8.7 30.5 3.00 mg/l 7.00 mg/l <5.0 mg/l <1.0 mg/l 2.3×10^3MPN/100ml 8.8 30.6 3.00 mg/l 5.00 mg/l <5.0 mg/l <1.0 mg/l 2.3×10^4MPN/	6.5-9.0 25-31 7.00mg/l None 50.0 mg/l 2.0 mg/l None 6.5-9.0 25-31 7.00mg/l None 50.0 mg/l 2.0 mg/l None 6.5-9.0 25-31 7.00mg/l None 50.0 mg/l 2.0 mg/l None	Visible turbidity	When creek turns blurd and check settling pond	Implement RA 9275

								MPN/100ml	100ml				
	The Water- Quality of Marine Water	pH, Temperature BOD COD TSS Oil and Grease Total Coliform pH, Temperature BOD COD TSS Oil and Grease Total Coliform pH, Temperature BOD COD TSS Oil and Grease Total Coliform	Sampling	Quarterly	MW1 MW2 MW3	PCO	P20,000	7.39 23.97 1.70 mg/l 13.60 mg/l 39.95 mg/l 0.85 mg/l 1.53^4MPN/100 ml 7.22 23.97 1.70 mg/l 18.70 mg/l 21.85 mg/l 0.85 mg/l 66.3^4MPN/100 ml 7.22 23.88 1.70 mg/l 66.30 mg/l 39.995 mg/l 0.85 mg/l 1.53^4MPN/100 m	8.7 28.2 2.00 mg/l 16.00 mg/l 47.0 mg/l <1.0 mg/l 1.8MPN/100 ml 8.5 28.2 2.00 mg/l 22.00 mg/l 25.0 mg/l <1.0 mg/l 78MPN/100m l 8.5 28.1 2.00 mg/l 78.00 mg/l 47.0 mg/l <1.0 mg/l 1.8MPN/100 ml	6.5-8.5 25-31 n/a None 80.0 mg/l 3.0 mg/l None 6.5-8.5 25-31 n/a None 80.0 mg/l 3.0 mg/l None 6.5-8.5 25-31 n/a None 80.0 mg/l 3.0 mg/l None	Visible turbidity	When water turns blurd and check settling pond	Implement RA 9275
	The Air- Emission from Stand-by Gensets	CO, NOx	Emission Testing	Annual	Genset area	PCO	P100,000	CO-425 NO_2-1,700	30.6	CO-500 SO_2-2,000	Conduct regular maintenance every week	Conduct emission testing every year	Implement RA 8749 Secure Permit to Operate Do not use the genset in case
III. ABANDOINMENT PHASE	The land- Construction debris	Debris	Observation	One Time Only	Project	PCO	NA	NA	NA	NA	Cleaning	Cleaning	NA

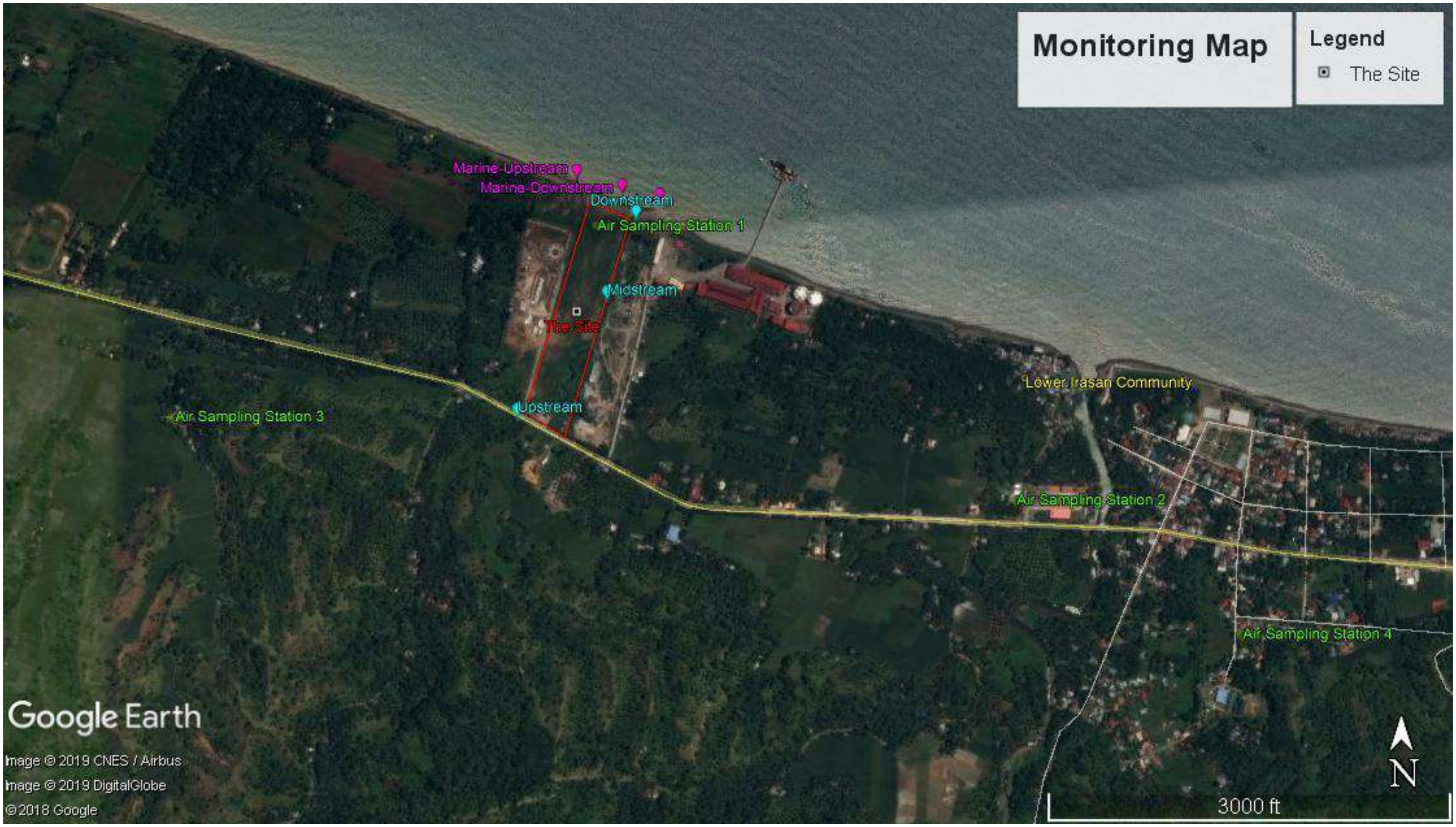


Figure 6-1 Monitoring Map

Table 6-3 Monitoring Map Location

Location	SW1 (Downstream) April 12, 2018 0905H 8°31'30.28"N; 123°13'6.33"E	SW2 (Midstream) April 12, 2018 0915H 8°31'25"N; 123°13'4"E	SW3 (Upstream) April 12, 2018 0930H 8°31'16"N; 123°12'58"E
Location	MW1 8°31'33"N; 123°13'2"E	MW2 8°31'32"N; 23°13'4"E	MW3 8°31'31"N; 123°13'7"E
Air Sampling Location			
	Station	Coordinates	1-hr monitoring
Location	Between Vicente Lao Construction and Sea Oil Depot	8°31'30"N; 123°13'4.0"E	
	Near Public Market and Bus Terminal, Roxas	8°31'9.0"N; 123°13'36"E	
	Purok Madasigon, Upper Irasan, Near Anquit Residence	8°31'15"N; 123°12'32"E	
	Brgy. Langitan, Sarah Compound	8°30'59"N; 123°13'53"E	

7.0 DECOMMISSIONING/ ABANDONMENT/ REHABILITATION POLICY

The existing project is not expected to be abandoned within the next 25 to 50 years from its planned operations for as long as the demand for cement products justifies the operation of the finishing plant. However, if abandonment is necessary due to urgent reasons, the proponent will perform an Abandonment Plan. The following scenarios may become reasons to abandon the project:

- Unsustainable business operations due to economic downturns;
- Changes in zoning, building, and other related ordinances of the Roxas, Zamboanga Del Norte;
- Transfer of business to other locations;
- Accidents and emergencies that could render the cement finishing plant unfit for occupation; and
- Closure order from Government agencies.

As such, the proponent will allocate sufficient time and available resources for proper dismantling and removal of structures and equipment from the existing site to minimize possible or further threats to the surrounding environment. Other activities that will be done during this event are the following:

- Advice and properly compensate all affected personnel;
- Secure necessary government clearances related to abandoning existing projects (including Request for Relief in the ECC conditions from the proponent);
- Removal of solid, liquid, and hazardous wastes within the site through a DENR-certified waste transporter/treater; and
- Clean-up and possible remediation of the site, if future evaluations and testing suggest such activity is necessary

8.0 INSTITUTIONAL PLAN FOR EMP IMPLEMENTATION

The proponent has an existing Environmental Unit (EU) headed by the Pollution Control Officer (PCO) which shall be reporting directly to the management of Petra Cement, Inc. The Environmental Unit (EU) is composed of the Assistance Pollution Control Officer, Community Relations Officer (CRO) and Safety Officer. The functions of each item is presented below:

Functions:

During Construction and Operation Phase

The Pollution Control Officer (PCO) shall be responsible for the implementation of the recommended Environmental Management Measures and Environmental Monitoring Plan as stated in this report. He shall direct all contractors and sub-contractors in case they have observed the alert and action situation for immediate corrective measures.

He shall be responsible for submission of the regular submission of the compliances report to the EMB region IX Office.

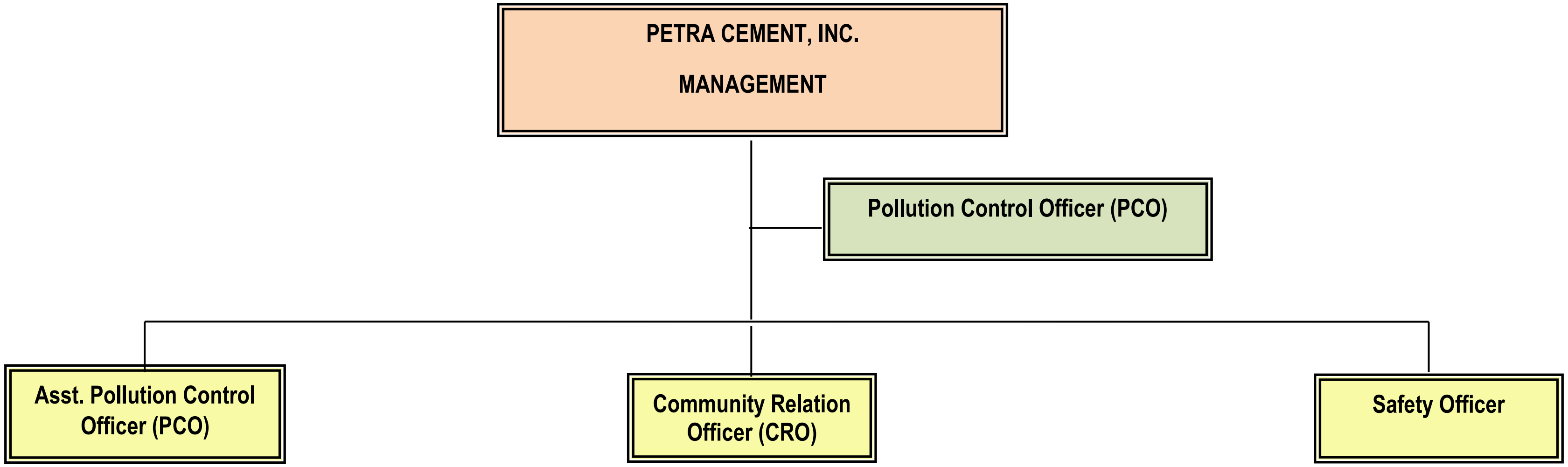


Figure 8-1 Organizational Chart of the Environmental Unit (EU)

List of Annexes:

- **A. Technical Scoping Checklist**
- **B. Transfer Certificate of Title (TCT)**
- **C. SEC Registration**
- **D. ECC of the Existing Project issued by EMB Region 9**
- **D1. Agreement between Port Facility and Petra Cement, Inc. and Addendum on the Memorandum of Agreement (MOA) between Seaoil Philippines, Inc. and Petra Cement, Inc.**
- **D2. Certification issued by Seaoil Philippines, Inc. on the carrying capacity of the Port**
- **D3. ECC issued for Seaoil Philippines, Inc.**
- **E. Zoning/LGU Resolution/Business Permit**
- **F. Engineering Plans**
- **G. Accountability Statement of the Proponent**
- **H. Accountability Statement of the Preparers**
- **I. Photographs of the Project Site and Its Current Status**
- **J. Compliance Monitoring Report (CMR)/Self-Monitoring Report (SMR) Duly Received by EMB Region 9**
- **K. Pedology Attachment/Soil Series Map and Result of Physico-Chemical Analysis Result May 18,2018**
- **L. Hydrologic and Hydraulic Assessment Study by AMH Consultant Result and PHIVOLCS Earthquake Hazard Assessment**
- **M. Tree Cutting Permit Issued by Philippine Coconut Authority (PCA)**
- **N. Surface Water Sampling Result March 11, 2018 with Photographs and Surface Water Sampling Result March 28, 2016 and Marine Water Sampling Result March 11, 2018 with Photographs**
- **O. Climatological Normal and Extreme, Station: Dipolog, Zamboanga Del Norte**
- **P. Wind Rose Analysis**
- **Q. Air Sampling Result March 11, 2018 and 2016**
- **R. Perception Survey Result with Sample of Accomplished Perception Survey Questionnaire**
- **S. IP Certificate**
- **T. Draft MOA for Creation of MMT – EMB Region 9**
- **U. MOA for the Adopt-an-Estero Program**
- **V. Brochure of the Machine- GEBR. PFEIFFER AG.**
- **W. PEMAPS and Accountability of PEMAPS**
- **X. Air Dispersion Modelling**