EXECUTIVE SUMMARY

ES 1.0 Project Fact Sheet

Table ES-1. Project Fact Sheet

Name of Project	**CONSOLIDATION OF PROPOSED INCREASE IN CLINKER, CEMENT AND QUARRY PRODUCTION AND PIER FACILITIES**		
Project Location	Brgys. Kiwalan, Dalipuga, Acmac, Bonbonon and Bunawan, Iligan City, Province of Lanao del Norte		
Project Category & Type (based on Annex A of MC 2014- 005 Guidelines)	Cement Plant with Quarrying		
Existing ECCs	1. ECC No. 0803-009-2231 for the Consolidation of Quarry Projects, issued by DENR EMB Central Office on May 26, 2010 2. ECC No. 0505-004-105 for the Cement Manufacturing and Quarry Expansion Project, issued by DENR EMB Central Office on July 25, 2006 3. ECC No. 10(35) 02 08-26 3037-50200 for Pier & Loading Facilities, issued by DENR EMB Region 10 on August 26, 2002 4. ECC No. 9611-03-302 for the Limestone Extraction project (formerly owned by MCCI), issued by DENR EMB Region XII on Nov 7, 1996		
Project Size	**ECC**	**EXISTING PRODUCTION RATE**	**PROPOSED PRODUCTION RATE**
	Cement Milling Production		
	ECC 1	2.0 MMTPY	4.30 MMTPY
	Clinker Production		
	ECC 2	0.61 MMTPY	3.70 MMTPY (increase)
	Quarry Production		
	ECC 1	Limestone: 810,000 MTPY Shale: 255,000 MTPY	Limestone: 5.91 MMTPY Shale and other Siliceous Materials: 2.29 MMTPY
	ECC 2	Limestone: 810,000 MTPY Shale:: 250,000 MTPY	
	ECC 4	Limestone: 100,000 MTPY	
Summary of Major Components	**Component**	**Existing**	**Proposed**
	Quarry		
	Limestone Quarrying	1.72 MMTPY	5.91 MMTPY
	Shale and other siliceous materials	0.505 MMTPY	2.29 MMTPY
	Cement Plant		
	1 unit Primary Crusher and 1 unit Secondary Crusher	300 TPH	same
	2 units Rotary Dryer	100 TPH each	same
	4 Units Raw Material Bins	66.2 m3	same
	1 unit Ball Mill	140 TPH	same
	2 Units Raw Mill Silo	2,200 MT each	same
	1 unit Kiln Surge Bin	72.8 MT	same

	1 unit Kiln with Preheater Cyclones	1,800 TPD/ 610 MTPY	same
	1 unit Gas Conditioning Tower	8 nozzles; 3,700 m3/min	same
	1 unit Cooler	1,600 TPD	same
	1 unit Coal Vertical Roller Mill	15 TPH	same
	1 unit Finish Mill 1	80 TPH	same
	1 unit Fly-ash feeding System	20 TPH	same
	3 units Cement Silos	4,000 MT each	same
	1 unit Finish Mill 2 with Pre-grinder	2.0- MMTPY	same
	2 units Flyash Silo	1,600T each	same
	1 unit Pre-grinder cement Silo	Internal Cap: 4,000 MT External Cap: 7,000 MT	same
	1 unit Bulk Truck Cement Loading	250 TPH	same
	1 unit RCMI Material Storage	40,000 MT	same
	1 unit Cement Silo with Bulk loading Facility	12,000 MT	same
	4 units Cement Silo	1,500 MT	same
	1 unit Packhouse 1/5 Rotopacker	12 spouts (3,600 BPH)	same
	1 unit Cement Tonner Bag Loading	20 TPH	same
	1 unit Packhouse 2 Rotopacker	10 spouts (2,400 BPH)	same
	1 unit Packhouse 2 Haver & Boeker Bagging Facility	600 TPD	same
	1 unit Packhouse 3 Rotopacker	6 spouts	same
	1 unit Packhouse 4 Rotopacker	8 spouts (1,920 BPH)	same
	1 unit Generator Set	250 KW (315 KVA)	same
	Dust Collector System- Existing		
	2 units Bag filter: dust collector Rotary Drum Dryer	135,000 m^3/hr	same
	1 unit bag filter: Rotary Drum Dryer Auxiliary	8,232 m^3/hr	same
	1 unit bag filter : Rotary Dryer Bucket Elevator, Belt Conveyors, Material Storage	8,700 m^3/hr	same
	1 unit bag filter: Raw Mill Weigh feeder	11,300 m^3/hr	Same
	2 units Multicyclones: Raw Mill Separators	42,000 m^3/hr	same
	1 unit bag filter: Raw Mill Silo	6,630 m^3/hr	same
	1 unit bag filter: Raw Mix Silo	7,200 m^3/hr	same
	1 unit Electorstatic Precipitator: Rotary Kiln	2,436 Am^3/min	same
	1 unit Electorstatic Precipitator : Cooler	4,433 $m^3$3/min as per PTO	same
	1 unit bag filter: Cooler discharge	5,700 m^3/hr	same
	1 unit bag filter: Coal Mill	41,340 m^3/hr	same

	1 unit bag filter: Coal Mill Fine Coal Silo	5,100 m³/hr	same
	1 unit bag filter: Finish Mill 1 weigh feeder:	10,140 m³/hr	same
	1 unit bag filter: Finish Mill 1 Mill	100,800 m³/hr	same
	5 units bag filter: Packhouse 1 Rotopacker	1 Unit 19,500 m³/h 1 Unit 24,840 m³/hr 1 unit 13,800 m³/hr 2 unit 11,400 m³/hr	same
	2 units bag filter: Packhouse 1 Cement Silo	16,210 m³/hr	same
	2 units Mill bag filter – FM2	84,000 m³/hr	same
	1 unit bag filter: weigh feeder – FM2	12,600 m³/hr	same
	1 unit bag filter: rotopacker #3 – Packhouse 2	24,000 m³/hr	same
	1 unit bag filter: HBBF- Packhouse 2	16,980 m³/hr	same
	1 unit bag filter: Cement Silo – Packhouse 2	8,700 m³/hr	same
	1 unit main bag filter: Roller Press	6,000 m³/min	same
	2 units bag filter: fresh feed transport system	200 m³/min200 116.7 m³/min	same
	3 units auxiliary bag filter: Roller Press	416.7 m³/min 333.3 m³/min 50 m³/min	same
	3 units bag filter: cement transport system	95.8 m³/min	same
	3 units bag filter: roller press feeding system	200 m³/min 83.3 m³/min 100 m³/min	same
	2 units bag filter: Cement Silo - Top	66.7 m³/min	same
	1 unit bag filter: External Silo	27.5 m³/min	same
	1 unit bag filter: Internal Silo	73.3 m³/min	same
	1 unit bag filter: Bulk Truck Cement Loading	25 m³/min	same
	Cement Plant – Proposed Expansion		
	1 unit Primary Crusher	-	1,400 TPH
	1 unit Limestone Stacker/Reclaimer	-	Stacker: 1,000 TPH ; Reclaimer: 500 TPH
	1 unit Shale Stacker/Reclaimer	-	Stacker: 1,000 TPH ; Reclaimer: 500 TPH
	1 unit Coal Stacker/Reclaimer	-	Stacker: 300 TPH ; Reclaimer: 150 TPH

	1 unit Vertical Roller Mill	-	510 TPH
	1 unit Blending Silo	-	15,000 MT
	1 unit Coal Mill	-	53 TPH
	1 unit Rotary Kiln with two (2) Streams Preheater	-	6,500 TPD
	1 unit Baghouse	-	300,000 m^3/hr
	1 unit Clinker Cooler	-	6,500 TPD
	1 unit Electrostatic Precipitator	-	300,000 m3/hr
	1 unit Clinker Silo	-	54,000 MT
	1 unit Finish Mill 3 with Pre-grinder	-	2.3 MMTPY
	Finish Mill 3 Coveyor equipment (several, assorted)	-	200-300 TPH
	Finish Mill 3 Material bins and feeders (several, assorted)	-	
	1 unit Roller Press	-	3,200 kW
	1 unit High efficiency separator with cyclones	-	2,100 kW
	1 Hot Gas Generator	-	11.1 Mkcal/hr
	Fly Ash Silo	-	750 MT
	Belt Conveyors	-	200 to 230 TPH
	Dust Collector System – Proposed Project		
	1 unit - 111 Bag filter	-	8,700 m^3/hr
	1 unit – 131 Bag filter 1	-	7,200 m^3/hr
	1 unit – 131 Bag filter 2	-	7,200 m^3/hr
	1 unit – 212 Bag filter	-	7,000 m^3/hr
	1 unit – 141 Bag filter	-	6,200 m^3/hr
	1 unit – 213 Bag filter 1	-	6,800 m^3/hr
	1 unit – 213 Bag filter 2	-	7,000 m^3/hr
	1 unit – 213 Bag filter 3	-	7,050 m^3/hr
	1 unit – 213 Bag filter 4	-	7,100 m^3/hr
	1 unit – 213 Bag filter 5	-	6,200 m^3/hr
	1 unit – 311 Bag filter 1	-	6,800 m^3/hr
	1 unit – 311 Bag filter 2	-	7,200 m^3/hr
	1 unit – 311 Bag filter 3	-	5,400 m^3/hr
	1 unit – 311 Bag filter 4	-	5,600 m^3/hr
	1 unit – 311 Bag filter 5	-	5,200 m^3/hr
	1 unit – 321 Bag filter 1	-	6,800 m^3/hr
	1 unit – 321 Bag filter 2	-	6,200 m^3/hr
	1 unit – 331 Baghouse Kiln	-	300,000 m^3/hr
	1 unit – 331 Bag filter	-	5,200 m^3/hr
	1 unit – 341 Bag filter	-	5,400 m^3/hr
	1 unit – 351 Bag filter	-	6,200 m^3/hr

	1 unit – 241 Bag filter 1	-	5,800 m³/hr
	1 unit – 241 Bag filter 2	-	6,200 m³/hr
	1 unit – 242 Bag filter 1	-	6,600 m³/hr
	1 unit – 242 Bag filter 2	-	5,400 m³/hr
	1 unit – 461 Baghouse Coal Plant	-	42,500 m³/hr
	1 unit – 421 Bag filter	-	8,700 m³/hr
	1 unit – 441 Electrostatic Precipitator Cooler	-	300,000 m³/hr
	1 unit – 471 Bag filter 1	-	5,800 m³/hr
	1 unit – 471 Bag filter 2	-	5,200 m³/hr
	1 unit – 481 Bag filter 1	-	5,200 m³/hr
	1 unit – 481 Bag filter 2	-	5,200 m³/hr
	1 unit – 491 Bag filter 1	-	5,200 m³/hr
	1 unit – 491 Bag filter 2	-	5,200 m³/hr
	1 unit – 491 Bag filter 3	-	5,200 m³/hr
	1 unit – 491 Bag filter 4	-	5,200 m³/hr
	1 unit BF1 Bag filter	-	6,700 m³/hr
	1 unit BF2 Bag filter	-	6,700 m³/hr
	1 unit BF3 Bag filter	-	12,500 m³/hr
	1 unit BF4 Bag filter	-	7,750 m³/hr
	1 unit BF1 Bag filter	-	7,750 m³/hr
	1 unit BF1 Bag filter	-	12,000 m³/hr
	1 unit BF2 Bag filter	-	12,500 m³/hr
	1 unit BF3 Bag filter	-	11,000 m³/hr
	1 unit BF4 Bag filter	-	9,000 m³/hr
	1 unit BF5 Bag filter	-	6,000 m³/hr
	1 unit BF6 Bag filter	-	13,500 m³/hr
	1 unit BF7 Bag filter	-	3,500 m³/hr
	1 unit BF1 Bag filter –Roller Press	-	30,000 m³/hr
	1 unit BF2 Bag filter	-	2,100 m³/hr
	1 unit BF1 Bag filter - Separator	-	195,000 m³/hr
	1 unit BF2 Bag filter	-	3,000 m³/hr
	1 unit CN1-4 Bag filter - Cyclones	-	3,200 mm
	1 unit BF1 Bag filter	-	52,000 m³/hr
	1 unit BF2 Bag filter	-	3,000 m³/hr
	1 unit BF3 Bag filter	-	5,000 m³/hr
	1 unit BF1 Bag filter	-	12,000 m³/hr
	1 unit BF2 Bag filter	-	7,500 m³/hr
	1 unit BF3 Bag filter	-	7,500 m³/hr
	1 unit BF3 Bag filter	-	6,500 m³/hr
	1 unit BF4 Bag filter	-	5,000 m³/hr

	Support Facilities	· 1 Mine Waste Dumpsite · 1 Plant Waste Dumpsite	· 1 Mine Waste Dumpsite · 1 Plant Waste Dumpsite
		· 9 Settling Ponds	· 10 Settling Ponds
		· 2 Quarry Stockyards	· 2 Quarry Stockyards
		· Coal Stockyard	· Coal Stockyard
		· Nursery	· Nursery
		· Access Roads	· Access Roads
		· Guest house/Staff house	· Guest house/Staff house
		· Magazine Area	· Magazine Area
		· Medical Clinic	· Medical Clinic
		· Administration Building & Offices	· Administration Building & Offices
		· Machine Shop	· Machine Shop
		· Warehouses	· Warehouses
		· Canteen	· Canteen
		· Motorpool	· Motorpool
		· Water Treatment Facility	· Water Treatment Facility
		–	· Waste heat recovery system
		· Co-processing and TSD Facility	· Co-processing and TSD Facility
		· 13 MW Power Plant facility	· 13 MW Power Plant facility
	Pier		
		1 unit Pier and 2 units Wharf/Beach Pad Facilities	1 unit Pier and 2 units Wharf/Beach Pad Facilities
Project Cost	Php 18 Billion		
Construction Period	By July 2021 (estimate)		
Proponent Name	**Republic Cement Mindanao, Inc. (RCMI)**		
	Contact Person:		
	Darwin S. Magpily – Vice President for Operations and Plant Manager		
	Brgys. Kiwalan and Dalipuga, Iligan City, Province of Lanao Del Norte		
	Tel : Tel 02 885 4599		
EIA Preparer / Consultant	**TECHNOTRIX INTEGRATED SERVICES, INC.**		
	Unit 12106 12th Floor The trade and Financial Tower 32nd Street cor 7th Ave Bonifacio Global City		
	Barangay Fort Bonifacio Taguig City 2634		
	Telephone No.: (632) 7373 1456		
	Cellular No.: 0917.8255203		
	E-mail address: Technotrix,tisc#gmail.com		
	Contact Person:		
	Edgardo G. Alabastro, Ph.D.		

Based on the above table indicating the various APCDs, it may be construed that there could be great potential to emit significant fugitive dusts (TSP, PM10) once APCD Is not properly maintained. This is duly recognized in the Air Dispersion Modeling, which includes the various APCDs and the scenarios of uncontrolled cases of the APCDs. Page 12 of the ADM Report, **Annex 2.3-1**.

Moreover, maintenance plans of the entire Dust Collection Systems are to be observed; these are provided in **Annex 2.3-5**: Dust Collection System Maintenance Program.

ES 1.1 Project Description Summary

Republic Cement Mindanao Inc. (RCMI) and Republic Cement Iligan, Inc. (RCII) were previously separate companies, each with its own process facilities and quarry operations. The two (2) companies have now merged into a single entity with RCMI being the surviving company. **Annex ES-2** shows the approval of this merger by the Securities and Exchange Commission (SEC) and corresponding Letter-request to MGB-10 to Register the Merger and Reflect Changes to MGB Records.

The project size and components reflected in **Table ES-1** as well as the other aspects of the project and operations are therefore consolidated under the Proponent RCMI.

Moreover, the existing ECCs of RCMI and MCCI (ECC numbers 1 to 4 in **Table ES-1**) are also merged into this new ECC application under RCMI. The separate EPRMPs and Additional Information (AIs) for RCII and RCMI are consolidated into one and under the name of RCMI. Also, the new MPSA No. 105-98-XII for a 26.7867 hectares limestone quarry is integrated into the total project.

For the Proof of Authority over the Site, please refer to **Annexes ES-3 to ES-6** regarding the MPSAs; **Annexes ES-7** for the Land Titles (TCTs) of the plant site; and **Annexes ES-9 to ES-12** for the copies of the 4 ECCs. **Annex ES-8** is a Letter to MGB-10 dated Aug 6, 2018 re: Non-Applicability of DMPF as Quarrying Operations started prior to the grant of MPSA.

For the EPRMP of the merged companies, the technical scoping requirements which were previously determined separately for RCII and RCMI and which are essentially the same, are used as the guidelines for this revised EPRMP. The Public Participation Activities under DAO 2017-15 previously undertaken separately for RCII and RCMI are now integrated in this EPRMP.

ES 2.0 EIA Process Documentation

The content of the EIS report was established during the conduct of Technical Scoping on 02 April 2019 (See **Annex ES-2)**. As prescribed by the EMB/DENR under the Revised Manual for Coverage Screening and Standardized Requirements under the PEISS, the appropriate type of documentation for this project is the Environmental Performance Report and Management Plan (EPRMP).

ES 2.1 EIA Team

The composition of the EIA Team with compliance with EMB MC 2011-005 is shown in **Table ES-2**. Resource Persons/Expert Companies were also engaged and are also listed hereunder.

Table ES-2. Team of EIA Preparers

Team Member	Module	EMB Registry No.	Company
Edgardo G. Alabastro, Ph.D.*	Team Leader; Air & Water	IPCO-257	Technotrix Integrated Services, Corp (TISC).
Hazel A. Victoriano	Overall Project Coordinator	Application with EMB filed	TISC
Dr. Felixberto Roquia	Sociology Module	IPCO-028	Private Practitioner
Benjamin Francisco	Marine and Fresh Water Ecology (Team Leader)	PCO-038	TISC Consultant
Virgilio Pantaleon	Coral Reef, Seagrass	-	TISC Consultant
Engr. Emerson Darroles	Oceanography	-	TISC Consultant

Team Member	Module	EMB Registry No.	Company
Assisted by Engr. Emiterio Hernandez (Resource Person)			
Jose Rene Villegas	Marine Team	-	TISC Consultant
Ernie Fontamillas	Marine Team	-	TISC Consultant
Michael Francisco	Fisheries	IPCO-040	TISC Consultant
Nazario Sabello	Air Quality & Air Dispersion Modelling	-	TISC Consultant
Jean Ravelo	Geology	-	TISC Consultant
Lawrence S Mojica	Technical Assistant	-	TISC Consultant
Angelie Faye Nicolas *	Technical Assistant	IPCO-259	TISC Consultant
Warren Conde	Field Survey	-	TISC Consultant
Others			
Engr. Jake Digol	Mining Engineer		RMCI Resource
Benjamin Cuevas, Forester	Forester		RMCI Resource

ES 2.2 EIA Study Schedule & Area

The study area is focused on the project site on the impact areas and on Brgys. Kiwalan, Dalipuga, Acmac, Bonbonon and Bunawan in the City of Iligan, Province of Lanao del Norte.

The EIA study schedule is reckoned from the start of the EPEP and FMRDP in 2018. The EIS for the original cement manufacturing and quarry project was referred to and used as relevant information as the original EIS is similar with the expansion project and both being essentially in the same sites.

The following are the activities that were conducted for this study. Continuing activities will be based on the results of the evaluation of the EPRMP submissions by the EIA Review Committee.

Table ES-3. EIA Study Schedule

ACTIVITY	DATE	AREAS COVERED
Bathymetric Survey	Started Dec 2017	Proposed project site and immediate vicinities
Marine Study	February 2018	Proposed Project site and immediate vicinities
Secondary Data Researches	January 2019	Iligan City
Air Dispersion Modelling	September 2020	Proposed project site and immediate vicinities
siliceous materials Quarrying (DMPF)	AEPEP Feb 2019	Siliceous materials MPSA Area
SMRs and CMRs for baseline inputs	Continuing	Air Water and as required by MMT
SOCIAL PREPARATION UNDERTAKEN		
Initial Perception Survey	12-14 January 2019	Barangays Kiwalan, Dalipuga, Acmac, Bonbonon and Bunawan
Information, Education and Communication (IEC)	11 January 2019	
Public Scoping	20 February 2019	Provided in **Annex ES-14** Public Participation Activities
Technical Scoping	02 April 2019	All Modules Per RPM Technical Scoping Checklist provided in **Annex ES-1.**

The following activities prescribed in the Revised Procedural Manual will still be undertaken to complete the EPRMP through official receipt thereof by the EIAMD/Review Committee.

1. Review by EIARC
2. Public Hearing
3. Revision of EPRMP Report
4. Decision on ECC Issuance Incorporating therein conditions to the ECC.

ES 2.3 EIA Methodologies

The EIS Methodology is adopted in the EPRMP screening form resulting from the technical scoping. The EPRMP screening form is the signed Formal Checklist with the EMB and the Environmental Impact Assessment Review Committee (EIARC) Members, the Proponent and EIA Consultant indicating therein the requirements and the content of the EPRMP report. The signed EPRMP Screening Form is shown in **Annex ES-1.**

Primary and secondary data were utilized for the assessment of the project impacts. Primary data were obtained from onsite investigation and field sampling/ surveys. The Self-Monitoring Reports (SMRs), Compliance Monitoring Report (CMRs), Compliance Monitoring Validation Reports (CMVRs), SDMP Reports, and all various other reportorial requirements submitted to DENR, are also key primary data. Secondary data were acquired from various sources, e.g. the CLUP, published government (MGB, PAGASA, PHIVOLCS) reports and maps. Relevant and previously conducted surveys included in the original EIS Report were also used as applicable.

Table ES-4. EIA Methodologies

Module / Section	Baseline	Methodology
LAND		
Land Use Classification	**Secondary data**: Iligan City Comprehensive Land Use Plan (CLUP).	Assessment of compatibility of the proposed expansion project in the land use classification
Geology	**Secondary data**: Geologic, seismic, liquefaction, slope hazard maps and evaluation based on government data. **Primary data:** Various internal geology reports	Identification and assessment of project impact in terms of the changed in topography including existing hazard as maybe aggravated
Pedology	**Primary Data:** SMRs, CMRs, CMVRs	Describe the physical properties and erodibility potential of the soil, ongoing erosion processes and assess the erosional impacts of the project.
Terrestrial Ecology	Biodiversity Study of RC Group	Standard Methodology
WATER		
Hydrology / Hydrogeology	**Secondary data:** Existing drainage system. Historical flooding occurrences	Identification and assessment of project impact on the change in drainage morphology, local drainage and resulting effects of flooding
Marine Water Quality	**Primary data:** Standard Methods for Water Quality Sampling and Monitoring. **Water Body Classification:** DENR Class SC SMRs, CMRs, CMVRs	Assessment of impacts on siltation of surface and coastal marine waters DAO 2016-08
Oceanography	**Primary data:** Bathymetric Survey	Bathymetric by sounding technique **Numerical Modeling:** No aspects of project that would change bay bathymetry.
Marine	Abundance / density / distribution of ecologically and economically important species, mangroves, benthism planktons, coral reefs, algae, seaweeds, sea grasses Presence of pollution indicators	Transect, manta tow and spot dives surveys, marine resource characterization (e.g. city/municipal and commercial fisheries data), Key informant interview.

Module / Section	Baseline	Methodology
AIR		
Ambient Air Quality	**Primary data:** Ambient air quality sampling and testing. SMRs, CMRs, CMVRs **DENR Classification Ambient Air and Noise Classification**	**Methodology:** Standard Methods for Ambient Air Quality Sampling and Monitoring
Ambient Noise Quality	**Primary data:** Ambient noise quality sampling and testing.	Noise Meter
Contribution in terms of GHG	Data in Greenhouse Gases	Monitor/tracking using Cement Sustainability Initiatives (CSI) format
PEOPLE		
Demographic Profile / Baseline	**Primary data**: Conduct of Public Perception Survey, IEC, various stakeholder engagements conducted in the past **Secondary data:** Comprehensive Land Use Plan of Iligan City	
ERA		
Physical and Natural Environment	Annex 2_7.e of the Revised Procedural Manual	

ES 2.4 Public Participation Activities

Information, Education and Communication (IEC) Activity

IEC activity was conducted with the concerned stakeholders on 11 January 2019 at the RCMI Guesthouse Brgy. Kiwalan, Iligan City, Lanao del Norte, attended by twenty four (24) stakeholders. Among these were LGU Officials, Government Offices, Non-Government Organizations (NGO) / People's Organization (PO), Private Offices and Impact Barangays. Provided below in **Table ES-5** are the top key issues raised during the IEC and FGD conducted. **Annex ES-14.1** for the documentation of the conducted IEC.

Note that the issues raised and the proponent's responses contain references to both the former RCII and RCMI because the IEC and Public Scoping were conducted prior to the merger of the 2 companies.

Table ES-5. Information, Education and Communication (IEC); 11 January 2019

Sector or Representative Who Raised the Issue/ Suggestion	Issues/Suggestions Raised by Stakeholder	Proponent's Response
Ms. Grace Catubig Chairwoman of Barangay Kiwalan	Increase in production will also mean increase in quarrying, especially limestone and shale area, and hence, more blasting. RCII knows what they are doing and has adequate mitigating measures. We hope this is included in the study so we won't be affected like what happened in Naga, Cebu.	We assure you that we are doing our best efforts. MGB 10 has just conducted a geohazard assessment, wherein both RCII and RCMI passed all criteria.
		Moreover, we are also continually improving our safety protocols even if we have passed all criteria. Our blasting is monitored by MGB, they have a representative each time we do blasting.
	The SDMP budget on health is sizeable. We attend to the health needs of our residents thru the help of RCII.	Noted.
Resident from Impact Barangay	Will vibrations produced by blasting create cracks in the land and affect groundwater? We are planning to rehabilitate our water source in Brgy. Kiwalan but the blasting might affect it.	Increase in operation does not necessarily mean increase in blasting. Requirements for raw materials will increase but blasting will be the same, i.e., controlled methodology. The vibration will be maintained within the MGB allowable levels at all times.

Sector or Representative Who Raised the Issue/ Suggestion	Issues/Suggestions Raised by Stakeholder	Proponent's Response
		With regards to groundwater, a hydrogeologic study is currently being undertaken, precisely to determine potential impacts in volume, quality, etc.
Mr. Solon Adamat Representative of Atty Grace Pabelic, Regional Director of National Commission on Indigenous Peoples (NCIP)	Include in the study the presence of IPs in Brgy. Kiwalan and the rest of neighboring barangays. ECC review and approval is from DENR only, NCIP also has EO/AO No. 3 which is the issuance of Certificate of Non-Overlap.	DENR has the mandate to review and decide on ECC applications, but in the process, there is consultation with various government agencies, NGOs, organizations, and the public. The Certificate of Non-Overlap is also being applied for.
Female Officer from Purok 8, Brgy. Kiwalan	Our home is near the quarry, which shakes during blasting	We shall validate your concern. There is vibration, but all are within the allowable limits and will not endanger the neighborhood. We have complete records of the vibrometer readings. Also, these are done within allowable distance.
Norma R. Galorio Iligan City Planning Officer	Are these residential areas inside the mining zone, if so, that should be disallowed to locate there in observance of the City Ordinance. If pre-existing, no further improvements are allowed.	They were pre-existing, hence, allowed. Anyways, they are outside the mining operations of RCII.
	Suggestion to include Brgy. Acmac in host barangays.	The operation is within Brgys. Kiwalan and Dalipuga only but the proponent's MPSAs cover Acmac, Bonbonon, and Bunawan. Hence, they are all included as beneficiaries.
Resident from Impact Barangay	Traffic congestion at the entrance gate due to delivery trucks.	This shall be included in the study.
Ms. Juvilyn Claveria Barangay Captain of Brgy. Acmac	According to the law, increase in production also means increase in SDMP budget. Republic Act 8190 provides for localization of employment.	This applies to workers of RCII and its contractors as well.
	SDMP has made us productive and self-reliant. The Company follows according to the law, and they attend to every concern. We can approach Mr. Piloton 24/7.	Noted.
	With regards to the 5 Pillars of SDMP, it is the stakeholders who should speak out regarding their priorities. We have bigger budget for health because we asked for it during the planning.	
Atty. Cenas Head, City Environmental Management Office	Increase of workers during construction phase will result to corresponding increase in waste generation.	Yes, the Contractor will be hiring construction workers. Most of them will likely be locals, nevertheless, they will generate wastes. We shall include that in the study.
Ms. Rosemarie Macarandan Principal, Kiwalan National High School	Concern for students of Kiwalan National High School which is located near the project area. What are the benefits or privileges for them?	The scholarship program from elementary to high school in the past was cut off as recommended by MGB itself, and the Brgy. Captain knows about this. It is because DepEd's schools are free. Nevertheless, the budget for this is continuing. We just have to consult with the stakeholders as to what program should we replace it with.

Sector or Representative Who Raised the Issue/ Suggestion	Issues/Suggestions Raised by Stakeholder	Proponent's Response
	Republic Cement has been very supportive to Kiwalan. We won at the regional level as a National High School because there were many projects implemented with the help of Republic. For clarification, it's only the tuition that is free, DepEd still charges miscellaneous fees.	Noted. We can discuss that during our meeting for this year's SDMP.
Ms. Eleonor V. Cañonero City Health Officer of Iligan	Are there studies regarding the complaints of affected communities with regards to the operation of the plant? Were they affected?	There were complaints received in the past, including an NOV. All these are attended to and acted upon by the Company and the Multipartite Monitoring Team (MMT).
	The SDMP's allocation for health is small. Isn't there significant effects of the operation on health?	Conducted Social Impact Assessment (SIA) in 2018, wherein recommendations were given to improve dust emission levels, which was implemented. In the processing of the ECC amendment, the proponent's performance in the past shall be evaluated.
Engineer Jeffrey Department of Health, R10	Include health preventive measures in the SDMP, such as regular check-ups; sanitary water systems; etc. Also include as mitigating measures in the EIA report. To the barangays, hope you include health preventive measures in the SDMP.	Noted. Programs such as Zero Waste Management, toilets, water system, and others that affect health are included.
	Include health impact assessment in the study so it will be used as baseline for future complaints. Also include mitigating measures. Propose to have free medical check-ups for the residents, because the operation may be environmentally acceptable but still it will have chronic health effects.	Health is included in the SDMP, also there's integrated Health and Safety Program. Maybe another SIA will be conducted in near future for purposes of improving the programs. Number 1 focus at the plant is Health, Safety and Environment.
Kristina Zapanta Nurse from Department of Health, R10	Is there health impact assessment for the workers? For the additional workers during the expansion, will they also be included? On IEC, is health impacts included? How often is IEC done and who is the target audience?	
Representative from City Environmental Management Office	Size of expansion of quarry sites and plant?	Area size will not increase, rather it is the rate of quarrying that will expand. The plant expansion will all be inside the existing plant compound - no additional areas.
	What are the impacts to our fields especially for the farmers? Based on plans, will the affected areas be deforested? What are the mitigating plans?	Number 1 focus at the plant is Health, Safety and Environment.
	What is the impact to employment, how many can work? Will Iligan residents be able to work here?	Local employment - around 500 workers needed in the construction. Locals are prioritized.
	Air pollution effects.	Air pollution control devices will be expanded according to the increase in production. A study will be conducted for such. We have proof that we have greatly improved in this aspect. We are now using eloectrostatic precipitator

Sector or Representative Who Raised the Issue/ Suggestion	Issues/Suggestions Raised by Stakeholder	Proponent's Response
		in contrast to conventional method in the past. This EP is ran by electricity. For the expansion, bag house will be used, to avoid effects of power interruptions.
	Cement from other countries are much cheaper and are being imported. What is its effect to Republic?	People should not be supporting this move because it can affect local production, which gives employment opportunities to the people.
Mr. Ednilo Macatol Fisherfolk	Wastes, both solid and liquid are generated, and these go to the creeks and the sea. What are the mitigating measures? These wastes cause our lands to dry up, thus destroying our livelihood. If these happens, where can people run to because they need to find other jobs?	The cement production process is a closed loop in terms of water circulation. It is a dry process, water is not needed. Water is used for domestic purposes only. In the quarry, water runoff during rains are controlled thru drainage system and siltation ponds. Released water into the creeks do not contain silt. Regarding livelihood, we have SDMP livelihood projects. We also have CSR, which is not governed by any law - it is Company prerogative so thru this we can assist people.
	Dust emitted by trucks in the delivery of coal, gypsum and silica. What happens if the frequency increases?	This will be part of the study.
Resident from Impact Barangay	Is the bag house related to Power Source, because they also mentioned that they are using EP?	Power Source is a different entity, and RCMI is a client. We do not know.
Ms. Dapog	Can the Plant help the residents that will be affected in case they get sick?	There is the SDMP. With increase in production rates, there will be corresponding increase in SDMP budget. Host communities can benefit from it, including health programs - depending on the agreement among stakeholders.
Ms. Kim Miranda Representative Sarip Clan	What exactly are done with regards to health for those inside the plant since pollution will surely affect them? Request for medical mission.	Still thru SDMP, which is implemented through the Barangay LGU. It is not towards specific persons but thru associations, but there are many projects, like medical missions.

Note: Complete Visayan version is included in **Annex ES-14.1**.

INITIAL SOCIAL SURVEYS WITH THE COMMUNITIES NEAR THE PROJECT SITE

The results of the initial surveys covering the communities near the project site are presented in **Annex ES-14.3**. The said surveys were conducted as part of the Information, Education and Communication (IEC).

The Preliminary Perception Survey was conducted last January 12-14 2019 with a total of 177 respondents, to assess the socio-cultural economic situation of the communities that are to be affected by the proposed expansion project, particularly the 5 barangays in the City of Iligan, namely: Kiwalan, Dalipuga, Acmac, Bonbonon and Bunawan.

For the perceived benefits, top answers are on livelihood and business opportunities, improvement of roads and other infrastructure, additional tax and good service of the government. On the other hand, perceived adverse impacts are traffic and water pollution.

ENHANCED PERCEPTION SURVEY

Further and enhanced household perception surveys were made after the IEC activities with a total of 510 respondents from Kiwalan, Dalipuga, Acmac, Bonbonon and Bunawan barangays in the City of Iligan.

For perceived beneficial and adverse impacts, top answers are on employment and livelihood, additional tax, road construction, good service of the government and development of the barangay and the city. On the other hand, perceived adverse impacts are health concerns, traffic and water and air pollution.

Public Scoping

The Public Scoping's conducted on 20 February 2019 at Barangay Kiwalan Gymnasium, Barangay Kiwalan, Iligan City, Lanao del Norte participated by two hundred fifty eight (258) stakeholders. Among those invited were LGU Officials, Government Offices, Non-Government Organizations (NGO) / People's Organization (PO), and others. The Summary of Participants during the Public Scoping is provided in **Annex ES-14.2**.

Summary of Issues and Concerns Raised during Public Scoping Activity

The objective of the conducted Public Scoping Activity and other continuing IEC to be conducted is to ensure that the Environmental Impact Assessment (EIA) will address the relevant issues and concerns of the stakeholders and that it will be consistent with the Philippine Environmental Impact Statement System (PEISS). Issues and Concerns raised during the Public Scoping Activity is provided in **Table ES-6** below.

Table ES-6. Summary of Major Issues and Concerns Raised During Public Scoping

Sector or Representative Who Raised the Issue/ Suggestion	Issues/Suggestions Raised by Stakeholder	Proponent's Response
LAND		
City Engineering Office – Iligan	Land area to be covered by quarrying will expand	Same land area as in existing MPSA, no expansion in terms of land area
Brgy Captain Omar Cader - Bonbonon	Will Datu Sarep's property be affected by the expansion? If so, when and where?	Not affected; area of activities will be within the same area as in existing. (Existing activities and operations have not affected Datu's property)
	Will the expansion have effect on air quality and land? What are the preventive measures?	These will be part of the study. (Section 2.3 Air in the EPRMP)
Representative from DEP ED Region 10	Is there Land Title for plant site.	Yes, plant site land is titled.
DEP ED Region 10	Hazardous wastes. What hazardous wastes will be involved or generated?	This will be part of the study. (Section 4 ERA of the EPRMP will discuss this matter). *Note : This concern is related to land, air, water and People Environmental Resources*
WATER		
Committee on Health	Sea Water quality degradation	This will be included in the EPRMP Module on "Water". (Degradation will be evaluated based on historical trends and records of the SMRs)
AIR		
Representative from DEP ED Region 10, Purok President, &	Noise pollution, dust (sometimes), and sometimes children get sick	These will be part of the study. (Section 2.3 "Air" of the EPRMP will make assessment on air quality degradation; will undertake an Air Dispersion Modelling study.

Sector or Representative Who Raised the Issue/ Suggestion	Issues/Suggestions Raised by Stakeholder	Proponent's Response
Committee on Health (all 3 had same issue raised)		The Environmentally Sensitive Receptors (ESRs) e.g. the households, communities and social centers are distant from the source of air and noise pollution.
Committee on Health	Sea Water quality degradation.	This will be part of the EPRMP. Historical records and trends, if available, will give indications of potential sea water quality degradation
PEOPLE		
Committee on Health	Will the expansion be beneficial to the barangays and the people?	Yes. There will be increase in SDMP budget for the host barangays and more people will be hired.
Representative from DEP ED Region 10	Specific area of expansion. Will it affect any school?	Expansion will be within existing Plant only. No schools will be affected.
Committee on Health	Are the 5 pillars of SDMP focused only on a specific barangay or for all barangays?	Procedurally SDMP is only for the host barangays. For others, Republic Cement Group also has programs under its Corporate Social Responsibility. (CSR)
Purok 8 President Dhito Macatol	Would increase in clinker production mean increase in importation of clinker, which would then cause more cargo ships to come that may pose safety issues?	The reason we intend to increase clinker production is to lower, if not totally eliminate, clinker importation. *Note: This is safety issue affecting "People"*

ES 3.0 EIA Summary

ES 3.1 Summary of alternatives considered in terms of siting technology selection/operation processes and design

In terms of siting options there are no feasible alternative except the existing sites of the plant facilities and the quarry.

- Technology and processes/design are the same as existent because of the expansion nature of the project.

- The quarrying is to be undertaken by open pit method similar to existing practice.

ES 3.2 Summary of baseline characterization (in relation to the results of the regular monitoring of projects impacts and environmental performance)

Table ES-7 below indicates the current environmental condition (per environmental sector) on the area using the results of the impact environmental monitoring in comparison with the previous condition (during EIA for the application of existing ECCs).

The current conditions in comparison with that for the expansion project are reckoned from impacts. The environmental monitoring results are based from the existing SMRs, CMRs, CMVRs and SDMP reports.

Note that the previous ECCs comprise of miscellaneous ECCs and amendments and therefore the EIA process started as early as 2004, and thus, using these as references for comparison are not readily undertaken. Instead "current" is referred to the existing operations of the RCMI and RCII before and after the merger. The existing ECCs are (Please see **Annexes ES-9-12**):

1. ECC No. 0803-009-2231 for the Consolidation of Quarry Projects, issued by DENR EMB Central Office on May 26, 2010

2. ECC No. 0505-004-105 for the Cement Manufacturing and Quarry Expansion Project, issued by DENR EMB Central Office on July 25, 2006
3. ECC No. 10(35) 02 08-26 3037-50200 for Pier & Loading Facilities, issued by DENR EMB Region 10 on August 26, 2002
4. ECC No. 9611-03-302 for the Limestone Extraction project (formerly owned by MCCI) issued by DENR EMB Region XII on November 07, 1996
5. The RCMI MPSA 104 renewal is shown in **Annex ES-3**.

Table ES-7. Summary of Key Baseline Characterization

Conditions/Impact		CONCLUSIONS/REMARKS
PREVIOUS	**CURRENT**	
LAND		
Geology and Mineral Resources		
Depletion of ore - Quarrying started way back in the early 1960's. - No available data on volume extracted	Depletion of ore Rate: 1.72 MMTPY limestone and 0.51 MMTPY shale Volume Extracted (2007-2020): 2,374,990 MT shale and 8,784,236 MT limestone	Changes that occurred are in compliance with the Approved Development and Utilization Plans submitted every 3 years
Topography		
Plant was existing, located in flat, developed area. Terrain in the quarries have been altered wherein a series of benches exist as well as haul roads , siltation ponds, stockpiles and waste dump existed. Active/Disturbed areas was approximately: 61 ha	Plant in the same area. The active areas worked on since 2006 where generally on the areas that were already mined (open). The ensuing changes were the lowering and lengthening of the benches. Active/Disturbed areas: 76.438 ha Limestone: 59.75 ha Shale: 16.688 ha	Pre-existing areas with mining footprints as of 2004 is more or less the same as RCMI's existing quarry areas (See **Fig 2.1-8**). Changes is more on addition of benches and lowering of elevation. Additional areas disturbed is about 15.5 ha Changes that occurred are in compliance with the Approved Mine Plans submitted every 3 years
Inducement of Geological Hazards		
No landslides, subsidence, liquefaction, mudflow, and flood affected the area	No landslides, subsidence, liquefaction, mudflow, and flood affected the area	No change.
Soil Erosion / Loss of Topsoil and Overburden		
The existing disturbed areas of approximately 61 hectares were already devoid of topsoil and overburden. Eroded silt/soil captured through drainage system and settling ponds. Siltation in the shale area is more significant than in the limestone area wherein soil is nil to non-existent. No exceedance in terms of TSS.	Approximately 15.5 hectares additional areas were disturbed, topsoil and overburden removed are stored in Waste Dumpsite for future use in rehabilitation. Eroded silt/soil captured through drainage system and settling ponds. From 2nd semester of 218 to 3rd quarter of 2020, a total volume of 11,165 m3 of silt were collected from RCMI's settling ponds. This equates to about 5,100 m3 per year. Siltation in the shale area is more significant than in the limestone area wherein soil is nil to non-existent. No exceedance in TSS.	Soil erosion arrested through the drainage system and settling ponds and recovered through desilting, and then stored in the mine waste dump for future use. Average of 5,100 m3 per year of slt/soil recovered from the ponds. Engineering and mitigation measures in place.

<table>
<tr><th colspan="2">Conditions/Impact</th><th rowspan="2">CONCLUSIONS/REMARKS</th></tr>
<tr><th>PREVIOUS</th><th>CURRENT</th></tr>
<tr><td colspan="3">Soil Quality / Fertility</td></tr>
<tr><td>2002 soil tests in 4 stations: (Table 2.1-8)

pH: 7.8 to 8.1
OM: 3.89 to 7.12%
P: 9 to 18 ppm
K: 0.27 to 0.89 mol.

The high exchangeable P and K and high N percent in Champaca 2 and ICC 12 indicates high fertility in these areas as likewise indicated by the luscious growth of agricultural crops.
Note that these sampling stations are in the parcels outside the active quarry areas.</td><td>2020 soil tests results for 10 stations: (Table 2.1-10)

pH: 7.14 to 8.83
OM: 0.077 to 0.994 %
N: 0.014 to 0.123 %
P: <2 to 337 mg/kg
K: 107 to 1,672 mg/kg
Metals
As and Cd: below detection limit; Pb: 4.8 to 8.2 mg/kg; Hg: < 0.002 to 0.012; B: 0.24 to 1.5; Mn: 100 to 442 mg/kg; Fe: 0.269 to 6.16 mg/kg; Cu: 2.9 to 89.4 mg/kg; Zn: 4.3 to 66.9 mg/kg; Ni: 4.1 to 68.7 mg/kg; Co: < 0.8 to 8.1 mg/kg</td><td>Soil quality not adversely changed. Relevant for the rehabilitation program which as mentioned in the as proposed FMRDP, is for a combination of residential, industrial and agro-forestry.

Metallics not a concern because results show these as within the Dutch Intervention Values (DIVs)</td></tr>
<tr><td colspan="3">Flora (vegetation removal and loss of habitat)</td></tr>
<tr><td>Quarries pre-existing, disturbed area in 2004 approximately 61 hectares (no vegetation)</td><td>Active/disturbed area is 76.438 hectares for both quarries; approx 15.5 hectares cleared during the period.

CUT TREES AS OF 2020 (within MPSA 031-95-XII only)
Shale quarry lot 3551: Total land area = 2.03 hectares
Planted Trees =117 (Already cut) -- Replacement =5,850 seedlings (1:50)
Native trees = 130 (waiting for FMB approval)

Shale quarry lot 3597: Total land area = 0.987 hectares
Planted Trees =152 (Already cut) -- Replacement =7,600 seedlings (1:50)
Native trees = 105 (waiting for FMB approval)

No declared mined-out area yet, hence, RCMI plants in the buffer zones and in idle benches as temporary vegetation.
Total area reforested: 23.77
Total planted trees: 12,530</td><td>For every 1 cut tree, 50 seedlings are planted for replacement.
RCMI has expanded its reforestation efforts through NGP.
EPEP/FMRDP in place.</td></tr>
</table>

Conditions/Impact		**CONCLUSIONS/REMARKS**
PREVIOUS	**CURRENT**	
	NGP (outside project site) : 272 trees inside 100 hectares Mangrove: >200,000 propagules	
Fauna		
Quarries pre-existing, disturbed area in 2004 approximately 61 hectares (no vegetation, fauna insignificant within the disturbed areas)	No recorded evidences significant disturbances	The reforestation and the NGP will provide suitable habitats for faunal species.
WATER		
Groundwater / Water Resources		
The Company owns 6 deep wells in Brgy. Kiwalan but utilizes only 2 deep wells (RCDW8 AND RCDW10). Water extraction: July 2001 - 574.64 m3/day. No disruption of aquifers by avoiding the penetration of aquifers below the limestone deposits. Quarrying is conducted above the natural springs w/ buffer of at least 50m. Moreover, there is absolutely no blasting done in areas near caves, one of which contain aquifer (Cave No. 9 a.k.a. Matu-ug Cave) that is being tapped by the City Water District.	RCMI extracts water from 2 company deep wells (RCDW8 AND RCDW10) with rated discharge of 385 gpm or 87.6 m3/hr. Water requirement: 703.3 m3/day No disruption of aquifers by avoiding the penetration of aquifers below the limestone deposits. Quarrying is conducted above the natural springs w/ buffer of at least 50m. Moreover, there is absolutely no blasting done in areas near caves, one of which contain aquifer (Cave No. 9 a.k.a. Matu-ug Cave) that is being tapped by the City Water District.	No change in extraction rates - within the limits set in the Conditional Water Permits issued by NWRB. For proposed expansion, no additional deep wells are envisioned..
Groundwater Quality		
In the 2002 sampling of reservoirs/wells (**Table 2.2-3**) it was found that there is an exceedance in the calcium content and total hardness level in all 5 stations (except for the hardness at well in Brgy. Kiwalan, outside the project site). This explains the viscous sensation obtained from using water for washing in the RCMI premises. The RCMI well yielded higher coliform exceedance probably due to more users flocking the reservoir- evidently unfit for potable consumption. For the well located outside the project premises, the calcium and bacteriological content are above the permissible levels, thus, non-potable.	No groundwater quality monitoring for the past years. 2019 test results show that (**Table 2.2-4**) Cr 6, NH3, Phosphates, Nitrate, As, Cd, Hg and Pb contents of Water Softener Well, DW # 9, and Panaghoyan Spring are well within the DENR standards for Class A.	No competition in water use with communities. Strict compliances will be observed with the NWRB Permit. Standard water treatment methods available if underground water would be used for domestic purposes.
Water Quality of Iligan Bay (Marine Water)		

Conditions/Impact		CONCLUSIONS/REMARKS
PREVIOUS	**CURRENT**	
2001 sampling results: All physical parameters were within acceptable limits. While there is no standard for TDS, the increasing levels as one goes farther into the sea is perceived very high based on conventional standard set at 1,500 mg/L. Turbidity is minimal (<1 NTU) as well as TSS (1 to 4 mg/L) indicating very low to nil siltation in the area. Oil and grease are maintained way below the limits. Acidity is within acceptable range. There is abundant supply of oxygen (6-7 mg/L). Further observation revealed the presence of abundant fish and other marine organisms within 300m distance from the jetty. Exceedances were present in heavy metals such as lead (0.455 mg/L) and cadmium (0.033 mg/L) and were observed at fixed rates. The exceedances could be the result of the regular hauling/transporting of cement and other industrial products surrounding the coasts. The fixed levels indicate contamination diffusion over some parts of the bay.	Based on monitoring results from 1 sampling station located 100m from the jetty, it can be said that there is general compliance with the DENR standards and hence, no significant effect of the project to the marine water quality in the RCMI vicinity. Minor exceedance is observed for the temperature (32), which exceeded the DENR higher limit three times and once for the O & G limit (3.8 mg/L). This may be attributed to oil spills from sea crafts and not from the project. See graphical representation.	Generally, the water quality of Iligan Bay is expected to be preserved. Observed isolated cases of degradation e.g. O & G could be attributed from spills or leaks from sea crafts.
Water Quality (Freshwater)		
2001 water sample from the nearest section of Tag-ibo Ck (300m outside the project area and does not receive direct effluents from project) shows fairly high oxygen levels and permissible rates for physico-chemical parameters. The high levels of oxygen and low BOD rates are characteristic of an estuarine inhabited by various aquatic species. The high coliform content, however, is attributed to the bacteriological quality of runoff from the uplands where more domestic activities are undertaken. Results of drain canals sampling in 2001 show that the quality of effluents produced from both production and domestic activities are within the permissible limits, except for BOD5 in the effluents from production.	2018 to 2020 tests - the trend of the water quality reveals that: - There is general compliance with the stream quality standards - There are isolated episodes of peaks for (a) TSS displayed a short-term episode but the sources are not established (b) pH values are observed to be well within standard and relatively consistent (c) Oil and Grease -could be attributed from oil spills from sea crafts and not from the project. Episodes of peaks in BOD5 observed. Attributable to human activities e.g. use of toilets, baths and for food preparation.	Based on the test results, there is no significant effect of the project to the surface water quality in terms of metallic substances in the area near the RCMI plant.

Conditions/Impact		CONCLUSIONS/REMARKS
PREVIOUS	**CURRENT**	
Marine Ecology		
Monitoring & assessments prior to projects implementation not reliable	Based on recent marine ecology surveys (Sec 2.2.5) no evidences of dense populations of corals and other marine species. Only few coral colonies along a silted column of water behind the RCMI pier complex.	No degradation of marine species envisaged in the absence of stressors from project to these. Bay oceanography not altered.
Freshwater Ecology		
Not germane to the project. Nearest creek is 300m outside of project side and does not receive effluents from the project. Nearest river is 2.25 km to the south.		
AIR		
Air Quality (& Noise)		
Reckoned from the old EIS/EPRMP for which data are more than five (5) years old and therefore considered obsolete: Air quality is fairly good as shown by the low concentration levels of the pollutants: SO2 - 4.8 ug/Ncm; NO2 - 12.56 g/Ncm; and TSP - 135 g/Ncm. Likewise, the noise levels in the project site and vicinity are below the DENR limits. There is 1 exceedance in TSP (351.3 g/Ncm) for the station in front of Iligan City East High School. This may be due to dusts getting airborne as students played around very close to the sampler and the passage of numerous vehicles.	Ambient Air Quality General compliances with NAAQGV of the Phil Clean Air as shown in Table 2.3-7 for regulated pollutants: TSP, NOx and Sox. PM10 results for 2020 monitoring indicate compliance with standards and are shown in Table 2.3-9 Source Emissions Quality for PM, Sox, NOx and CO in compliance with Section 19 of the Philippine Clean Air Act.	No degradation of ambient air quality foreseen as further verified by the results of the Air Dispersion Modelling. Permits to Operate (PTOs) are required for the APCDs thus assuring compliances with air quality parameters.
GHG Emissions		
Reckoned from global inventory GHG emissions are deemed not significant because of the country's reported inventory. Inventory takes into account not only CO2 but also LUCF and LULUCF	Reckoned from global inventory GHG emissions are deemed not significant because of the country's reported inventory. Inventory takes into account not only CO2 but also LUCF and LULUCF	Notwithstanding the considered insignificant contribution of the project to global inventory, RCMI is nevertheless undertaking Carbon Sink and NGP which are GHG friendly.
PEOPLE: Annual SDMP Accomplishment Reports are submitted regularly, these SDMPs are formulated in consultation with the stakeholders; IECs are done regularly		
Land Ownership and Right-of-way		

Conditions/Impact		CONCLUSIONS/REMARKS
PREVIOUS	CURRENT	
Plant is within the Company property, quarries are within the MPSAs and (surface) land ownership of active/disturbed areas are held by the Company as well.	Plant is within the Company property, quarries are within the MPSAs and (surface) land ownership of active/disturbed areas are held by the Company as well.	No change, no conflicts
Employment and Livelihood Opportunities		
Pre project information show 211 RCMI workers consists of 163 Production workers, 13 Managerial, and 35 Admin/clerical workers. Quarry contractors are outsourced. Local residents are given priority in employment while local suppliers/providers are likewise given preference for contract jobs/services, if available.	The existing manpower for operations of RCMI totals to 166 for both the plant and the quarries while it's quarrying Contractor (Delta Earthmovers) maintains 68 personnel, and other service Contractors have 745 workers. During the operations phase of the proposed expansion, the number of workers shall increase to 184 for RCMI while workers for Delta and other service contractors shall remain the same .	RCMI has continuously provided permanent as well as contractual job opportunities to the residents of its host communities. In addition, contracted services and suppliers are given to local businessmen.
In-migration		
No informal settlers. Average rate of population increase in Kiwalan from 2000 to 2010 is -0.04 (decrease) and for Dalipuga is 3.98, and therefore, while that of the City is 1.32.	No informal settlers. Average rate of population increase in Kiwalan from 2010 to 2015 is 5.07 and for Dalipuga is 1.68, and therefore, while that of the City is 1.23.	Deemed as insignificant consideration for the expansion project.
Services and Resource Competition		
Water supply from own deep wells and from local concessionaires. Power from NPC. Communication from private providers. No competition	Water supply from own deep wells and from local concessionaires. Power from NPC. Communication from private providers. No competition	Same
Public Health and Safety		
No accidents nor sickness attributed (complained) to RCMI operations	No accidents nor sickness attributed (complained) to RCMI operations	Continuous vigilant observance of health and safety protocol and of the DOLE regulations on these.
Traffic Congestion		
No significant traffic congestion. Vehicles are mostly the delivery trucks for raw materials that are outsourced. Majority of the raw materials are delivered by sea.	No significant traffic congestion. Vehicles are mostly the delivery trucks for raw materials that are outsourced. Majority of the raw materials are delivered by sea.	Same

ES 3.3. Concise integrated summary of the main impacts and residual effects after applying mitigation

(based on the results of the long term monitoring and compared with the previous baseline including assessment of the effectivity of the measures and the proposed changes to consider the expansion), status of EMF and EGF implementation (including the proposed changes to include the expansion)

By way of clarification, based on Revised Procedural Manual 2003-30, Residual Impacts / Effects are the remaining impacts after implementation of preventive and mitigating measures. The summary of the main impacts and residual effects after applying mitigation is shown below, **Table ES-8.** This table indicates the activity to a certain environmental sector (e.g. potential impact on air quality, potential impact on freshwater ecology, etc.

Table ES-8. Summary of the Main Impacts and Residual Effects

Activity	Impact	Mitigating Measure	Efficiency of Measures	Residual Effect
PRE-CONSTRUCTION PHASE (for proposed expansion): No perceived impacts. The pre-construction phase in the EPRMP reports covers activities like planning, engineering design, and procurement of equipment.				
Construction Phase (PROPOSED PROJECT ONLY) for the installation of new structures and equipment inside the Plant				
Site Clearing, Removal of vegetative cover, Excavation	Potential disturbance of the floral and faunal species.	Construction will all be within the Cement Plant Complex where there are no forests nor wildlife and no trees to be cut as the facility is already existing. The existing plant is already cleared of vegetation except for the landscaping. No faunal species are present. Avoid landscaped areas as much as possible. In case there are few trees to be affected, secure tree cutting permit and compliance on the replacement of removed vegetation (1:50)	100% replacement of removed vegetation with same species however earth balling is the first option.	No adverse residual effects; positive effects are from the greening/landscaping program.
	Loss of vegetation, Movement and/or loss of wildlife species aggravated by the loss of habitat and food for survival	- Re-vegetation and enhancement of buffer zone. - For the Cement Plant Complex, there are no trees to be cut as the facility is already existing. Moreover, the proposed expansion or construction of additional plant facilities is to be done within the existing plant, which is already cleared of vegetation except for the landscaping. No faunal species are present.	100% implementation of control management.	No adverse residual effects; positive effects are from the greening/landscaping program.
	Potential impact to Iligan Bay due to soil erosion, siltation, and flow of storm water runoff.	- Maintain appropriate setback distances from Iligan Bay for all construction activities that might increase storm water runoff or cause erosion or sedimentation. - Appropriate dumping of soil wastes located into the Mine Waste Dumpsite for temporary storage equipped with siltation ponds. This soil will be used again during road paving and compaction in the future especially at quarry area. - If possible, avoid working outdoors during wet and rainy conditions. - Provision of adequate drainage system to accommodate peak runoff that could contaminate the nearby water bodies and degrade the area. - Install temporary drainage ditches and sediment traps/pond around the construction area to pump out runoff caused by heavy rainfall.	100% conveyance of run-off water and sediments to siltation ponds/traps	No residual effectsCompliance to MGBNo further activities after site decommissioning/rehabilitation.

Activity	Impact	Mitigating Measure	Efficiency of Measures	Residual Effect
	Soil/Land Contamination Due to Improper Waste and/or Garbage Disposal.	- Provide area to stockpile construction wastes before hauling. - Provide proper solid waste disposal. - Implement waste segregation. - Practice good housekeeping.	100% compliance to RA 9003	No residual effects; The wastes will not remain at impact areas and will be properly disposed of by 3rd parties.
Use of heavy vehicles and construction equipment / Use of heavy equipment to transport materials	Potential contamination of soil and nearby water bodies due to accidental spills or releases of fuel or lubricating oils	- The same measures cited above (in the case of soil management) for the management of oils/leaks will be implemented. - Daily monitoring of hydraulic system including the hose which is the main source of any vehicular leaks. - Use dipping pan in case a leak is observed. Equipment with leaks are not authorized to resume unless resolved.	100% no soil contamination related to fuel/oil spills or accidental spills	No residual effects Compliance with MGB No further impacts after cessation of involved activities or operations
	Potential Impacts to Air Quality due to dust emissions	- Covering haulage trucks to control dust emissions before traveling on public roads.- Spray water at least twice a day on unpaved access roads, haulage roads, stockpiles and dust generating areas. - Enforce speed limits (20km/h) to reduce airborne fugitive dust from the vehicular traffic. - Revegetate disturbed areas after disturbance and implement maintenance to ensure growth.	100% compliance to RA 8749	No residual effectsDust pollutants are controlled and if dispersed (minimally) will not stay in environment.
	Possible increase of noise level (Nuisance)	- Provide silencers and mufflers to minimize noise. - Construction activities should be done only during daytime. - Proper maintenance of the equipment and vehicles.	100% compliance to Noise Standards	No residual effects Noise generation does not linger after stoppage of involved activity

Activity	Impact	Mitigating Measure	Efficiency of Measures	Residual Effect
Delivery/ Transport of construction materials	Potential damage to Barangay Roads/Right-of-Way Issues	- Rehabilitation of roads that will be damaged will be integral to the responsibilities of the Proponent as well as its Contractor/s. - Right-of-way issues, if any, will have to be resolved first by the Proponent. - Absolutely no activity in any area of conflict unless issue is resolved. - Construction raw materials and additional equipment shall be delivered by suppliers to the plant site through the National Highway, which is a public road, and by sea through RCMI's own port. Hence, no significant RROW issues are foreseen. - Access roads were constructed by RCMI for use of residents living near the plant and/or quarries.	100% compliance to Road Right-of-Way issues	Positive residual effects of road maintenance and rehabilitation.
	Traffic Congestion	- Limit in the use of certain roads specifically for the project. - Programmed dispatch of construction vehicles.	100% compliance to Traffic Laws & Traffic Management	No residual effects
Equipment refueling, maintenance or operation	Potential contamination of soil and nearby water bodies due to accidental spills or releases of fuel or lubricating oils	- Proper maintenance and regular inspection of vehicles and construction equipment. - Designation of a motorpool wherein refueling and maintenance works will be done and in which area sump pits for oil leaks will be provided. - Facilities for recovery of leaks and storage in drums will be provided. - Collection of used oils in containers for disposal by third party (minimum 6 months and maximum of 1 year) - Proper training of vehicle operators especially on spill prevention and containment.	100% compliance to RA 6969	No residual effects. Accidental oil spills will be immediately cleaned up and properly disposed of by 3rd party TSD facility
Movement of Workers	Potential increase on BOD loading and coliform level of nearby water body (Iligan Bay) due to generation of wastes by workers.	- Provide temporary facilities ("portalets") for workers. - Strictly impose on the contractors and its workers to observe proper waste disposal and proper sanitation. - Sanitation including the sludge collection of the portalets will be weekly or twice a week (depend on the actual usage/volume of sludge). 3rd party sludge transporter should be registered/authorized by DOH and EMB. - Conduct Quarterly Effluent Monitoring	100% compliance to RA 9275 (DAO 2016-08) and the Sanitation Code	No residual effects No further impacts after cessation of involved activities.
	In-migration because of increased business and livelihood opportunities	Prioritizing the hiring of construction workers to local residents and those in the impact areas of the project.	100% compliance to Labor Code of the Philippines including OSH Standards	No adverse residual effects Business, livelihood and business opportunities positive impacts

Activity	Impact	Mitigating Measure	Efficiency of Measures	Residual Effect
	Increase in indirect revenues	- Local qualified contractors will be given priority. - Positive impact.		Improved government services
	Competition in the use of resources, principally water availability.	No competition of water resource during this phase as the water requirements for construction is minimal and can be sourced from RCMI's existing deepwell. The domestic water as well as drinking water supply for the workers shall be sourced from the local concessionaire.		No residual effects
	Physical injuries arising from accidents such as: - Being hit by falling weak structures - Being overrun by heavy equipment	- Daily toolbox meeting should be strictly imposed. - Workers must be compelled to wear at all times during working hours (usually 8hours) the Provided Personal Protective Equipment (PPE). - The construction company shall have a Safety Engineer to oversee health hazards over the personnel all throughout the construction phase. - First aid kit shall be made available at all times at the project site. - Observance of safety practices and training of construction workers. - Established Emergency Preparedness and Response Program including regular emergency drills. - Good housekeeping practices.	100% compliance to Occupational Safety and Health Standards	No residual effects
	Occurrence of sickness & diseases in workers and community.	There are no specific elements of the project during the construction phase that may cause sicknesses and diseases that can spread to the communities. Post-ECQ Health and Safety Guidelines to be included in the OSH protocols.		No residual effects
OPERATIONS PHASE (Existing and Proposed)				
QUARRIES				
Quarry Operations	Change in geology / Depletion of Ore	- Comply with development plan - Progressive rehabilitation and re-vegetation of mined out quarries and planting in idle lots - Utilize the recovered topsoil that was stored in waste dump for future rehabilitation and re-vegetation.	100% compliance to RA 7942 “Philippine Mining Act of 1995”	Extraction/depleton of ore is permanent - No replacement.

Activity	Impact	Mitigating Measure	Efficiency of Measures	Residual Effect
	Change in topography/ landform	- The area will be re-contoured and stabilized during rehabilitation. - Proper benching and installation of bench drainage to prevent soil erosion. - Installation of coconet and planting of creeping vines to improve the slope stability. - Avoidance of very steep slopes whenever necessary and practical. - Compliance to the Final Mine Rehabilitation and Decommissioning Plan (FMRDP). The progressive nature of quarrying, which is inherent with the project, provides the major mitigation measures. Progressive rehabilitation and enhancement work such as:· • Providing for green areas, tree planting, • Installation of drainage and sewerage system and other activities should be expected to leverage to a certain degree the adverse effects.	100% compliance to mining plan 100% compliance to FMRDP	Change is permanent but to be left in stable conditions as a result of the mitigating measures.
	Potential Rockslides/ Landslides / Mass Movement	- Maintaining slope stability by proper engineering measures. - Reduction of cut slopes by terracing - Prevention of increase in internal water pressure by vegetation cover - - Adequate drainage control	100% stabilized slopes and efficiency of erosion control	Improved measures against potential landslides
	Potential inducement of flooding	- Installation and proper maintenance of drainage system. - Water and silt in settling ponds monitored. Silt content should not exceed 50% of its capacity. - Desilting is done regularly, and more frequent or as needed during rainy season.	100% conveyance of runoff water to settling ponds and 100% no overflowing of ponds.	No residual effects

Activity	Impact	Mitigating Measure	Efficiency of Measures	Residual Effect
	Potential impact to water quality of nearby creeks and Iligan Bay due to erosion, siltation, and flow of storm water runoff.	- Unnecessary removal of overburden and vegetative cover is avoided. - As much as possible, all major clearing and stripping of the overburden shall start at the dry season - The stripped topsoil are being handled properly - Waste materials coming from the overburden were not dumped on natural drainage ways. Established dumpsite in strategic locations are far from the drainage ways. - Provision of adequate drainage system to accommodate peak runoff that could contaminate the nearby water bodies and degrade the area. - Drainage system around bare areas are designed to direct runoff water to settling ponds and capture the sediments. There are 9 ponds in the quarries, each w/ capacity of 2,000 m^3. - 1 settling pond to be added in the limestone area for the proposed increase in production rate. - Regular de-silting of the sedimentation ponds are employed quarterly but more frequently or as needed during rainy season. This is done when silt level reaches 50% of pond capacity. Freeboard marker installed. - Erosion control measures such as slope stabilization. - Proper benching and installation of bench drainage to prevent soil erosion. - Installation of coconet and planting of creeping vines to improve the slope stability. - Avoidance of very steep slopes whenever necessary and practical. - Maintain appropriate setback distances from water bodies for all quarrying activities that might increase storm water runoff or cause erosion or sedimentation. - Quarterly Monitoring of Effluent	100% compliance to RA 9275 (DAO 2016-08) 100% conveyance of runoff water to settling ponds 100% stabilized slopes and erosion control	Lesser potential for erosion and siltation.
	Potential impact to Air Quality due to dust and noise emission	**EXISTING** - Proper maintenance of the quarry equipment are imposed to reduce dust and noise. - Watering of unpaved roads done twice a day **ADDITIONAL**	100% compliance to RA 8749 and noise standards	No residual effects

Activity	Impact	Mitigating Measure	Efficiency of Measures	Residual Effect
		- Control measures outside the facility especially the quarry area is recommended such as periodic watering of roads, minimizing generation and resuspension of dust particles. Area source dust abatement such as water sprinkling and planting vegetations as green buffer zone in the cement manufacturing operation is also recommended to control dust resuspension.		
	Disruption of groundwater / aquifer	- Based on geo-hydrological study, clastics and limestone can be quarried provided that a minimum of 10m of cover on top of the aquifer is maintained to serve as protection. - Deep-ripping of compacted soil surfaces. - Avoiding the penetration of aquifers below the limestone deposits. Quarrying conducted above the natural springs w/ buffer of at least 50m. The final pit bottom will be at +60 masl for limestone and at +30 masl for shale, which are both above the level of known aquifers/springs. - Controlled blasting employed all the time - Conducted geo-resistivity study	Zero disruption of groundwater	No residual effects
	Increase in manpower/ employment opportunities and increase in average income	- Positive impact, thus, no mitigation **Existing manpower:** RCMI: 166 for both the plant and the quarries. Quarrying - Delta Earthmovers – 68 Other Contractors: 745 **Proposed expansion:** Construction phase for additional plant facilities: 1,000 RCMI: 184 (additional 18) Quarrying - Delta Earthmovers – 68 (same) Other Contractors: 745 (same)	-	Positive residual effects Enhanced socio economic benefits
	Increase in the income of the national as well as local government units	Positive impact, thus, no mitigation	-	Positive residual effects Enhanced socio economic benefits

Activity	Impact	Mitigating Measure	Efficiency of Measures	Residual Effect
	Soil/Land Contamination due to improper disposal of earth/land spoils.	- Provide temporary stockpile for overburden and store it at designated mine waste dumpsite equipped with siltation ponds. - Proper maintenance of the mine waste dumpsite in terms of slope stability, sufficient drainage, temporary vegetative cover, etc. - The stored mine wastes shall be used as backfill materials during the rehabilitation of mined-out areas and other earthworks such as in road maintenance, berms, etc. - Practice good housekeeping.	100% compliance to RA 7942	No residual effects. Mine wastes are to be re-used in the rehabilitation, eventually.
Use of heavy vehicles and mining equipment in quarrying/ hauling	Potential oil leaks/spills, which may impact on the quality of the nearby water bodies	The same measures cited above (in the case of soil management) for the management of oils/leaks will be implemented.	100% Compliance to RA 6969	No residual effects
Land Clearing	Removal of the overburden, loss of topsoil	Only areas that are identified to be quarried are to be cleared. - Comply with development plan - Progressive rehabilitation and re-vegetation of mined out quarries and planting in idle lots - Utilize the recovered topsoil that was stored in waste dump for future rehabilitation and re-vegetation. - Topsoil will be replaced during progressive rehabilitation. Existing Active Disturbed Areas: 76.438 ha Additional Areas to be Cleared: 81.432 Total Area: 157.87 ha Topsoil to be backfilled is 0.5 meters thick X 1,313,837.27 m^2 = 656,919 m^3 *Note: For the area to be backfilled using topsoil, the total area is only 131.3837 hectares since we only considered to backfill the benches (bench widths) and we excluded other areas for backfilling such as slopes and drainage canals per bench.*	100% compliance to mining plan	Improvement of soil (topsoil)

Activity	Impact	Mitigating Measure	Efficiency of Measures	Residual Effect
	Major disturbance of the mini forest cover with impacts on the terrestrial ecology - Loss of flora and fauna	- Avoidance of tree cutting or disturbance to the extent possible especially when endangered species may be affected. - Progressive rehabilitation, re-vegetation, and enhancement of mined-out quarries, idle lots, and buffer zone. - Vegetation loss will be replaced in the progressive rehabilitation program at 1:50 cut and plant ratio. - Additional Area to be Cleared for Expansion Project = 81.432 ha; - Additional trees to be cut = 8,150 to 12, 215 (100-150 trees/hectare cleared) - Expanded National Greening Program, Mangrove Rehabilitation Project and Mine Forest Program in the quarries, plant, as well as areas outside the project site. - Utilize the recovered topsoil that was stored in waste dump for future rehabilitation and re-vegetation. - As an example, overburden that was stripped from shale quarry at AQL 41(5) was delivered directly to the southern portion to be used for re-soiling at elevation 40msl. Similar procedure to be practiced prospectively. - Establishment/maintenance of at least one plant nursery. - Consultant forester will be hired when the rehabilitation starts - Construction/installation of culverts at selected portions of the mine access for ground vertebrate to migrate and cross through. - Conduct annual biodiversity monitoring/assessment Prior to land clearing operations within the mine expansion area, the proponent will conduct tree inventory following FMB Technical Bulletin and in coordination with DENR-CENRO, which will be the basis for application of Special Tree Cutting and/ or Earthballing Permit. Once the STCP is issued by the DENR, the Proponent shall abide by all the conditionalities as set forth in said STCP, particularly the tree replacement following the guidelines under DENR Memo Order No. 2012-02 dated November 05, 2012 in order to replace standing trees affected by the clearing operations. In the case of coconuts, cutting permit shall be secured from PCA.	100% rehabilitation/ re-vegetation of disturbed areas100% observance of biodiversity monitoring and study 100% Compliance to R.A. # 9147 and other related laws/policies on wildlife conservation	Enhanced floral community due to reforestation.Enhanced habitat for faunal species.

Activity	Impact	Mitigating Measure	Efficiency of Measures	Residual Effect
		The Proponent will include discussions on wildlife conservation in compliance to RA 9147 and its IRR based on the results of Terrestrial Ecology assessment and shall be incorporated in the formulation of the EMP and EMoP. This can be done or implemented under Annual Environmental Protection and Enhancement Program (AEPEP) Results of the biodiversity assessment conducted by IIT will be incorporated in the discussions on biodiversity parameters during project operation vs. baseline data as contained in the EIS. *Note: TB 2016-04 of 02 December 2016 is duly noted. This refers to the conduct of Protected Area Suitability Assessment (PASA), and therefore apparently not relevant to the Project since it is not cited as an E-NIPAS area.*		
BLASTING	Possible damage to caves no. 5 and 9 (Matu-ug Cave) and disruption of the groundwater resource contained in No. 9, which is tapped by the City's water district..	- Caves No. 5 and No. 9 are located in other parcels of MPSA-104, which are outside of the quarry areas. - Absolutely no blasting near caves - Blasting done in 80% of limestone, and none in shale quarrying	100% compliance to RA 7942	No residual effects
	Physical injuries or damage to property due to fly rocks.	- All residents are periodically informed of blasting schedule. Notices sent to the barangay, PNP & MGB 3 days before blasting. Siren provided at the quarry and nearby residential areas. - Blasting is concentrated to hard limestone deposits only and is limited to day time.	100% compliance to RA 7942	No residual effects
	Ground vibration	- Controlled blasting method employed. - Blasting pattern planned beforehand and ground vibration is measured, recorded and reported to MGB	100% compliance to RA 7942	No residual effects
	Disruption quantity and quality of aquifers (esp. shallow water wells).	- Controlled blasting is adopted - Blasting pattern planned beforehand and ground vibration is measured, recorded and reported to MGB	100% compliance to RA 7942	No residual effects

Activity	Impact	Mitigating Measure	Efficiency of Measures	Residual Effect
	Potential impact to Air Quality due to dust and noise emission	- Controlled blasting is adopted - Blasting pattern planned beforehand and ground vibration is measured, recorded and reported to MGB	100% compliance to RA 8749 and noise standards	No residual effects
	Risk of contamination of soil and water from hazardous wastes	- Plant implemented strictly on hazardous waste management program. - Administer proper storage and handling of hazardous wastes. The plant has a Hazardous Waste facility where hazardous waste are temporary stored and managed. - Secondary containment was constructed to prohibit oil/chemical spill, which may lead water/soil/and groundwater contamination - Properly categorize wastes for disposal and further treatment - Allocate staging area to accommodate waste treaters and disposal contractors - Ensure that personnel and equipment needed for oil spill response are always ready.	100% Compliance to RA 6969	No residual effects. Hazardous wastes will ultimately be disposed by TSD providers and will not remain at the impact areas.
STOCKPILING	Potential Erosion and Siltation	- Properly stockpile and dispose the materials generated from the quarry, silt from settling ponds, and other wastes in permanent, stabilized areas away from any water body and drainage systems maintained in safe and non-polluting conditions. - All topsoil are properly stockpiled upslope and away from other spoils materials. - Strictly effect stabilization and erosion control of the affected side slopes of the roads and nearby gullies and creeks within the project site, as well as the siltation ponds. - All stockpiled soils and spoils were stabilized with temporary vegetation i.e., grasses or plants with good root systems. - Installed sediment traps and drainage ways.	100% conveyance of run-off water to settling ponds 100% stabilized slopes and efficiency of erosion control	No residual effects
	Contamination of groundwater due to leaching of stockpile	- Ensure no contamination of groundwater by thorough soil compaction not allowing coal to enter the groundwater instead will be driven to the stockpile siltation ponds. - During rainy season, open coal stockpile should be covered by tarpaulin but not during dry season as it will cause smoldering. - The floor of stockyard is designed as to have curbing along the periphery. This shall prevent the runoff from heaped materials directly running over soil surface. - Conduct annual groundwater sampling/ monitoring	100% compliance to DAO 2016-08	No residual effects

Activity	Impact	Mitigating Measure	Efficiency of Measures	Residual Effect
HAULING (Including use of heavy vehicles and mining equipment)	Potential impact to Air Quality due to dust and noise emission	- Conducted at least twice (2) a day water spraying along access roads, haul roads, and stockpiles especially during dry season. - Imposed speed limit to 20 kph to minimize airborne dust and ground vibration especially passing thru barangay proper. - Installation of mufflers and other noise suppressor to all vehicle and heavy equipment. - Imposed restriction of hours of activities especially from Site 2. - Regular maintenance of vehicle and heavy equipment as per PMS checklist - Regulated the use of road passing barangay proper- Covering of dump truck using tarpaulin to control dust emissions. - Load limit capacity are strictly implemented and required for hauling contractor. - Regular removal of spillages on haul roads. - Revegetate disturbed areas as soon as possible.	100% compliance to RA 8749 and noise standards	No residual effects. Dust and noise pollutants do not stay in air environment
	Contamination of Iligan bay from fugitive dust during transfer of raw materials	- Same measures as above. - Provide and maintain sufficient drainage along roads and around stockpiles.	100% Compliance to RA 6969	No residual effects. Dust do not stay long in air environment
	Increase in noise level	- Mining activities will be done essentially during daytime only - Provide silencers and mufflers to minimize noise - Proper maintenance of the equipment and vehicles - Planting trees that could serve as sound buffers. - Establishment of 20-meter buffer zone of different species combination of plants including shrubs, small and medium-sized trees.	100% compliance to Noise Standards	No residual effects. Noise does not linger
Movement of Workers	Impact to water quality of nearby water body (Iligan Bay) in terms of increase in BOD loading and coliform level due to wastewater/sewage generation by workers.	- Provide temporary facilities ("portalets") for workers. - Strictly impose on the contractors and its workers to observe proper waste disposal and proper sanitation. - Sanitation including the sludge collection of the portalets will be weekly or twice a week (depend on the actual usage/volume of sludge). 3rd party sludge transporter should be registered/authorized by DOH and EMB. - Conduct Quarterly Effluent Monitoring	100% compliance to RA 9275 (DAO 2016-08)	No residual effects

Activity	Impact	Mitigating Measure	Efficiency of Measures	Residual Effect
	Soil/Land Contamination due to improper disposal of solid wastes generated by mining workers	- Implement waste segregation. - Provide proper solid waste disposal system. - Practice good housekeeping.	100% compliance to RA 9003	No residual effects
CEMENT PLANT				
CEMENT PLANT OPERATIONS (Crushing, Burning, Clinkering, Finish Milling, Packing)	Potential impact to Air Quality due to dust and noise emission	- Conducted daily water spraying and road sweeping on unpaved and cemented roads at Packhouse area.- Installation of exhaust mufflers on vehicles. - Dust collection equipment (rotary drum dryer, bag filter, electrostatic precipitator, etc) installed in all parts of the Cement Plant, Finish Mill and Packhouse) - Landscaping around the buildings/plant to act as dust and noise buffer. - Incorporating noise criteria in the specifications and selection of equipment - Use of effective noise attenuating materials for the plant structure and walling - Planting of the appropriate vegetation as buffer **FOR THE PROPOSED EXPANSION**, a whole new array of dust collecting equipment shall be added to the existing Air Pollution Control Facilities and Devices (See Tables ES-1 and 1-7)	100% compliance to RA 8749 and noise standards	No residual effects. Dust and noise pollutants do not stay in air environment
	Potential impact to Air Quality due to Ambient Emissions (Particulates, NOx, SO2, CO)	- Replacement and maintenance of Air Pollution Control Facility and Devices as per PMS checklist - Conducts tree planting along plant vicinity to provide a buffer zone. This is part of NGP and MFP project implementation and accomplishment. - Conducts at least twice a day water spraying along quarry road especially during dry season to suppress dust emission. - Mechanical road sweeper with vacuum was utilized to clean the material spillages. This is to reduce manual sweeping, which might result to fugitive dust. - Covering of dump truck using tarpaulin to address the material spillage during transport. - Daily checklist for the mobile equipment is employed including the smoke belching monitoring. - Conducts quarterly monitoring of ambient air at the designated sampling areas. - Turned the idle areas into landscape areas to address fugitive dust when windblown.	100% compliance to RA 8749	No residual effectsAir Pollutants dispersed and does not stay in atmosphere

Activity	Impact	Mitigating Measure	Efficiency of Measures	Residual Effect
	Potential impact to Air Quality due to Source Stack Emissions (Particulates)	- Conducted tree planting along plant vicinity to provide a buffer zone. This is part of NGP and MFP project implementation and accomplishment. - Conducted annual stack sampling monitoring for the smoke stack specified at Permit to Operate. - Installed CEMS/COMS at kiln stack and conducted quarterly CGA and annual RATA. - Cement plant shutdown if Electrostatic Precipitator (ESP) fails to work in 20 minutes. **FOR THE PROPOSED EXPANSION**: Replacement/modernization and Maintenance of Air Pollution Control Facilities and Air Pollution Control Devices as per PMS checklist in all areas of the Cement Plant, Finish Mill, Packhouse and other sections of the Plant Complex).	100% compliance to RA 8749	No residual effects. Pollutants dispersed and does not stay in atmosphere
	Potential impact to Air Quality due to GHG Emission	- Monthly and Annual monitoring of GHG specifically CO2 emission using cement sustainability initiative (CSI) standard format. - Initiated NGP and MFP for the CO2 sequestration program. - The plant uses alternative raw material such as fly-ash and other cementitious materials to reduce the clinker consumption and thus reduce the CO2 emission.	100% compliance to RA 8749	No residual effects to the air environment; GHG dispersed and do not stay in air environment GHG destination is the stratosphere
	Air quality pollution from TSP and PM10 from non-regulated sources (vents, silos, finish mills, fugitive sources)	- Proper operation and following the PMS of dust collectors - Regular compacting of unpaved access roads - Utilize the mechanical road sweeper with vacuum - Formulation and implementation of a motor vehicle maintenance program, including emissions testing - Regular checking and following the PMS for conveyor systems and vents	100% compliance to RA 8749	No residual effects Air pollution dispersed
	Potential impact to Air Quality due to Ambient Noise emission	- Conducts quarterly monitoring of noise pollution at designated sampling areas. - Strictly imposed maintenance of major and auxiliary equipment to reduce maintenance related noise pollution. - Conducted tree planting along plant vicinity to provide a buffer zone. This is part of NGP and MFP project implementation and accomplishment. - Installed wall cladding and enclosure of major equipment to contain the noise.	100% compliance to Noise Standards	No residual effects Noise no permanent impacts after noise generator cease to operate

Activity	Impact	Mitigating Measure	Efficiency of Measures	Residual Effect
	Potential contamination of soil and water and creation of foul odor due to solid waste generation	- As an ISO 14000:2015 accredited company, the Plant has rigid solid waste management program. - Trash bins are properly labelled and daily collection was implemented. - Implements on-site waste segregation - The plant has a Material Recovery Facility - Metal scraps and glass/bottles are stored in scrapyard located near the MRF. Periodically sold to scrap buyers. - The scrapyard is located near the MRF and Hazardous Waste Storage - Recyclable bins (Earth Shape) were installed at designated areas. Also donated the Earth Bins to the Barangay, MGB and EMB X. - Daily collection of biodegradable wastes and disposed in compost pits - Residual wastes are disposed daily to Iligan City MRF for a charge of Php 200/m^2.	100% compliance to RA 9003	No residual effects; solid wastes will ultimately be disposed and will not remain at the impact areas.
	Potential contamination of soil and water due to hazardous waste generation	- Strictly implements hazardous waste management program. - Trash bins are properly labelled and weekly collection was implemented. - The plant has Hazardous Waste facility where hazardous waste are temporary stored and managed. - Secondary containment was constructed to prohibit oil/chemical spill which may lead water/soil/and ground water contamination - Co-processing in the Cement Kiln to use acceptable wastes as alternative fuel & raw material. - Generated/disposed quantity for each type of hazardous wastes is monitored, recorded and reported.	100% compliance to RA 6969	No residual effects; hazardous wastes will ultimately be disposed by 3rd Party TSD provider and will not remain at the impact areas
	Pollution of surface water and groundwater	- Quarterly monitoring of static water level of wells. - Conducted quarterly effluent sampling and monitoring. - Installation of oil-water separator in the waterway/canal for the oil & grease. - Constructed mini wastewater treatment for the canteen effluent and fish pond as indicator of good effluent quality.	100% compliance to RA 9275	No residual effects with application of mitigation measures.

Activity	Impact	Mitigating Measure	Efficiency of Measures	Residual Effect
	Siltation of water bodies	- Daily sweeping of dust and cement spillages on roads using mechanical road sweeper. - Provided adequate drainage with proper maintenance at Packhouse area & pier facilities. - Avoidance of spillage of materials during loading and unloading to/from barge.	100% compliance to RA 9275 (DAO 2016-08)	No residual effects with strict implementation of mitigating measures which are monitored by the EMB Reg X and the MMT.
	Potential contamination of soil and nearby water bodies due to oil spill from vessels and mobile equipment	- Proper disposal of used oil from vessel and from mobile equipment at Packhouse area. - Installed oil water separator at all canal outfalls from Packhouse and Motorpool of Packhouse Contractor - Nearest water bodies, except Iligan Bay, not in impact areas.	100% compliance to RA 6969	No residual effects; accidental oil spills will not remain at impact areas. Can readily be collected and disposed by TSD providers.
	Potential contamination of nearby water bodies with oil and grease and pollutants from runoff from the cement plant	- Installed oil and water separator at all canal outfalls. - Drainage system is well-maintained and monitored. - Immediate clean-up and remediation in case of accidental spill.	100% compliance to RA 6969 and to RA 9275 (DAO 2016-08)	No residual effects; accidental spills will not remain at the water bodies impact areas.
	Potential contamination of soil and water and foul odor due to Solid Waste Generation	- Strict implementation of solid waste management. - Implements solid waste segregation at Packhouse area & pier facilities.	100% compliance to RA 9275 (DAO 2016-08) and RA 9003	No residual effects; solid wastes will ultimately be disposed and will not remain at the impact areas
	Contribution to climate change from greenhouse gas emission	- Continue current GHG inventory program - Continue the NGP and MFP initiatives	100 % compliance on NGP and MFP	No residual effects
	In-migration	Prioritizing the hiring of workers to local residents and those in the impact areas of the project. Local qualified contractors will be given priority as well.	100% compliance to Labor Code of the Philippines including OSH Standards	Positive residual effects on employment

Activity	Impact	Mitigating Measure	Efficiency of Measures	Residual Effect
	Competition in the use of resources, principally on water availability	- Water use competition is not expected to be significant. - Contractors may draw water from the nearby water bodies and store this in water tanks for use during this phase and for domestic purposes. - Water extraction is within the allocation limits set in the Conditional Water Permits issued by NWRB. - Water pipelines were provided with water meter - Domestic water will be supplied from local concessionaires while drinking water will be from purchased bottled water, which is the case for drinking purposes. **FOR EXISTING SET-UP**, the water requirements for the project is 703.3 m3/day. **FOR PROPOSED EXPANSION**: This shall be increased to 3,100 m3/day for the proposed increase in quarry and plant production rates. This is taken from the 2 existing deep wells with rated discharge of 385 gpm or 87.6 m3/hr. No additional deep wells to be constructed. The process and the mining operation are dry in nature. Water requirements are for the plant and the sprinkling of dusty roads and areas.	100% compliance to RA 9275	No residual effects
Delivery of Raw Materials	Possible traffic congestion	Deemed not significant, no major truck movements in public roads. Nevertheless, measures are: - Limit in the use of certain roads specifically for the project. - Programmed dispatch of vehicles.	100% Compliance to traffic rules & standards	No residual effects

Activity	Impact	Mitigating Measure	Efficiency of Measures	Residual Effect
	Occupational Safety and Health hazards for workers frequently exposed to process units or facilities of Cement Plant complex	- Provision of proper sanitation and medical facilities to workers - Properly dispose of wastes at allocated disposal sites- Implement safety protocols at all times - Workers compelled to wear at all times during working hours the provided Personal Protective Equipment (PPE). - Observance of safety practices and training of workers. - Annual physical exam conducted for all employees. Results are submitted to DOH as a requirement to issuance of annual Sanitary Permit. - Annual IMS/ISO Surveillance audit is conducted by 3rd Party for ISO 14001:2015 and ISO 9001:2015 certification as well as recertification of OHSAS 18001:2007. - Implements various H&S programs such as: Hearing Conservation, PTB, Hypertension Management, Ergonomics, and Family Planning programs. - Free medical consultation, services, and medical treatment for employees in the clinic which is manned by a full-time nurse and occupational physician. - For hospitalization, RCMI has accredited hospitals in the vicinity of Iligan, Cagayan de Oro and Cebu for the benefit of the employees and their family members.	100% compliance to OSH Standards	No residual effects
	Physical injuries arising from accidents such as being hit by falling weak structures, being overrun by heavy equipment may be considered as attendant to plant works	- The Company Organization includes a Pollution Control Officer/Safety Engineer to oversee health and environmental hazards /concerns. - First aid kit shall be made available at all times at the project site. - Provide preventive measures for potential fire and explosion hazards	100% compliance to OSH Standards	No residual effects
	Potential impact to health of nearby residents/community.	- Conduct of community health services with the host community. - Conduct of community safety trainings on health awareness, emergency preparedness, road safety, and quarry safety. - Provides emergency transport for the community using the Company's ambulance. - Provides medical/financial assistance to host communities.		No residual effects

ES 3.4 Risks and uncertainties relating to the findings and implications for decision making

Based on the discussions of the Environmental Risk Assessment (ERA) **Section 4**, there appears to be no risks that cannot be managed through engineering intervention. However, the risks that provide challenges are those which are climate change related:

- **Strong Typhoons**
  Aberrations/strong typhoons may be experienced as an effect of climate change; however, these do not prevent implementation of the project because of the short term nature of typhoons thus emergency measure, e.g. evacuation of personnel will be developed.

- **Storm Surges and Sea Level Rises**
  Storm surges have been previously experienced in Iligan Bay, e.g., during Typhoon Sendong, but the sites affected were farther out from the pier of the Project. In any event, the risks and uncertainties that may arise therefrom are not deemed vital to decision making with respect to viability of the project.

  Sea Level Rise is not expected to create adverse implications for decision making because at worst case scenario only the pier operations will be affected.

ES 3.5 Status of EMF and EGF implementation (including the proposed changes to include the expansion)

Status: The same existing MMT members will be institutionalized, which anchors on the DAO 2017-15 "Guidelines on Public Participation under the Philippine Environmental Impact Statement (EIS) System".

On the proposed changes, as a matter of general procedure, the MOA for the MMT will be firmed up after securing of the ECC. The CLRF and the EGF for the expansion project will hence be determined.

SECTION 1. PROJECT DESCRIPTION

1.0 Basic Project Information and Background

The Project subject of the EPRMP is that of Republic Cement Mindanao Inc. RCMI) being the surviving company of the merger with Republic Cement Iligan Inc. (RCII) as discussed in the Executive Summary. It also includes the recently acquired Limestone Quarry Project from MCCI covered by MPSA No. 105-98-XII. This tenement was granted a Notice of Issuance of an Order on December 3, 2019 re: Deeds of Assignment by and between MCCI and RCMI (See **Annex ES-6**).

This application covers the consolidation of 4 existing ECCs held by RCMI as below:

	ECC No. 0803-009-2231	ECC No. 0505-004-105	ECC No. 9611-03-302	ECC No. 10(35) 02 08-26 3037-50200
Coverage	Consolidation of Quarry Projects	Cement Manufacturing and Quarry Expansion Project	Limestone Extraction Project	Pier & Loading Facilities
Date Granted	May 26, 2010	July 25, 2006	Nov 7, 1996	August 26, 2002
Tenement	MPSA-031-95-XI	MPSA-104-98-XII Amended	MPSA-105-98-XII	NONE
Contract Area (ha)	323.0953	519.0879	26.7867	NONE
Location	Kiwalan and Dalipuga	Kiwalan	Kiwalan	NONE
Date Granted	December 26, 1995	Feb 23, 1998		
Cement Milling	2.0 MMTPY	NONE	NONE	NONE
Clinker Production	NONE	610,000 MTPY	NONE	NONE
Wharf/Pier	Included but not used	NONE	NONE	Operational
Limestone Quarrying	810,000 MTPY	810,000 MTPY	100,000 MTPY	NONE
Shale Quarrying	255,000 MTPY	250,000 MTPY	NONE	NONE

It is important to note that MPSA No. 031-95-XI was granted on December 26, 1995, and therefore, its original 25-year contract term expires in December 2020. The Proponent has applied for its first renewal for another 25 years, which was approved by DENR Central Office on January 17, 2020 and is attached herein as **Annex ES-3.**

The other 2 mining contracts will expire in 2023, for which the Proponent will likewise lodge its applications for renewal.

Currently, the tenement name of MPSA-104 is still under the name of RCII. RCMI has already requested DENR for the Consolidation of 3 MPSAs under RCMI and requested MGB-10 for the registration of SEC Certificate regarding Merger of the 2 companies (RCMI to pay the registration fees on the week of Jan 8, 2021). **See Annex ES-2**.

1-1 Project Location and Area

The proposed expansion of the cement and clinker production is located within the existing **21.4214-hectare** RCMI Cement Plant complex, located in Brgy. Kiwalan. The expansion in quarrying production shall be conducted within the bounds of the 3 MPSAs of the Proponent, with an aggregate of **868.9699 hectares**, located in Barangays Kiwalan, Dalipuga, Bonbonon, Acmac, and Bunawan, all in Iligan City, Lanao del Norte. No additional land area is proposed for the expansion since only upgrading and installation of additional equipment and structures will be done to increase the production capacities.

RCMI holds 3 MPSAs in the vicinity, which are the following: MPSA No. 031-95-XII, MPSA 104-98-XII Amended, and MPSA No. 105-98-XII (newly-owned MPSA acquired from MCCI on September 27, 2019).

MPSA 031 is composed of 2 parcels namely: Parcel 1 (Junior, Einstine, Liberace) covering 191.9999 ha and Parcel II (Rene 1, Josete 1, Rene 2) with 131.0954 hectares for a total of **323.0953** ha. This is located in Brgys. Kiwalan and Dalipuga.

The MPSA 104-98-XII Contract area covers a total land area of **519.0879** hectares. Claims that are under Commercial status (AQL-14 and Champaca 1) covers an area of **93.9721 ha**, whereas the remaining **425.1158 ha** are under Exploration (Champaca 2,3 and Conal/Clent).

Meanwhile, MPSA 105 is likewise composed of 4 parcels which are: Parcel **I** "A-Fr" (6.2630ha); and Parcel **II** "B-Fr" (3.0772ha); Parcel **III** "Kiwalan 4 Fr" (9ha); and Parcel IV "Kiwalan 7" (8.4465ha); with a total area of **26.7867** ha. This is located in Brgy. Kiwalan.

The active limestone quarry is currently within Parcel **II** of MPSA No. 031-95-X**II** and the whole of MPSA No. 105-98-X**II**. For the shale, the active quarry area is in Parcel **I** of MPSA No. 031-95-X**II** and the adjacent Parcel **I** (AQL-41) of MPSA 104-98-X**II** Amended.

The general location map of the RCMI is shown in **Figures 1-1** to **1-4**. The geographical coordinates defining the boundary of the proposed project site are provided in the **Tables 1-1 to 1-3.**

To date, the disturbed area for limestone is 42.74 ha, while the active area covers 17.01 ha, for a total of 59.75 ha. For shale, the disturbed area is 11.118 ha and the active is 5.57 ha, for a total of 16.688 ha.

For the expansion project, additional areas to be cleared (disturbed) are 61.722 ha for shale and 19.71 ha for limestone for a total of 81.432 hectares. This means that at the end of the MPSAs contract terms in 2045, a total of 157.87 hectares (76.438ha shale, 81.432 ha limestone) shall have been disturbed. The current and final disturbed areas are shown in **Figures 1-16 and 1-17** and in the table below.

Table 1-1. Active and Disturbed Quarry Areas

	Shale Quarry (ha)	Limestone Quarry (ha)	Total (ha)
EXISTING			
ACTIVE	5.57	17.01	**22.58**
DISTURBED	11.118	42.74	**53.858**
Sub Total	16.688	59.75	**76.438**
PROPOSED			
Additional Area for Clearing (ha)	61.722	19.71	**81.432**
Total Area to be Disturbed: Existing + Proposed (ha)	**78.41**	**79.46**	**157.87**

1-1.1 Map showing sitio, barangay, municipality, province, region boundaries, vicinity, proposed buffers surrounding the area and Primary & secondary impact areas

These are given in the succeeding figures below.

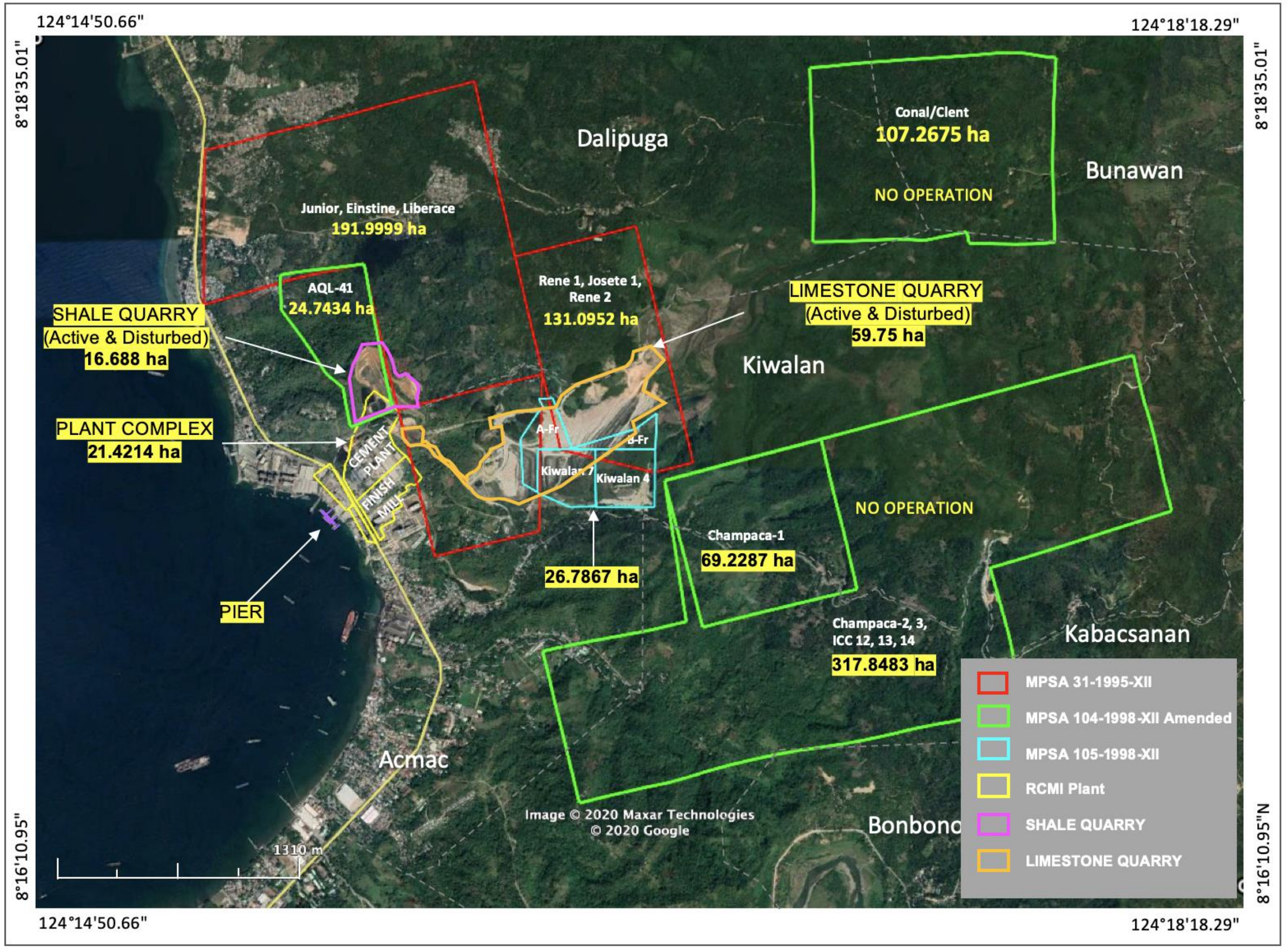
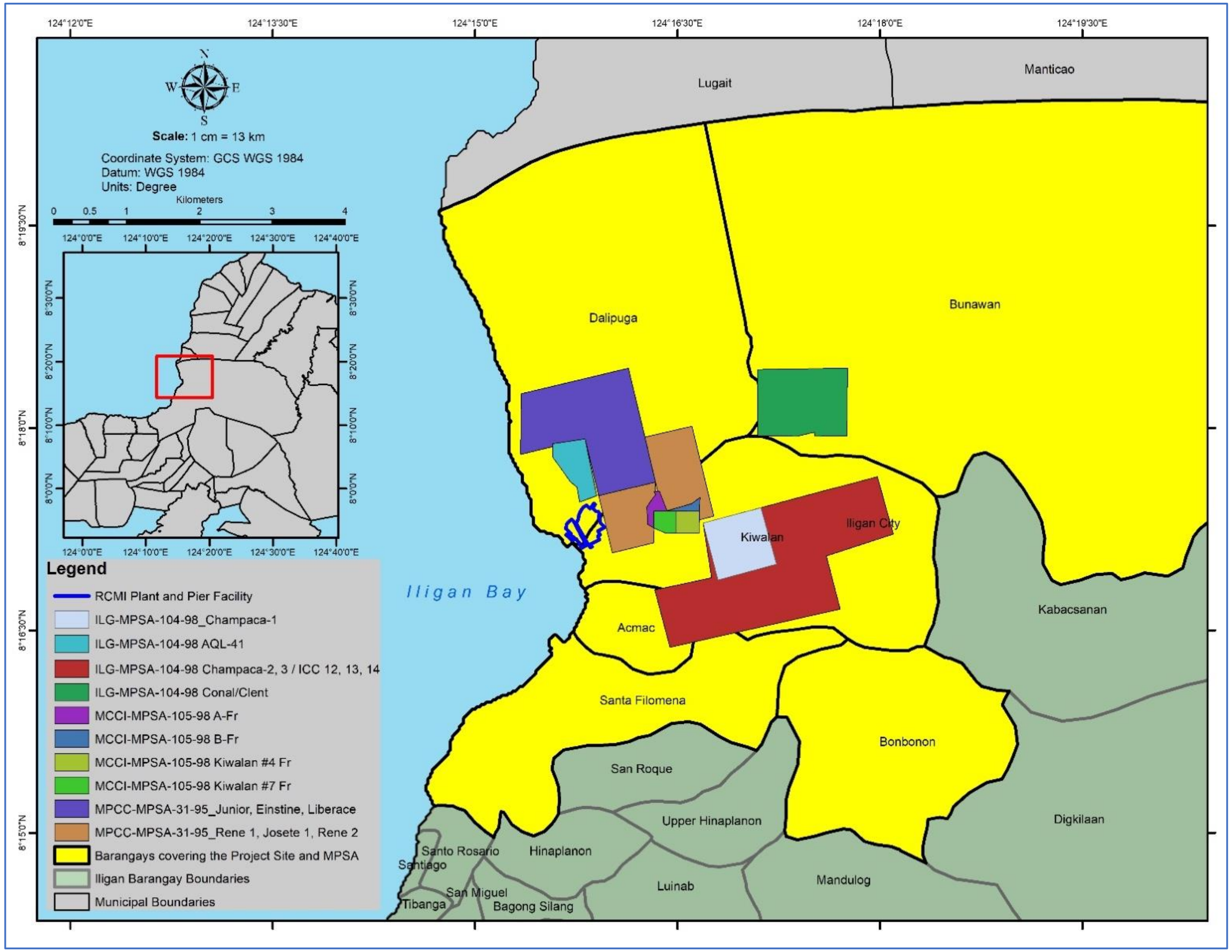
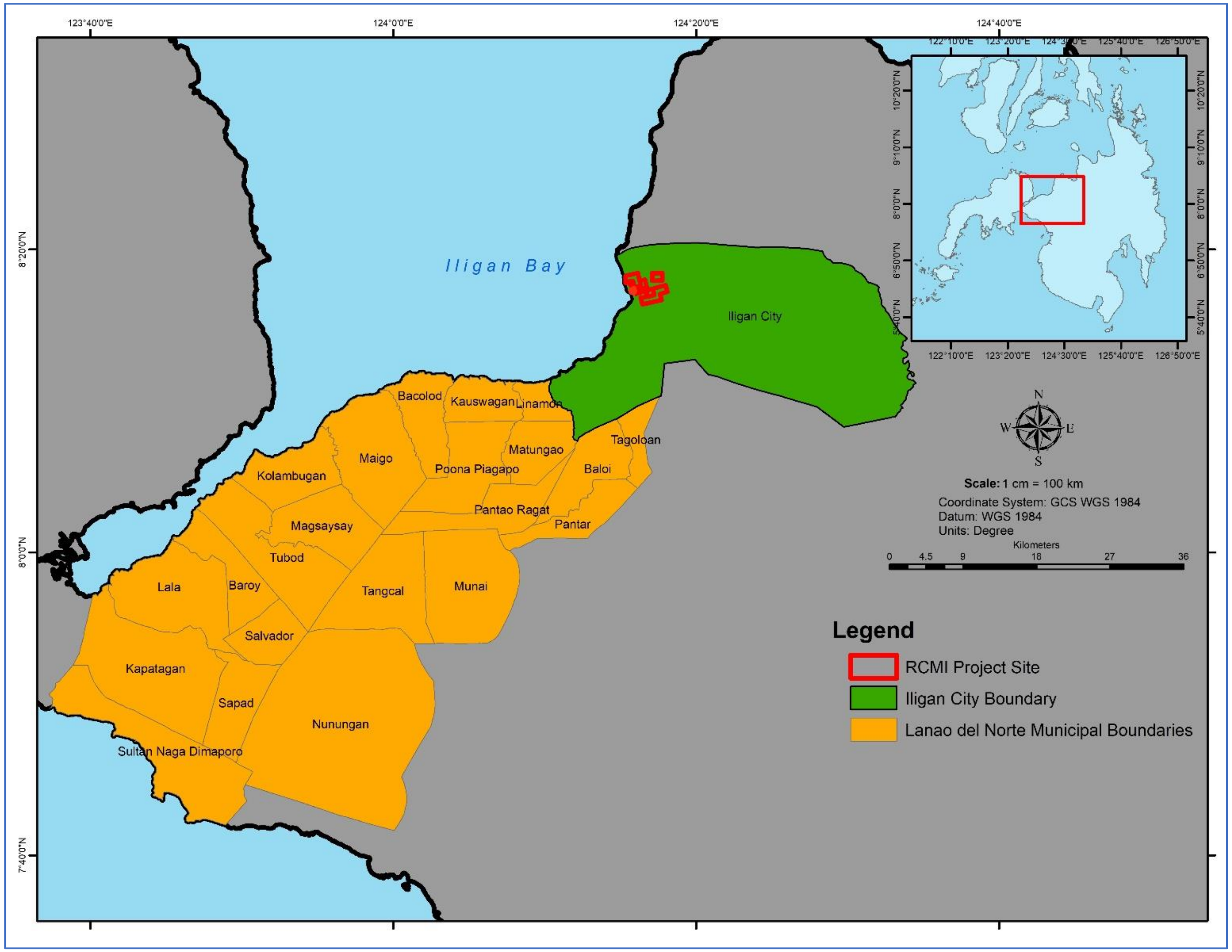


Figure 1-1. General Location of the Proposed Project on Google Earth Map



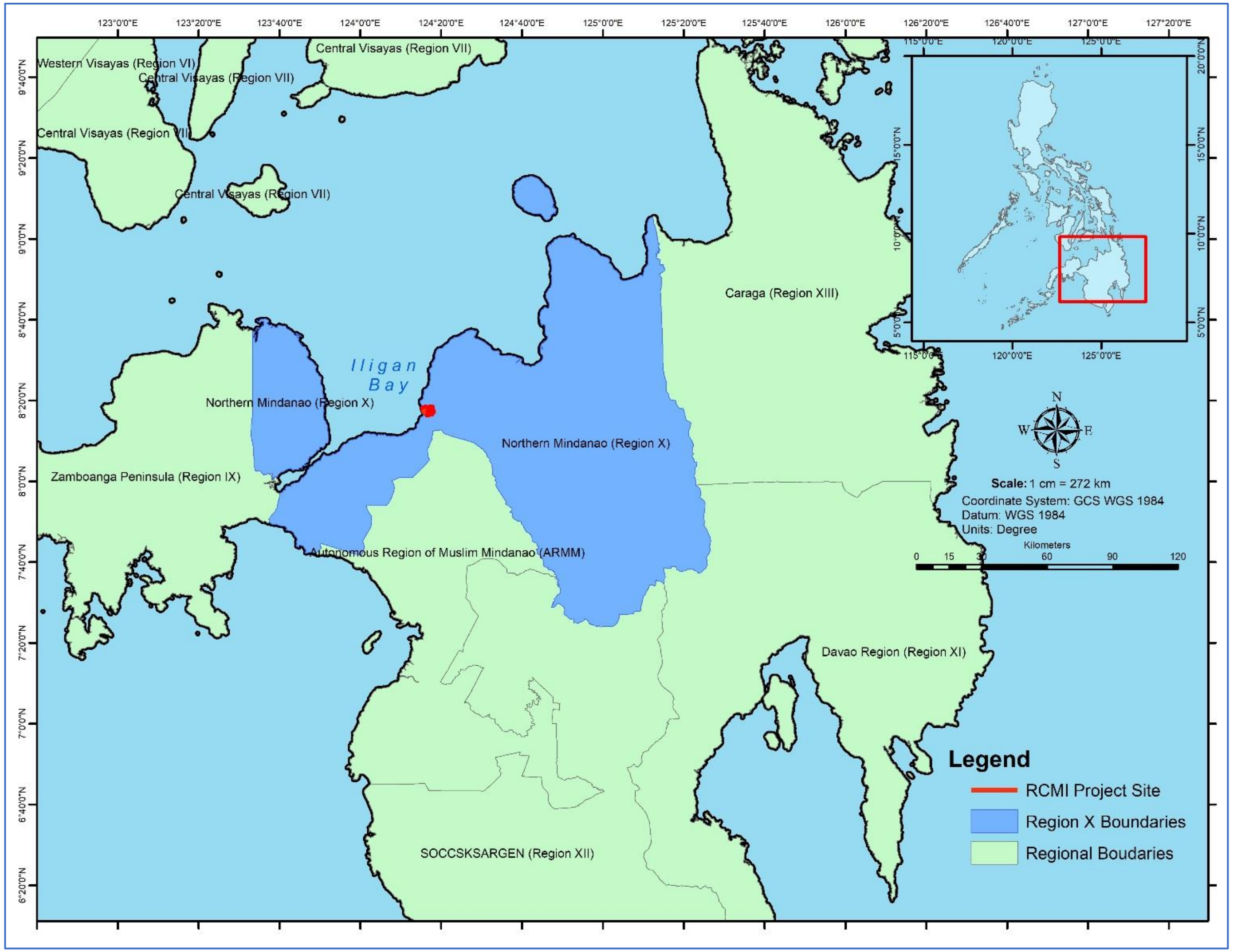
Source: PhilGIS.org Philippine Boundary Base Map

Figure 1-2. Map Showing the Proposed Project Site vis-a-vis the Barangay Boundaries of Iligan City



Source: PhilGIS.org Philippine Boundary Base Map

Figure 1-3. Map Showing the Project Site vis-a-vis the Municipal Boundaries of Lanao Del Norte



Source: PhilGIS.org Philippine Boundary Base Map

Figure 1-4. Map showing the Project Site location vis-a-vis the Regional Boundaries

1.1.1.1 Impact Areas

The delineation of the EIA Study Areas is based on the Direct Impact Area (DIA) and the Indirect Impact Area (IIA). These study areas are identified in the discussions of the specific modules, i.e. Land, Water, Air and People.

The guidelines provided by the Revised Procedural Manual for the DENR Administrative Order 2017-15 relevant to this project are used for the delineation of the DIA and IIA, to wit:

a. **Direct impact area (DIA)** is … the area where ALL project facilities are proposed to be constructed/situated and where all operations are proposed to be undertaken. For most projects, the DIA is equivalent to the total area applied for an ECC.

The EIA study area will focus on the identified direct and indirect impact areas of the Project. The direct impact area ("DIA") is the **21.4214**-hectare cement plant site and **868.9699** hectares for the 3 MPSAs where the quarrying is located.

- The DIAs covers only the RCMI facilities (plant and quarries)

b. **Indirect Impact Area (IIA)** …an IIA can be the stretch of the river/s OUTSIDE the project area but draining the project site which can potentially transport Total Suspended Solids and other discharges from the project towards downstream communities.

For the proposed project, the IIAs are:

The IIAs include areas outside the project boundaries that may be affected by the project as well as barangays Kiwalan, Acmac, Dalipuga, Bunawan, and Bonbonon.

Table 1-2 summarizes the delineation of the Impact Areas.

Table 1-2. Impact Areas

Major Impacts	Sitios or impact area	Impact Barangays
DIRECT IMPACT AREA		
Disturbance of existing access/haul roads	Iligan City	Brgys. Kiwalan and Dalipuga
Degradation of air quality	Iligan City	Brgys. Kiwalan and Dalipuga
Generation of solid and domestic wastes	Iligan City	Brgys. Kiwalan and Dalipuga
INDIRECT IMPACT AREA		
Potential water resource competition	No additional underground water wells construction for the Expansion Project	
Normal vehicle movements impact (noise, vibration) on properties of the households residing along the haul and access roads for the proposed project.	Brgys. Kiwalan and Dalipuga	Brgys. Kiwalan and Dalipuga
The host barangay/municipality which will benefit from the Company's SDMP	Iligan City	Brgys. Kiwalan, Dalipuga, Acmac, Bonbonon and Bunawan
Depletion of groundwater & degradation of quality	Not relevant due to no Additional underground water abstraction	
Impact on public access	Not relevant; public roads unaffected	
Threat to public health and safety	Not relevant; No hazard wastes	

The Direct and Indirect Impact Areas Maps are provided in **Figures 1-5** to **1-8.**

Table 1-3. Major DIA and IIA per Environmental Sector

Envi Sector	Direct Impact Area	Indirect Impact Area	Remarks
Land	The MPSAs/Quarry Areas Terrestrial ecology in these areas	Haul Roads	Haul roads may be subject to either damage or rehabilitation
Water	Iligan Bay Fronting Project Site	Iligan Bay distant from Project Site	Rivers, lakes absent

Envi Sector	Direct Impact Area	Indirect Impact Area	Remarks
			Underground water no additional extraction
AIR	DOMAIN OF Air Dispersion Modelling	Haul Roads	Fugitive dusts in haul roads
People	The most adjacent communities	Recipient of social benefits	

This DIA encompasses the ASRs identified in the Air Dispersion Modeling. The IIA is the haul road indicated in the Map for Land and Air

For the DIA and IIA of the "People Sector", the geographical areas for the Impacts on People Sector are wide areas e.g. the communities, the municipalities, the barangays and even the province that will benefit from livelihood, employment, SDP, etc. and thus the map is not provided.

1.1.1.2 The Buffer Zone

The buffer zone as defined by the E-NIPAS act is reckoned from the environmentally protected area which is distant from the project site. A buffer zone of 20 meters is being maintained in the quarries for areas adjacent to private lots and 50 meters for any structure within the project area. This is to avoid the effect of quarrying to the existing structure and private lots. **Figure 1-9** shows the initially delineated buffer zone.

Figure 1-5. DIA and IIA for the Land Sector

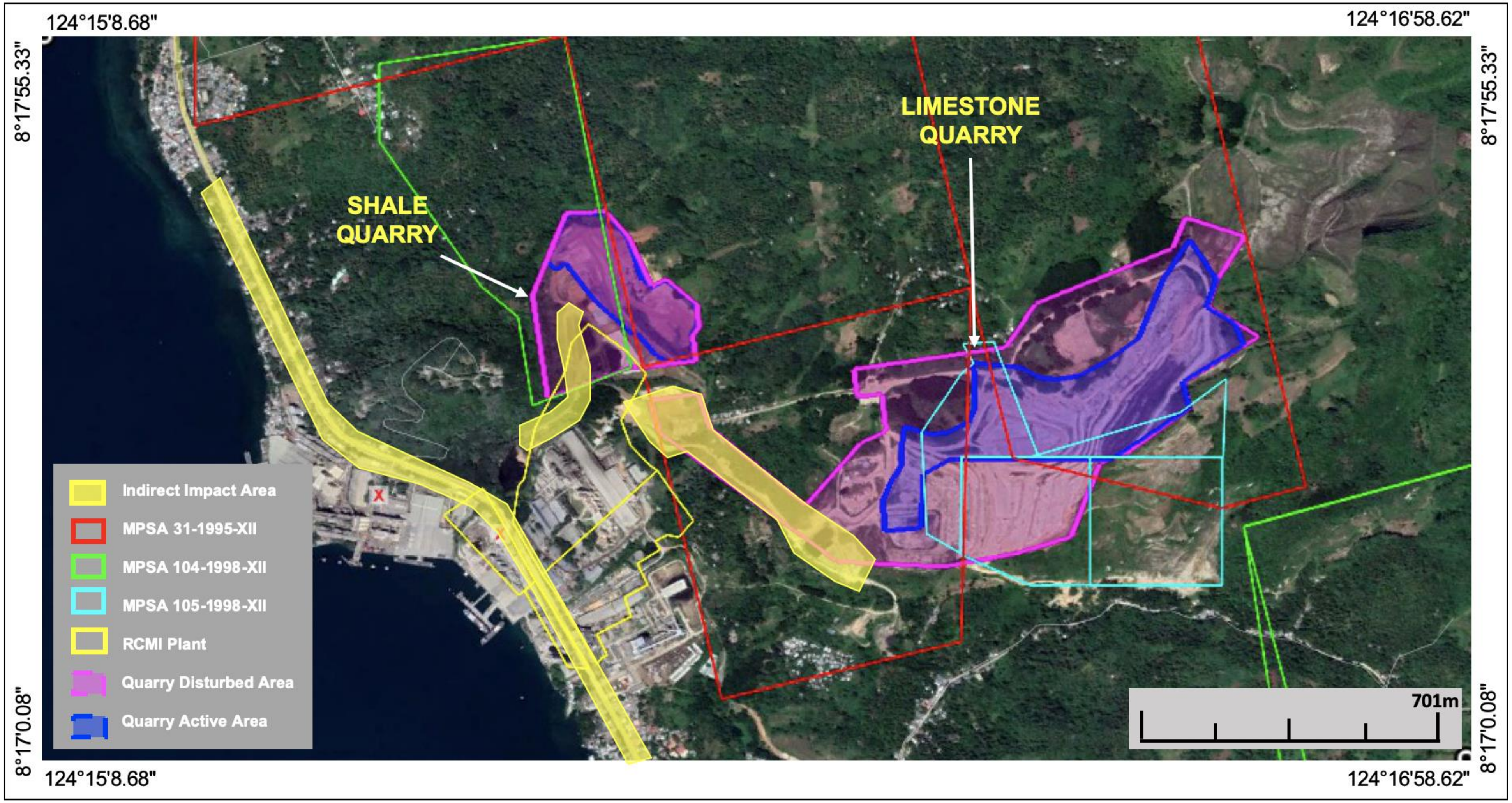


Figure 1-6. IIA for the Land Sector and Air Sector (Fugitive Dusts)

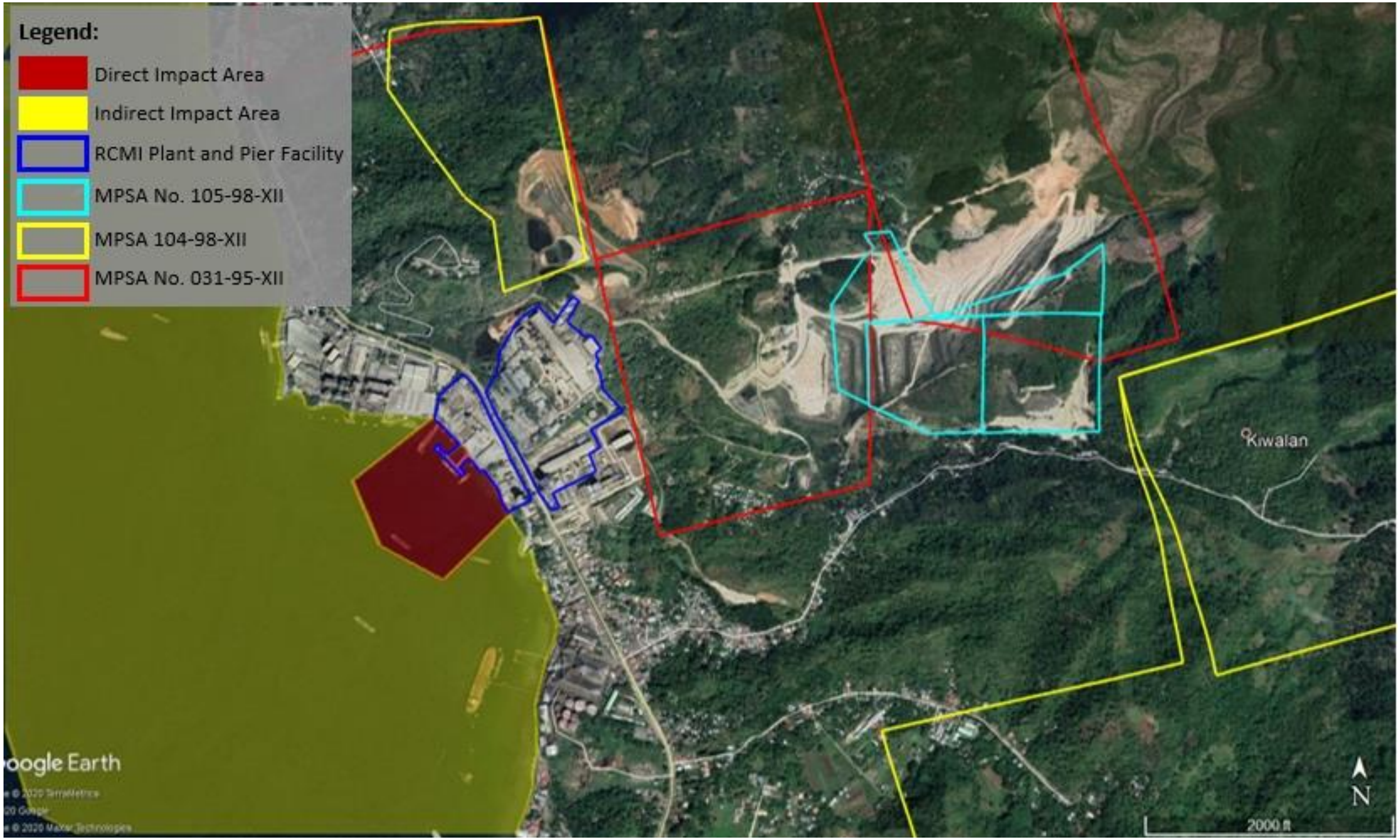


Figure 1-7. **DIA and IIA for the Water Sector**

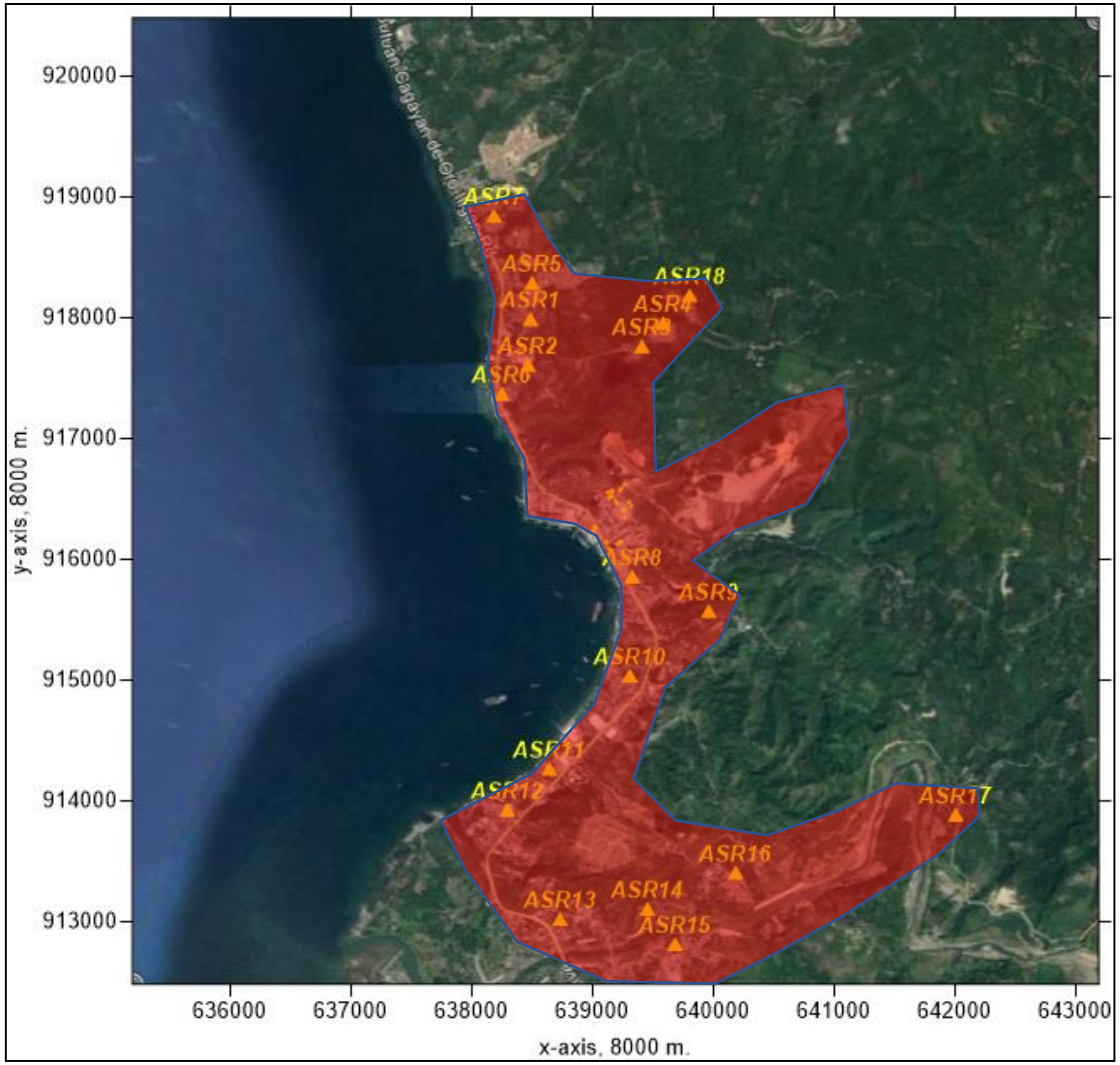
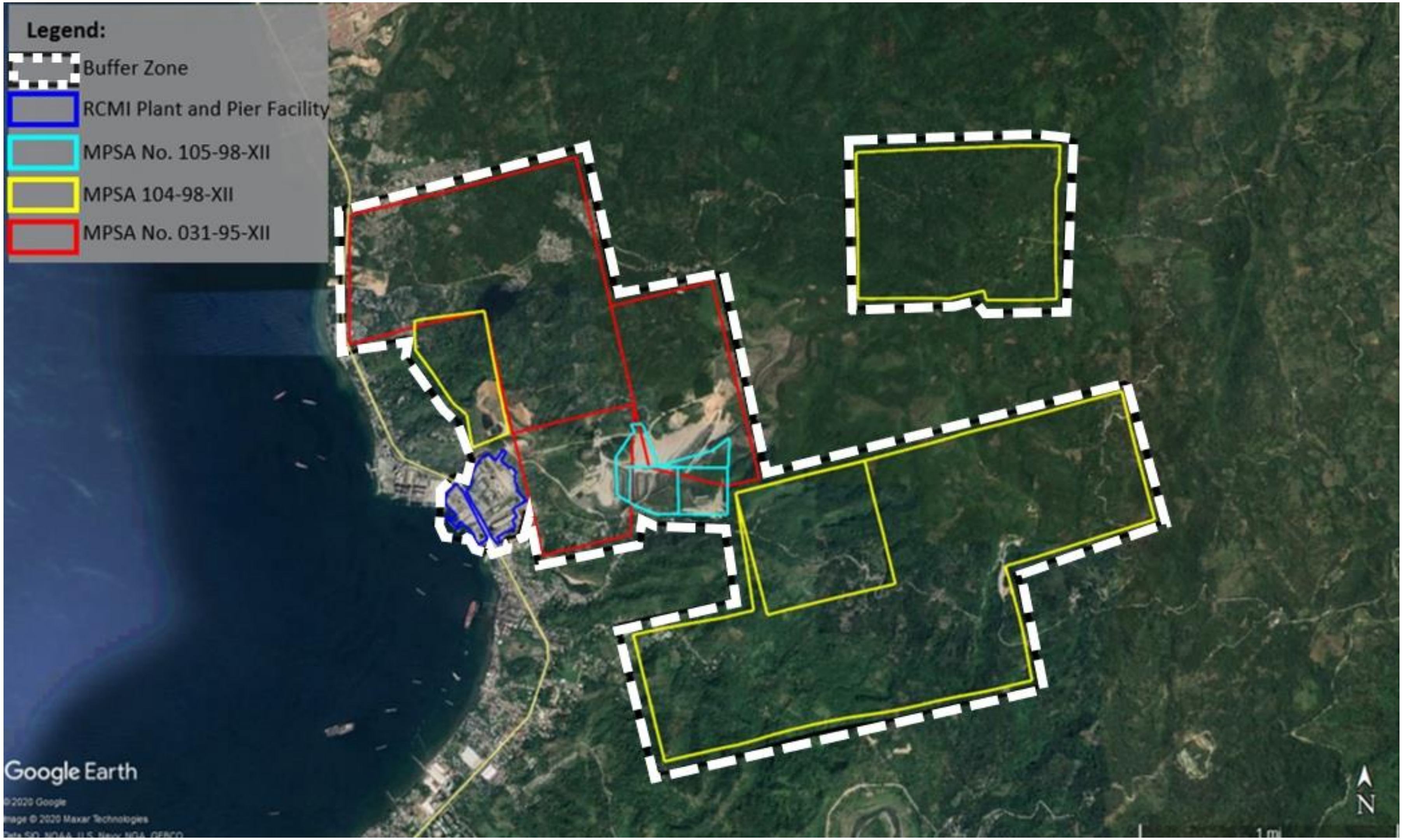
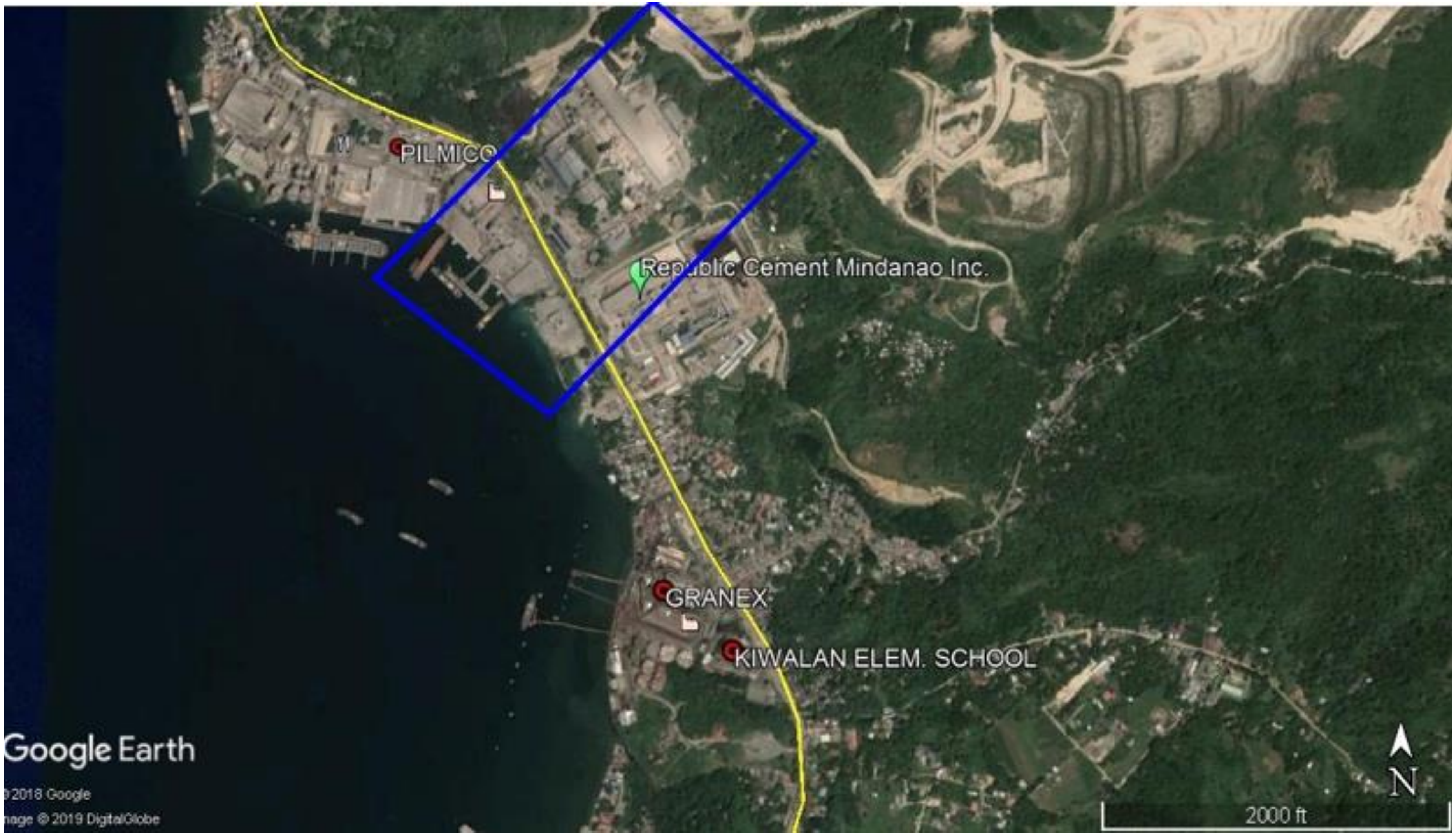


Figure 1-8. **DIA for the Air Sector**



Source: *2020 Google Earth*

Figure 1-9. Buffer Zone



Source: *2020 Google Earth*

Figure 1-10. Vicinity Map of the Project Site

1-1.2 Geographic Coordinates (Shape File Data) of Project Area in WGS 84

The geographical coordinates of the RCMI project site/land are given in **Tables 1-3** to **1-4.**

Table 1-4. Geographical Coordinates of the RCMI Plant Complex

Corner	North Latitude	East Longitude
LOT 3529-G		
1	8°17'14.04"	124°15'47.10"
2	8°17'18.03"	124°15'44.81"
3	8°17'20.82"	124°15'45.25"
4	8°17'21.31"	124°15'45.68"
5	8°17'25.19"	124°15'46.51"
6	8°17'29.58"	124°15'48.88"
7	8°17'31.69"	124°15'49.32"
8	8°17'33.18"	124°15'50.67"
9	8°17'31.07"	124°15'53.64"
10	8°17'29.36"	124°15'55.12"
11	8°17'25.80"	124°15'53.18"
12	8°17'23.91"	124°15'53.91"
13	8°17'22.37"	124°15'55.40"
14	8°17'21.99"	124°15'55.99"
LOT 3528-B		
1	8°17'12.45"	124°15'45.31"
2	8°17'18.57"	124°15'39.50"
3	8°17'20.63"	124°15'42.52"
4	8°17'13.56"	124°15'46.54"
LOT 3529-B		
1	8°17'07.18"	124°15'51.34"
2	8°17'12.35"	124°15'48.30"
3	8°17'14.04"	124°15'47.10"
4	8°17'21.99"	124°15'55.99"
5	8°17'20.30"	124°15'57.16"
6	8°17'18.16"	124°15'58.77"
7	8°17'16.89"	124°15'57.65"
8	8°17'17.06"	124°15'56.73"
9	8°17'16.56"	124°15'55.83"
10	8°17'15.92"	124°15'56.20"
11	8°17'14.86"	124°15'54.43"
12	8°17'13.24"	124°15'55.25"
13	8°17'12.29"	124°15'53.47"
14	8°17'10.82"	124°15'53.93"
15	8°17'09.45"	124°15'51.30"
16	8°17'07.87"	124°15'52.11"
17	8°17'07.65"	124°15'51.67"
LOT 3528-A		
1	8°17'06.99"	124°15'49.06"
2	8°17'12.74"	124°15'45.75"
3	8°17'13.56"	124°15'46.54"
4	8°17'06.81"	124°15'50.77"
TOTAL LAND AREA (hectares)		**21.4214**

Table 1-5. Geographical Coordinates of the RCMI Tenements in WGS 84

Tenement	Corner	Latitude	Longitude	Latitude	Longitude
		WGS-84		PRS 9	
MPSA 031-95-XII	Parcel I – JUNIOR, EINSTINE, LIBERACE				
	1	8°17'55.25"	124°15'48.82"	8° 17' 58.776"	124° 15' 43.343"
	2	8°17'48.34"	124°15'20.20"	8° 17' 51.950"	124° 15' 14.742"
	3	8°18'15.19"	124°15'20.38"	8° 17' 18.791"	124° 15' 15.006"
	4	8°18'26.60"	124°16'8.11"	8° 17' 30.168"	124° 16' 02.675"
	5	8°17'35.95"	124°16'20.28"	8° 17' 39.519"	124° 16' 14.856"
	6	8°17'29.89"	124°15'54.87"	8° 16' 33.451"	124° 15' 49.433"
				Land Area (hectares)	191.9999
	Parcel I – RENE 1, JOSETE 1, RENE 2				
	7	8°17'55.91"	124°16'15.48"	8° 17' 59.479"	124° 15' 35.87"
	8	8°18'0.91"	124°16'36.46"	8° 18' 04.485"	124° 15' 53.33"
	9	8°17'20.76"	124°16'46.12"	8° 17' 24.323"	124° 15' 00.40"
	10	8°17'19.18"	124°16'39.51"	8° 17' 22.745"	124° 15' 30.83"
	11	8°17'22.86"	124°16'39.51"	8° 17' 26.427"	124° 15' 37.00"
	12	8°17'22.86"	124°16'23.43"	8° 17' 26.430"	124° 16' 21.13"
	13	8°17'35.95"	124°16'20.28"	8° 17' 39.519"	124° 15' 35.87"
	14	8°17'8.96"	124°16'19.39"	8° 17' 12.527"	124° 15' 53.33"
	15	8°17'4.56"	124°16'0.95"	8° 17' 08.127"	124° 15' 00.40"
	16	8°17'29.88"	124°15'54.86"	8° 17' 06.67"	124° 15' 30.83"
	17	8°17'35.95"	124°16'20.28"	8° 16' 43.00"	124° 15' 37.00"
				Land Area (hectares	131.0954
				TOTAL LAND AREA (hectares	323.0953
MPSA 104-98-XII Amended	Parcel I - AQL-41 (COMMERCIAL)				
	1	8°17'53.04"	124°15'34.46"	8° 17' 55.36"	124° 15' 29.03"
	2	8°17'55.21"	124°15'48.78"	8° 17' 58.78"	124° 15' 43.36"
	3	8°17'29.88"	124°15'53.95"	8° 17' 33.45"	124° 15' 49.43"
	4	8°17'27.05"	124°15'46.31"	8° 17' 30.62"	124° 15' 40.88"
	5	8°17'33.72"	124°15'45.24"	8° 17' 37.29"	124° 15' 39.81"
	6	8°17'36.05"	124°15'42.40"	8° 17' 39.62"	124° 15' 36.97"
	7	8°17'47.10"	124°15'34.45"	8° 17' 50.94"	124° 15' 29.03"
				Land Area (hectares)	24.7434
	Parcel II - CHAMPACA -1 (COMMERCIAL)				
	1	8°17'17.67"	124°16'41.30"	8° 17' 21.25"	124° 16' 35.87"
	2	8°17'24.49"	124°17'7.08"	8° 17' 28.05"	124° 17' 01.65"
	3	8°16'59.40"	124°17'14.01"	8° 17' 02.97"	124° 17' 08.58"
	4	8°16'52.51"	124°16'47.97"	8° 17' 56.07"	124° 16' 42.54"
				Land Area (hectares)	69.2287
	Parcel III - CHAMPACA -2,3 / ICC 12,13,14 (EXPLORATION)				
	1	8°17'17.67"	124°16'41.29"	8° 17' 21.25"	124° 16' 35.87"
	2	8°17'38.26"	124°17'58.75"	8° 17' 41.83"	124° 17' 53.33"
	3	8°17'12.70"	124°18'5.82"	8° 17' 16.27"	124° 18' 40.00"
	4	8°17'3.10"	124°17'36.26"	8° 17' 06.67"	124° 17' 30.83"
	5	8°16'39.44"	124°17'42.43"	8° 16' 43.00"	124° 17' 37.00"
	6	8°16'22.56"	124°16'26.60"	8° 16' 26.11"	124° 16' 21.13"
	7	8°16'47.87"	124°16'19.90"	8° 16' 51.44"	124° 16' 14.46"
	8	8°16'53.44"	124°16'45.09"	8° 16' 57.00"	124° 16' 39.67"
				Land Area (hectares	317.8483
	PARCEL III - CONAL/CLENT (EXPLORATION)				
	1	8°18'26.43"	124°17'5.42"	8° 18' 30.00"	124° 17' 00.00"

Tenement	Corner	Latitude	Longitude	Latitude	Longitude
		WGS-84		PRS 9	
	2	8°18'26.43"	124°17'45.42"	8° 18' 30.00"	124° 17' 40.00"
	3	8°17'56.43"	124°17'45.42"	8° 18' 00.00"	124° 17' 40.00"
	4	8°17'56.43"	124°17'31.29"	8° 18' 00.00"	124° 17' 25.87"
	5	8°17'58.20"	124°17'30.86"	8° 18' 01.76"	124° 17' 25.44"
	6	8°17'56.43"	124°17'23.22"	8° 18' 00.00"	124° 17' 17.80"
	7	8°17'56.43"	124°17'5.42"	8° 18' 00.00"	124° 17' 00.00"
				Land Area (hectares	**107.2675**
				TOTAL LAND AREA (hectares	**519.0879**
MPSA 105-98-XII	**Parcel I (Kiwalan 4 Fr)**				
	1	8°17'13.16"	124°16'29.43"	8°17'16.73"	124°16'24.00"
	2	8°17'22.97"	124°16'29.42"	8°17'26.54"	124°16'24.00"
	3	8°17'22.97"	124°16'39.61"	8°17'26.54"	124°16'34.18"
	4	8°17'13.16"	124°16'39.61"	8°17'16.73"	124°16'34.18"
				Land Area (hectares	**9.0000**
	Parcel II (Kiwalan 7 Fr)				
	1	8°17'15.59"	124°16'19.42"	8°17'19.16"	124°16'14.00"
	2	8°17'23.01"	124°16'19.42"	8°17'26.58"	124°16'14.00"
	3	8°17'22.97"	124°16'29.42"	8°17'26.54"	124°16'24.00"
	4	8°17'13.16"	124°16'29.42"	8°17'16.73"	124°16'16.24"
	5	8°17'13.16"	124°16'24.88"	8°17'16.73"	124°16'19.45"
				Land Area (hectares	**8.4465**
	Parcel III (A-Fr)				
	1	8°17'15.59"	124°16'19.43"	8°17'19.16"	124°16'14.00"
	2	8°17'17.09"	124°16'16.79"	8°17'20.66"	124°16'11.36"
	3	8°17'24.70"	124°16'16.41"	8°17'28.27"	124°16'10.98"
	4	8°17'24.89"	124°16'16.43"	8°17'28.46"	124°16'11.00"
	5	8°17'29.28"	124°16'19.42"	8°17'32.85"	124°16'14.00"
	6	8°17'30.17"	124°16'20.43"	8°17'33.74"	124°16'15.00"
	7	8°17'31.63"	124°16'19.55"	8°17'35.20"	124°16'14.13"
	8	8°17'31.81"	124°16'21.96"	8°17'35.38"	124°16'16.54"
	9	8°17'23.12"	124°16'25.43"	8°17'26.69"	124°16'20.00"
	10	8°17'23.01"	124°16'24.88"	8°17'26.58"	124°16'19.45"
	11	8°17'23.01"	124°16'19.43"	8°17'26.58"	124°16'14.00"
				Land Area (hectares	**6.2630**
	Parcel IV (B-Fr				
	1	8°17'22.97"	124°16'39.61"	8°17'26.54"	124°16'34.18"
	2	8°17'23.01"	124°16'24.88"	8°17'26.58"	124°16'19.45"
	3	8°17'23.12"	124°16'25.42"	8°17'26.69"	124°16'20.00"
	4	8°17'26.37"	124°16'36.43"	8°17'29.93"	124°16'31.00"
	5	8°17'29.01"	124°16'39.90"	8°17'32.58"	124°16'34.48"
				Land Area (hectares	**3.0772**
				TOTAL LAND AREA (hectares	**26.7867**
				GRAND TOTAL LAND AREA (hectares)	**868.9699**

1-1.3 The Vicinity and Accessibility of the Project Site

Relevance of Accessibility:

For People: To get to work place
For construction crew
For evacuation route in case of dangers or perils

Modes: By Road
By sea through Iligan Bay
By air using Helicopter

For Materials: For transport of raw materials, chemicals and finished products

For Equipment: For transport during construction works and for process and quarrying equipment to place of use

The long stretch of the Maharlika National Highway and the Iligan Bay gives easy accessibility by land. Access roads are in place for internal (i.e. within the project areas) transport by road. The plant and quarries are easily accessible from the major cities of Mindanao, such as Cagayan de Oro City and Davao City through this highway that virtually connects all the major provinces and cities in the region.

Iligan Bay is also used by other industries adjacent to Republic Cement.

A helipad is available at the premises of the project site for air access. The Laguindingan International Airport is about 55km to the northeast.

The haulage roads from the quarry sites to the cement plant complex are all within the MPSAs of RCMI.

The project, which is located in Brgys. Kiwalan and Dalipuga, is situated in an area where there are other industries in the immediate vicinity such as Power Source Philippines Energy Inc.(adjacent to Cement Plant), Granex and Pilmico.

1-2 Project Rationale

RCMI believes that the construction of this project will contribute to the national and local economic development, to the sustainable development agenda and the current development thrusts of the Philippines as this project will be able to:

- Increase the cement production capacity from 2.0 million metric tons per year to 4.30 million metric tons per year, Shale and other Siliceous Materials Quarrying production from 475,000 metric tons per year to 2.29 million metric tons per year, Limestone Quarrying production from 1.72 million metric tons per year to 5.91 million metric tons per year, Increase the clinker production capacity from 0.61 million metric tons per year to 3.70 million metric tons per year .
- Support and meet the fast-growing demand of urbanization by increasing cement production capacity and that will contribute to increased local employment and increased tax revenue for the host community;
- Meet the increasing cement market demand by the private sector to support housing and industrial projects as well as that of the Philippine Government to support its Build-Build-Build Program.

Regional/Local economic development in terms of contribution to sustainable development agenda or current development thrusts

The project will immensely contribute to the continuing growth of Mindanao especially in the light of projected robust economic and social development in the Island which includes infrastructure projects and the attendant need for cement.
On the national level

The "Build-Build-Build" thrust and program of President Duterte will be largely dependent on availability of cement, a basic infrastructure raw material. It is apparent that this program as well as miscellaneous construction activities are one of the vision of the government for economic recovery post the Pandemic situation.

1-3 Project Alternatives
1-3.1 Criteria Used

<u>Resources:</u> Alternative sources of power, water, raw materials and other resources needed including factors significant to the selection such as supply sustainability and climate change projections

Power

The state-owned National Power Corporation supplies the power requirement of the facilities. Currently, the electric cooperative Power Source Philippines Energy Inc. (PPEI), which has a 20 MW coal power plant located within the premises of the project is tapped as alternative source of power.

There are no other feasible base load power sources. Solar energy is high in cost while wind and hydropower plant are not feasible for the site.

Area/Site Selection

The existing area/site is the most strategic area considering the land for the plant site is already existing. The site is accessible to land and water transport. The site has not experienced damaging natural hazards such as earthquakes nor floods.

There are no indigenous people nor settlers at site.

In the contextualization of the determination of the project site, the hazards (liquefaction, ground shaking, ground rupture, landslides, volcanic activities, tsunamis, flooding and storm surges are reckoned from site specific conditions and experiences and not from the macroscopic data from PHILVOCS MGB and others. The sites are within the same project areas are in the existing operations and have not suffered from these hazards. Thus the site is deemed as being accordingly safe from such hazards.

Technology

With respect to technology selection, the project will employ process, equipment and materials tested and used by the Project Proponent. The process and components are described in this Section.

For the Quarry Operations, the Pollution Control Measures and the environmental protection systems are embodied in the Environmental Protection and Enhancement Plan (EPEP) as submitted to the MGB.

1-3.2 Comparison of environmental impacts of each alternative for facility siting, development design, process technology selection, and resource utilization:

The environmental aspects of the siting, design, process and resource utilization have passed the criteria during the feasibility study for the project. Because of previous corporate experiences, there was no compelling reasons to still make comparative evaluation of each alternative.

1-3.3 Consequences of not proceeding with the project or the "no project: scenario".

Under this scenario:

- Opportunities for the enhancement of the barangay and the City both in terms of economic and social well-being will be denied.

- Opportunities for job and livelihood generation will be prejudiced.
- Inasmuch as the materials produced by the plant/project serves the cement industry, difficulties could be experienced in the construction sector if supply of materials would be compromised.
- The image of the country as a viable investment haven for multinational companies such as the Project Proponent could suffer.

1-4 Project Components
1-4.1 General Layout of Facilities

The major project components include the:
- 3 MPSAs where the limestone and shale quarries are located;
- Plant Complex; and
- Pier

It is important to note that both the proposed expansion of the quarrying and the cement processing are to be located in the same existing areas, and hence, there will be no change in area allocation. The gradual extension of the quarrying areas are covered in the existing ECCs.

The general layout is given in **Figures 1-11** and **1-12** below.

1-4.2 Maps showing location and boundaries of project area, footprint of main facilities, storage, and support facilities.

To further illustrate, the major project components are given in the succeeding figures:

- **Figure 1-13**. Layout of the Proposed Expansion Facilities (New Kiln Line Superimposed in the Existing Facilities: The new kiln line shall be built inside the cement plant and there will be additional equipment to be installed in order to upgrade the production capacity;
- **Figure 1-14**. Process Line Circulation Plan. Shows the layout of the Cement Plant and Finish Mill and how the materials are circulated therein;
- **Figure 1-15**. Packhouse Area Circulation Plan Shows the layout of the Packhouse and how the materials are circulated therein; and
- **Figure 1-16**. Beach Pad/Wharf and Pier Facility. RCMI has an existing Beach Pad and Pier Facility for the transport of materials by sea.

Figure 1-11. General Layout of Project Facilities Showing the MPSAs and the Plant on Google Earth Map

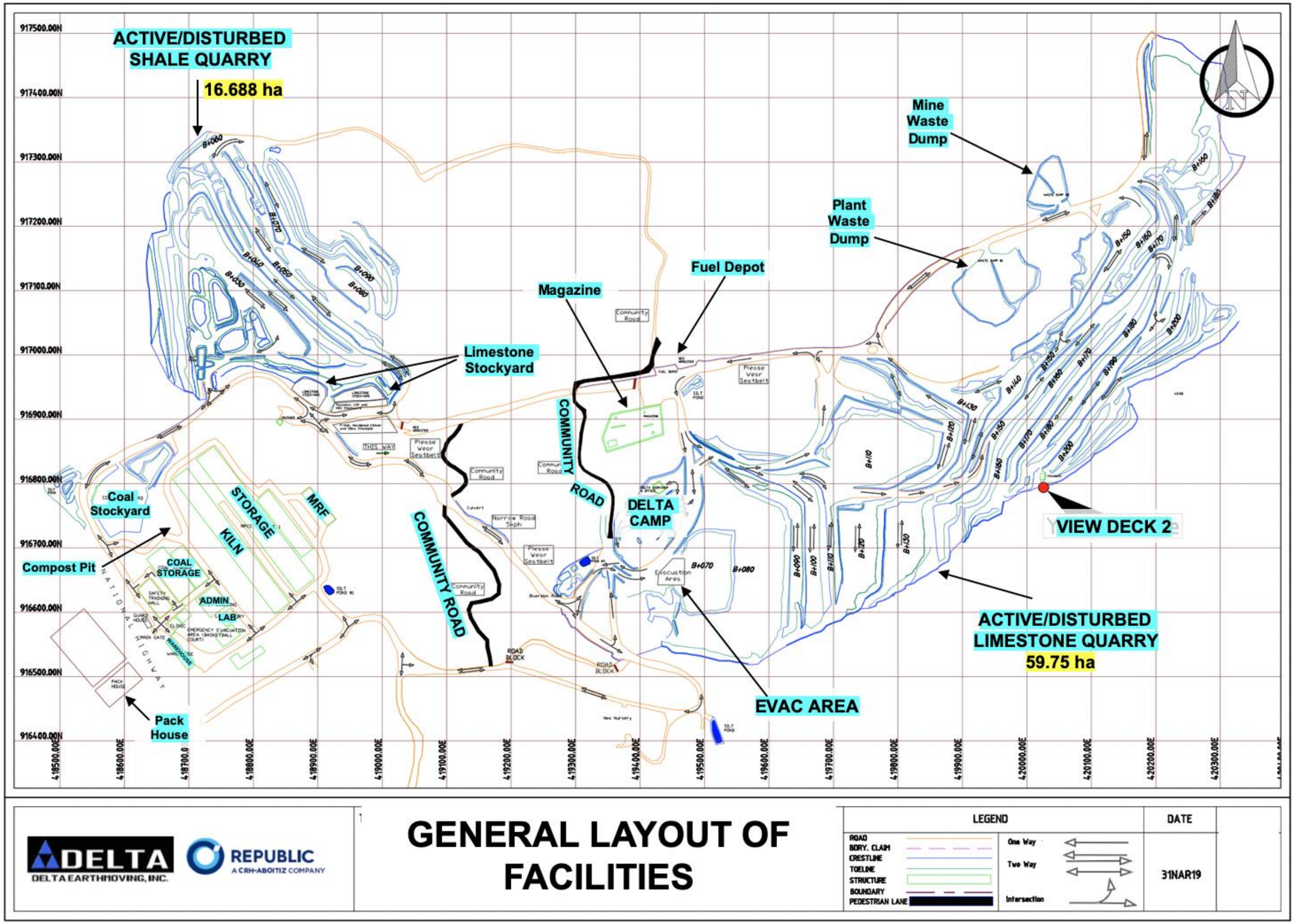


Figure 1-12. General Layout of Project Facilities on Topographic Map

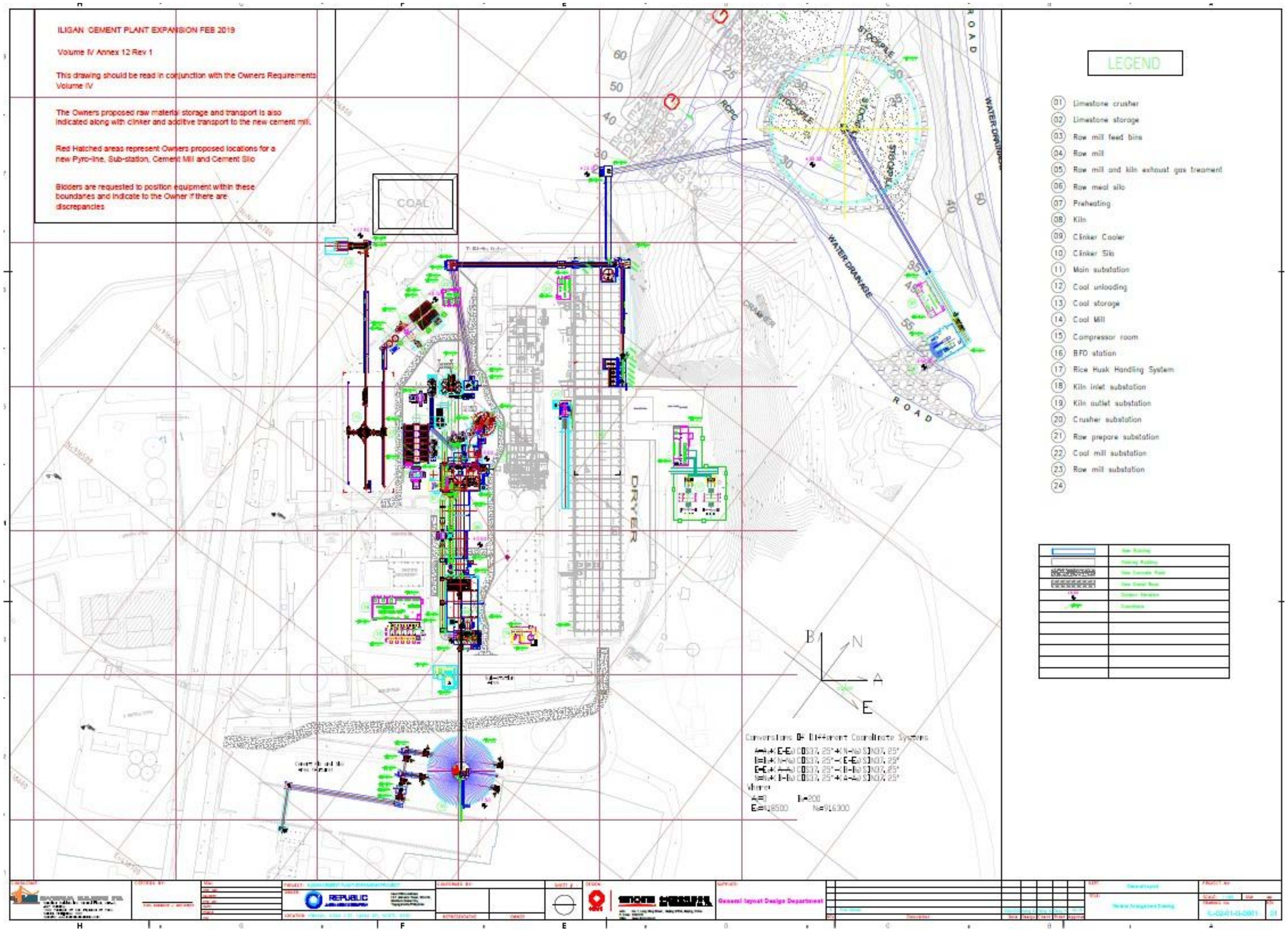


Figure 1-13. Layout of the Proposed Expansion Facilities (New Kiln Line Superimposed on the Existing Facilities)

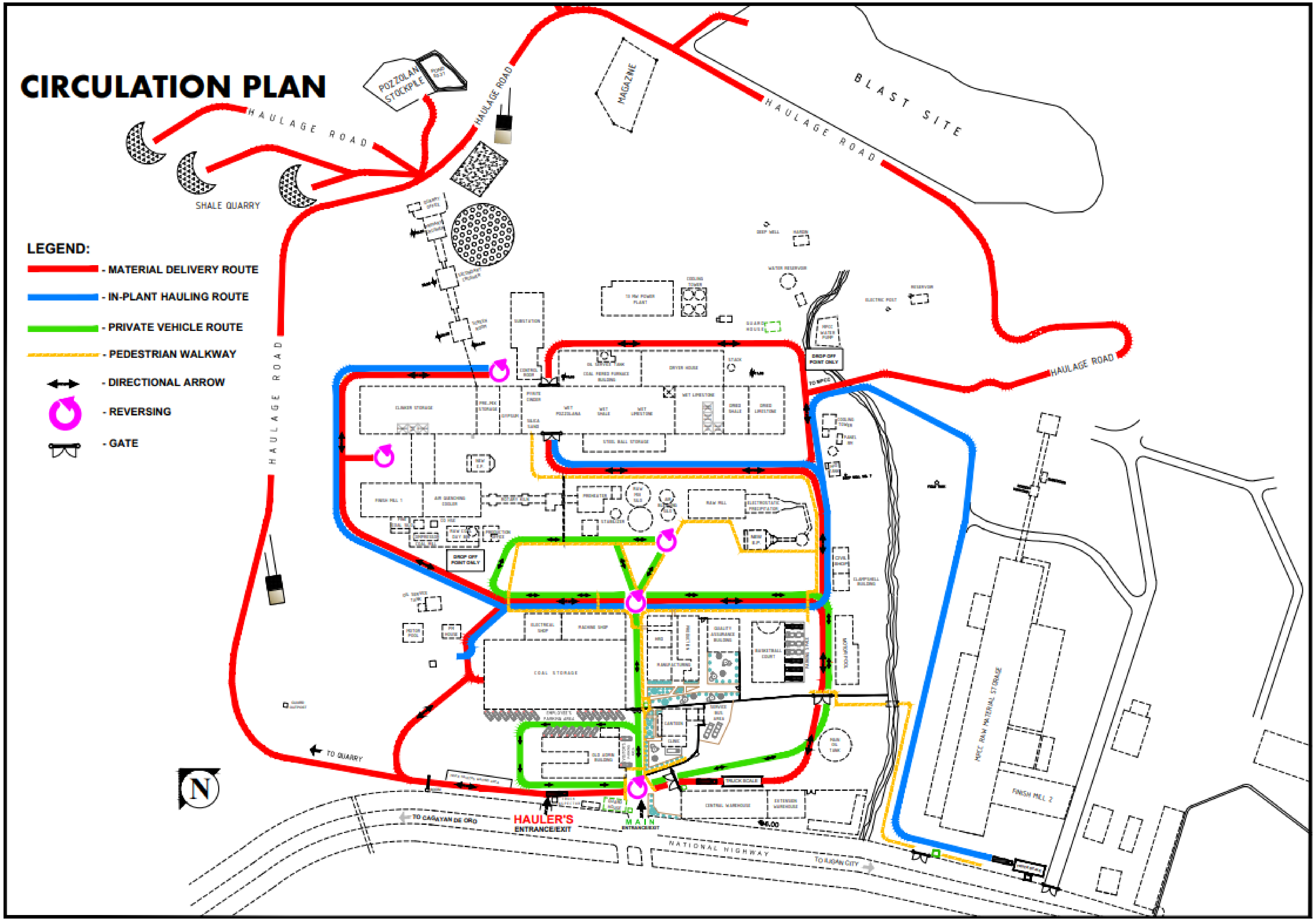


Figure 1-14. Process Line Circulation Plan

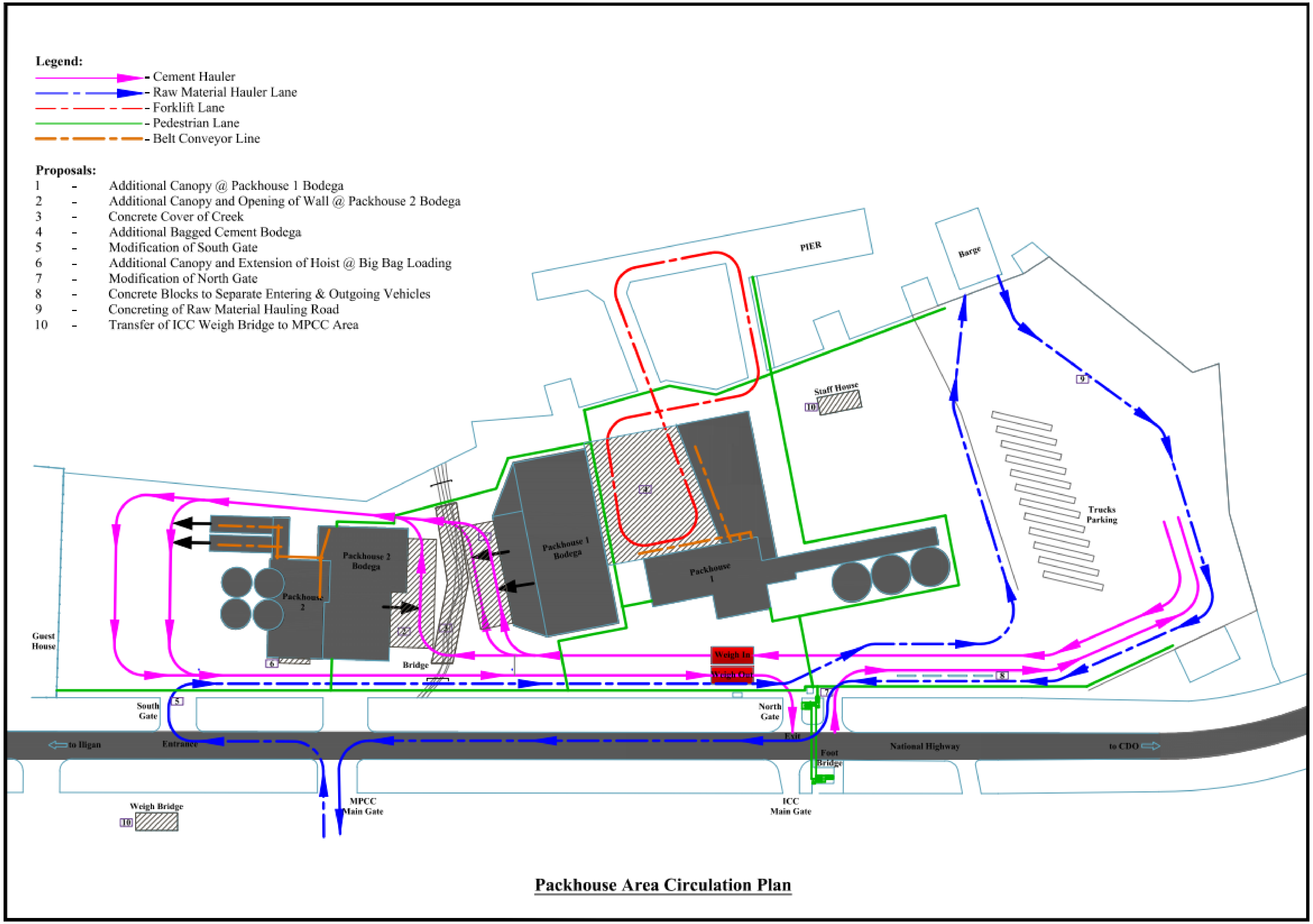


Figure 1-15. Packhouse Circulation Plan

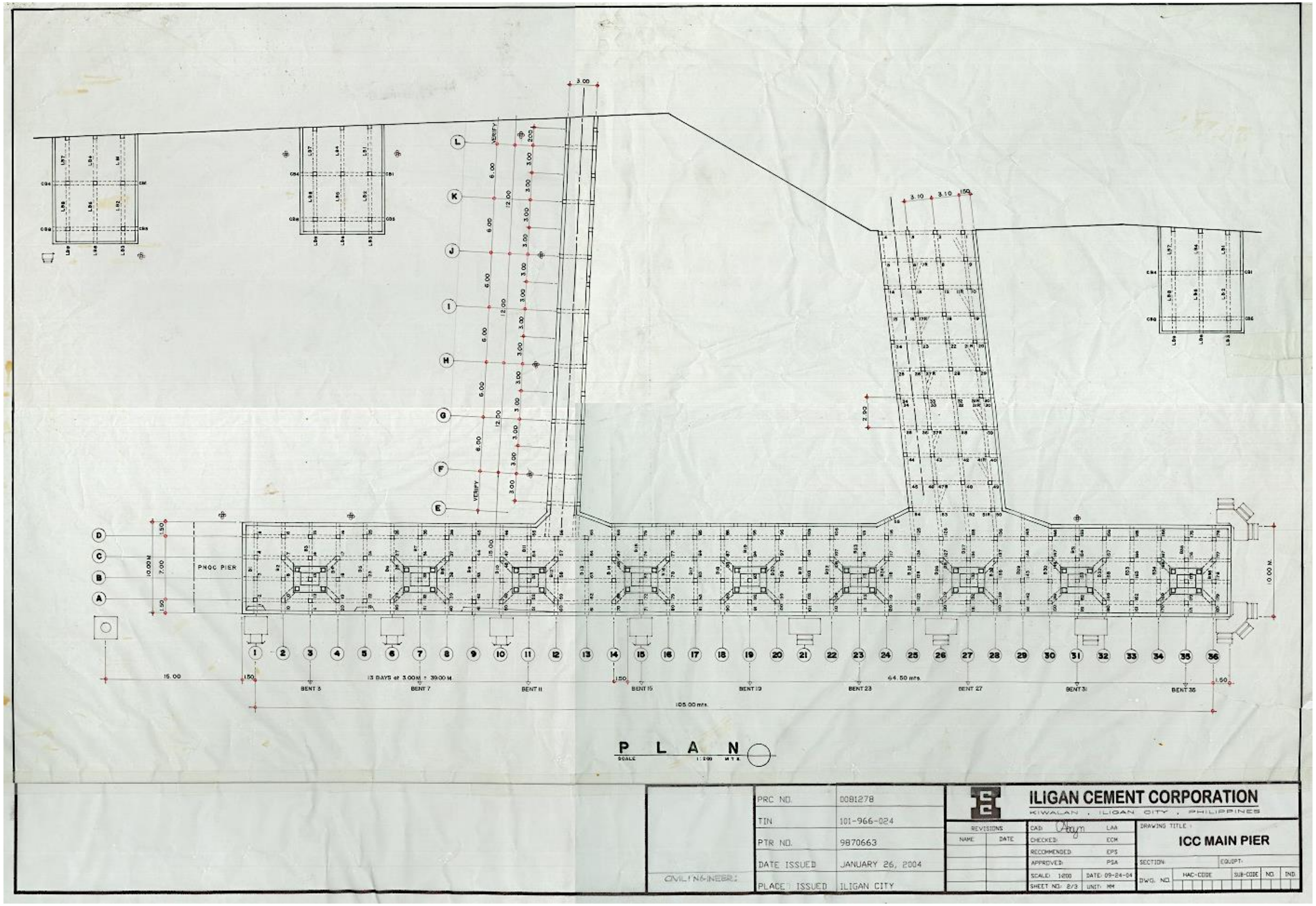


Figure 1-16. Layout of Beach Pad/Wharf and Pier Facility (NO CHANGE PROPOSED)

1-4.3 Identification of major components including technical details such as specifications, capacity, number, etc.)

- *Specify if Extraction only or with Ore/Mineral Processing (mining)*
- *Specify the operations and process*

This proposed expansion project involves the **quarrying** of limestone and shale as well as the **processing** of cement as a finish product.

The list of the existing major components of the RCMI cement and quarry operations and the proposed additional equipment for the increase in the capacity of both cement plant and quarry is shown in **Tables 1-6** and **1-7**. The Existing Plant Layout superimposing therein the Layout of the Expansion Facilities is shown in **Figure 1-12** above while **Figures 1-13** and **1-14** show the layout and process flow of the cement plant and finish mill, and the packhouse, respectively.

Table 1-6. Footprint of Major Project Components

Major Component	EXISTING (ha)	PROPOSED (ha)
Cement Plant	21.4214	21.4214
Limestone and Shale Quarries	868.9699	868.9699
Active/Disturbed Limestone Quarry Area	59.75	78.41 by end of MPSA term
Active/Disturbed Shale Quarry Area	16.688	79.46 by end of MPSA term
Pier	0.8414	0.8414
Waste Dumpsite	0.4229	1.00
Settling Ponds	9 ponds, 6,572 m^2, 31,967.53 m^3	10 ponds, 9,072 m^2 and 41,000 m^3 capacity

Upgrading of Cement Plant Facilities

This will involve the process optimization of major sections in the cement manufacturing process. The focus is on modification/improvement of process capacity limiting components in each major section. In particular, a new kiln line will be added in the cement plant section. The table below presents the specific targets of the optimization program.

Table 1-7. Optimization Program Targets

Plant Section/Component	Throughput (TPH)	
	Existing	Proposed
Crusher	300	1,400
Dryer	200	200
Raw Mill	150	510
Kiln	75	6,500 TPD
Cement Mill	80	200-300

In addition, several new equipment shall be integrated into the system as shown in the following table.

Table 1-8. List of Existing and Additional Project Components for Cement Plant and Quarry

Component	Existing	Proposed Additional
Quarry		
Limestone Quarrying	1.72 MMTPY	5.91 MMTPY
Shale and other siliceous materials Quarrying	0.51 MMTPY	2.29 MMTPY
Silt Traps and Settling Ponds	9 ponds	10 ponds
Drainage System	Ditches & canals are installed at the toe of benches, dumpsite, stockyard, roadside, etc., leading to the settling pond for removal of	Ditches & canals to be added at the toe of any additional bench

Component	Existing	Proposed Additional
	sediments before draining into receiving water body	
Cement Plant - Existing		
1 unit Primary Crusher and 1 unit Secondary Crusher	300 TPH	none
2 units Rotary Dryer	100 TPH each	none
4 Units Raw Material Bins	66.2 m^3	none
1 unit Ball Mill	140 TPH	none
2 Units Raw Mill Silo	2,200 MT each	none
1 unit Kiln Surge Bin	72.8 MT	none
1 unit Kiln with Preheater Cyclones	1,800 TPD/ 610 MTPY	none
1 unit Gas Conditioning Tower	8 nozzles; 3,700 m^3/min	none
1 unit Cooler	1,600 TPD	none
1 unit Coal Vertical Roller Mill	15 TPH	none
1 unit Finish Mill 1	80 TPH	none
1 unit Fly-ash feeding System	20 TPH	none
3 units Cement Silos	4,000 MT each	none
1 unit Finish Mill 2 with Pre-grinder	2.0- MMTPY	none
2 units Flyash Silo	1,600T each	none
1 unit Pre-grinder cement Silo	Internal Cap: 4,000 MT External Cap: 7,000 MT	none
1 unit Bulk Truck Cement Loading	250 TPH	none
1 unit RCMI Material Storage	40,000 MT	none
1 unit Cement Silo with Bulk loading Facility	12,000 MT	none
4 units Cement Silo	1,500 MT	none
1 unit Packhouse 1/5 Rotopacker	12 spouts (3,600 BPH)	none
1 unit Cement Tonner Bag Loading	20 TPH	none
1 unit Packhouse 2 Rotopacker	10 spouts (2,400 BPH)	none
1 unit Packhouse 2 Haver & Boeker Bagging Facility	600 TPD	none
1 unit Packhouse 3 Rotopacker	6 spouts	none
1 unit Packhouse 4 Rotopacker	8 spouts (1,920 BPH)	none
1 unit Generator Set	250 KW (315 KVA)	none
Dust Collector System- Existing		
2 units Bag filter: dust collector Rotary Drum Dryer	135,000 m^3/hr	none
1 unit bag filter: Rotary Drum Dryer Auxiliary	8,232 m^3/hr	none
1 unit bag filter : Rotary Dryer Bucket Elevator, Belt Conveyors, Material Storage	8,700 m^3/hr	none
1 unit bag filter: Raw Mill Weigh feeder	11,300 m^3/hr	none
2 units Multicyclones: Raw Mill Separators	42,000 m^3/hr	none
1 unit bag filter: Raw Mill Silo	6,630 m^3/hr	none
1 unit bag filter: Raw Mix Silo	7,200 m^3/hr	none
1 unit Electorstatic Precipitator: Rotary Kiln	2,436 Am^3/min	none
1 unit Electorstatic Precipitator : Cooler	4,433 m^3/min as per PTO	none
1 unit bag filter: Cooler discharge	5,700 m^3/hr	none
1 unit bag filter: Coal Mill	41,340 m^3/hr	none
1 unit bag filter: Coal Mill Fine Coal Silo	5,100 m^3/hr	none
1 unit bag filter: Finish Mill 1 weigh feeder:	10,140 m^3/hr	none
1 unit bag filter: Finish Mill 1 Mill	100,800 m^3/hr	none
5 units bag filter: Packhouse 1 Rotopacker	1 Unit 19,500 m^3/h 1 Unit 24,840 m^3/hr 1 unit 13,800 m^3/hr 2 unit 11,400 m^3/hr	none
2 units bag filter: Packhouse 1 Cement Silo	16,210 m^3/hr	none
2 units Mill bag filter – FM2	84,000 m^3/hr	none

Component	Existing	Proposed Additional
1 unit bag filter: weigh feeder – FM2	12,600 m^3/hr	none
1 unit bag filter: rotopacker #3 – Packhouse 2	24,000 m^3/hr	none
1 unit bag filter: HBBF – Packhouse 2	16,980 m^3/hr	none
1 unit bag filter: Cement Silo – Packhouse 2	8,700 m^3/hr	none
1 unit main bag filter: Roller Press	6,000 m^3/min	none
2 units bag filter: fresh feed transport system	200 m^3/min200 116.7 m^3/min	none
3 units auxiliary bag filter: Roller Press	416.7 m^3/min 333.3 m^3/min 50 m^3/min	none
3 units bag filter: cement transport system	95.8 m^3/min	none
3 units bag filter: roller press feeding system	200 m^3/min 83.3 m^3/min 100 m^3/min	none
2 units bag filter: Cement Silo - Top	66.7 m^3/min	none
1 unit bag filter: External Silo	27.5 m^3/min	none
1 unit bag filter: Internal Silo	73.3 m^3/min	none
1 unit bag filter: Bulk Truck Cement Loading	25 m^3/min	none
Cement Plant – Proposed Expansion		
1 unit Primary Crusher	-	1,400 TPH
1 unit Limestone Stacker/Reclaimer	-	Stacker: 1,000 TPH ; Reclaimer: 500 TPH
1 unit Shale Stacker/Reclaimer	-	Stacker: 1,000 TPH ; Reclaimer: 500 TPH
1 unit Coal Stacker/Reclaimer	-	Stacker: 300 TPH ; Reclaimer: 150 TPH
1 unit Veritcal Roller Mill	-	510 TPH
1 unit Blending Silo	-	15,000 MT
1 unit Coal Mill	-	53 TPH
1 unit Rotary Kiln with two (2) Streams Preheater	-	6,500 TPD
1 unit Baghouse	-	300,000 m3/hr
1 unit Clinker Cooler	-	6,500 TPD
1 unit Electrostatic Precipitator	-	300,000 m3/hr
1 unit Clinker Silo	-	54,000 MT
1 unit Finish Mill 3 with Pre-grinder	-	2.3 MMTPY
Finish Mill 3 Coveyor equipment (several,assorted)	-	200-300 TPH
Finish Mill 3 Material bins and feeders (several,assorted)	-	
1 unit Roller Press	-	3,200 kW
1 unit High efficiency separator with cyclones	-	2,100 kW
1 Hot Gas Generator	-	11.1 Mkcal/hr
Fly Ash Silo	-	750 MT
Belt Conveyors	-	200 to 230 TPH
Dust Collector System – Proposed Expansion		
1 unit - 111 Bag filter	-	8,700 m^3/hr
1 unit – 131 Bag filter 1	-	7,200 m^3/hr
1 unit – 131 Bag filter 2	-	7,200 m^3/hr
1 unit – 212 Bag filter	-	7,000 m^3/hr
1 unit – 141 Bag filter	-	6,200 m^3/hr
1 unit – 213 Bag filter 1	-	6,800 m^3/hr
1 unit – 213 Bag filter 2	-	7,000 m^3/hr
1 unit – 213 Bag filter 3	-	7,050 m^3/hr
1 unit – 213 Bag filter 4	-	7,100 m^3/hr
1 unit – 213 Bag filter 5	-	6,200 m^3/hr
1 unit – 311 Bag filter 1	-	6,800 m^3/hr
1 unit – 311 Bag filter 2	-	7,200 m^3/hr

Component	Existing	Proposed Additional
1 unit – 311 Bag filter 3	-	5,400 m^3/hr
1 unit – 311 Bag filter 4	-	5,600 m^3/hr
1 unit – 311 Bag filter 5	-	5,200 m^3/hr
1 unit – 321 Bag filter 1	-	6,800 m^3/hr
1 unit – 321 Bag filter 2	-	6,200 m^3/hr
1 unit – 331 Baghouse Kiln	-	300,000 m^3/hr
1 unit – 331 Bag filter	-	5,200 m^3/hr
1 unit – 341 Bag filter	-	5,400 m^3/hr
1 unit – 351 Bag filter	-	6,200 m^3/hr
1 unit – 241 Bag filter 1	-	5,800 m^3/hr
1 unit – 241 Bag filter 2	-	6,200 m^3/hr
1 unit – 242 Bag filter 1	-	6,600 m^3/hr
1 unit – 242 Bag filter 2	-	5,400 m^3/hr
1 unit – 461 Baghouse Coal Plant	-	42,500 m^3/hr
1 unit – 421 Bag filter	-	8,700 m^3/hr
1 unit – 441 Electrostatic Precipitator Cooler	-	300,000 m^3/hr
1 unit – 471 Bag filter 1	-	5,800 m^3/hr
1 unit – 471 Bag filter 2	-	5,200 m^3/hr
1 unit – 481 Bag filter 1	-	5,200 m^3/hr
1 unit – 481 Bag filter 2	-	5,200 m^3/hr
1 unit – 491 Bag filter 1	-	5,200 m^3/hr
1 unit – 491 Bag filter 2	-	5,200 m^3/hr
1 unit – 491 Bag filter 3	-	5,200 m^3/hr
1 unit – 491 Bag filter 4	-	5,200 m^3/hr
1 unit BF1 Bag filter	-	6,700 m^3/hr
1 unit BF2 Bag filter	-	6,700 m^3/hr
1 unit BF3 Bag filter	-	12,500 m^3/hr
1 unit BF4 Bag filter	-	7,750 m^3/hr
1 unit BF1 Bag filter	-	7,750 m^3/hr
1 unit BF1 Bag filter	-	12,000 m^3/hr
1 unit BF2 Bag filter	-	12,500 m^3/hr
1 unit BF3 Bag filter	-	11,000 m^3/hr
1 unit BF4 Bag filter	-	9,000 m^3/hr
1 unit BF5 Bag filter	-	6,000 m^3/hr
1 unit BF6 Bag filter	-	13,500 m^3/hr
1 unit BF7 Bag filter	-	3,500 m^3/hr
1 unit BF1 Bag filter –Roller Press	-	30,000 m^3/hr
1 unit BF2 Bag filter	-	2,100 m^3/hr
1 unit BF1 Bag filter - Separator	-	195,000 m^3/hr
1 unit BF2 Bag filter	-	3,000 m^3/hr
1 unit CN1-4 Bag filter - Cyclones	-	3,200 mm
1 unit BF1 Bag filter	-	52,000 m^3/hr
1 unit BF2 Bag filter	-	3,000 m^3/hr
1 unit BF3 Bag filter	-	5,000 m^3/hr
1 unit BF1 Bag filter	-	12,000 m^3/hr
1 unit BF2 Bag filter	-	7,500 m^3/hr
1 unit BF3 Bag filter	-	7,500 m^3/hr
1 unit BF3 Bag filter	-	6,500 m^3/hr
1 unit BF4 Bag filter	-	5,000 m^3/hr
Support Facilities	· 1 Mine Waste Dumpsite · 1 Plant Waste Dumpsite	· 1 Mine Waste Dumpsite · 1 Plant Waste Dumpsite
	· 2 Quarry Stockyards	· 2 Quarry Stockyards
	· 9 Settling Ponds	· 10 Settling Ponds
	· Coal Stockyard	· Coal Stockyard
	· Nursery	· Nursery

Component	Existing	Proposed Additional
	· Access Roads	· Access Roads
	· Guest house/Staff house	· Guest house/Staff house
	· Magazine Area	· Magazine Area
	· Medical Clinic	· Medical Clinic
	· Administration Building & Offices	· Administration Building & Offices
	· Machine Shop	· Machine Shop
	· Warehouses	· Warehouses
	· Canteen	· Canteen
	· Motorpool	· Motorpool
	· Water Treatment Facility	· Water Treatment Facility
	–	· Waste heat recovery system
	· Co-processing and TSD Facility	· Co-processing and TSD Facility
	· 13 MW Power Plant facility	· 13 MW Power Plant facility

The Cement Milling capacity is proposed for expansion from 2.0 MMTPY to 4.3 MMTPY. The cement manufacturing process will utilize 75.28% limestones, 20.37% shale, 4.03% silica, and 0.32% pyrite cinder. As such, the requirements for raw materials will be increased as well. The main reason why quarrying production rate for limestone and shale will have to be ramped up is to meet this increase in demand. The corresponding requirements increase for the raw materials is shown in the table below.

Table 1-9. Raw Materials Requirements for the Cement Processing

Raw Materials	% of Dry Raw Mix	Existing	Proposed	Source
		Monthly Consumption (MT)		
Limestone	75.28	67,861	493,000	RCMI Quarry
Shale	20.37	20,747	190,833	RCMI Quarry
Silica Sand	4.03	3,718	-	Bohol
Pyrite Cinder	0.32	295	-	Pasar, Leyte

Limestone and shale are the main raw materials for the cement mix while silica and iron serve as the correctives.

Raw Material Storage Facilities

Table 1-10. Capacities of Storage Areas

Material	Existing Storage Capacity (MT)	Proposed Storage Capacity (MT)
Batching Plant Area		
Indo Coal	7,580	7,580
Indo Coal LVM	3,850	3,850
Malangas	1,410	1,410
Old Scrapyard Area		
Rice Hull	123	123
Petcoke	675	675
Shale Quarry Pit Bottom Area		
Russian Coal	9,875	9,875
Petcoke 1 (near entrance)	4,291	4,291
Petcoke 2 (near Gypsum)	1,368	1,368
Gypsum	5,858	5,858
Crusher Area		

Material	Existing Storage Capacity (MT)	Proposed Storage Capacity (MT)
LST Emergency Stockpile	78,205	78,205
Paniangan Pozzolan	811	811
Shale	375	375
Laydown Area		
Imported Clinker	8,520	8,520
Purok 9 Area		
Silica	2,777	2,777
Quarry Area Explosives Magazines - Based on the approved maximum capacities by MGB10		
Explosives Magazine for ANFO	49,041.57 kg	49,041.57 kg
Explosives Magazine for Dynamite/Packed Emulsion	2,163.70 kg	2,163.70 kg
Explosives Magazine for Blasting Cap/IHD	180,000 pcs.	180,000 pcs.
Explosives Magazine for Safety Fuses and Cords	182,323.23 pcs.	182,323.23 pcs.

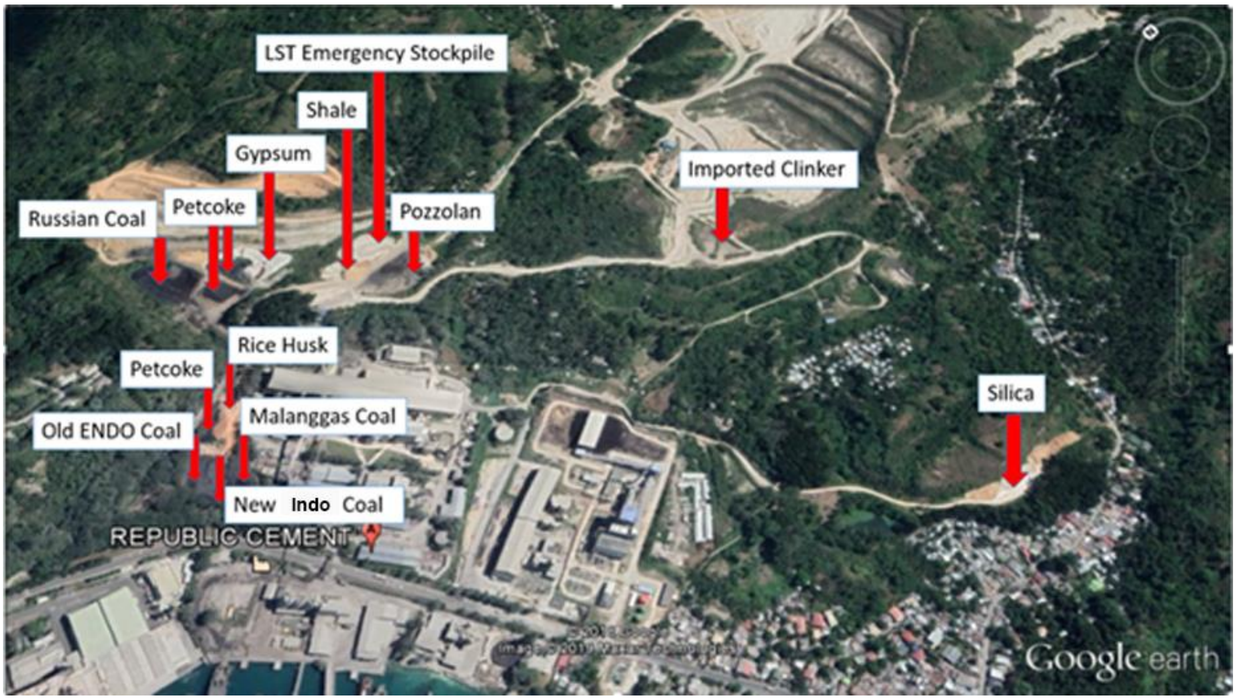


Figure 1-17. Stockpile Areas

Shale Quarry Expansion

There will be no changes in the existing shale quarrying except for the increase in production rate. It is presently being conducted within the existing MPSAs of the proponent RCMI. The existing ECCs allows RCMI to extract 510 MTPY. With the proposed upgrading of the cement plant production, the shale requirement will increase up to 2.29 million metric tons per annum. The operation for the next years to come will still be on the present area being quarried. In the far future (>10 years), the Proponent is looking into extracting shale in the other areas of the approved MPSAs as well, if the exploration results are favorable.

With the proposed increase in quarrying capacity, the total disturbed area by the end of the contract period (2044) will be approximately 79.46 hectares.

Quarry design parameters were set to ensure adherence to standard best practices. See **Table 1-10** below.

Limestone Quarry Expansion

The limestone requirement for the cement plant is being sourced from the proponent's MPSAs, including the newly-acquired tenement from MCCI. The production capacity is proposed to be expanded from 1.72 MMTPY to 5.91 MMTPY.

With the proposed increase in quarrying capacity, the total disturbed area by the end of the contract period (2044) will be approximately 79.46 hectares

The active and disturbed limestone and shale quarry areas to date are shown in **Figure 1-18** while the Final Pit Design showing the final pit limit is given in **Figure 1-19**. Note that areas in the final pit limit that are outside the Proponent's MPSAs shall not be extracted.

See table below for the quarry design parameters.

Table 1-11. Quarry Design Parameters

	EXISTING		PROPOSED	
Parameters	Limestone Quarry	Shale Quarry	Limestone Quarry	Shale Quarry
Annual Production (MT)	1,720,000	510,000	5,910,000	2,290,000
Active Bench Height (m)	10	10	same	same
Final Bench Height (m)	10	10	same	same
Active Bench Width (m)	20	20	same	same
Final Bench Width (m)	5	5	same	same
Active Bench Slope (degrees)	70	70	same	same
Final Bench Slope (degrees)	60	60	same	same
Berm Width (m)	1	1	same	same
Road Width (m)	12	12	same	same
Road Average Gradient (%)	11	11	same	same
Max Access Ramp Gradient (%)	10	10	same	same
Quarry days/week	5	2	same	same
Blasthole Pattern	3m X 4m	no blasting	same	same
Blasthole Diameter & Depth	96mm & 10.2m	no blasting	same	same

Data from 2007 to 2020 shows that an aggregate of 2,374,990 MT and 8,784,236 MT of shale and limestone were extracted, respectively.

Table 1-12. Quarry Production (2007-2020)

YEAR	Shale PRODUCED (MT)	Limestone PRODUCED (MT)
2007	156,943	603,464
2008	162,075	581,365
2009	167,065	646,168
2010	138,390	560,857
2011	127,871	518,713
2012	145,976	528,290
2013	132,811	493,640
2014	125,248	615,181
2015	116,736	800,727
2016	212,584	614,376
2017	170,374	656,556
2018	204,522	683,450
2019	247,845	753,487

YEAR	Shale PRODUCED (MT)	Limestone PRODUCED (MT)
2020	266,550	727,963
TOTAL	**2,374,990**	**8,784,236**

Proposed Extraction

If the proposal is granted, the production shall be ramped up to 5.91 MMTPY and 2.29 MMTPY for limestone and shale, respectively. This will amount to 147.75 MMT of limestone and 57.27 MMT of shale produced in the next 25 years.

The 3 years utilization plan is illustrated in Figures **1-20** to **1-25**.

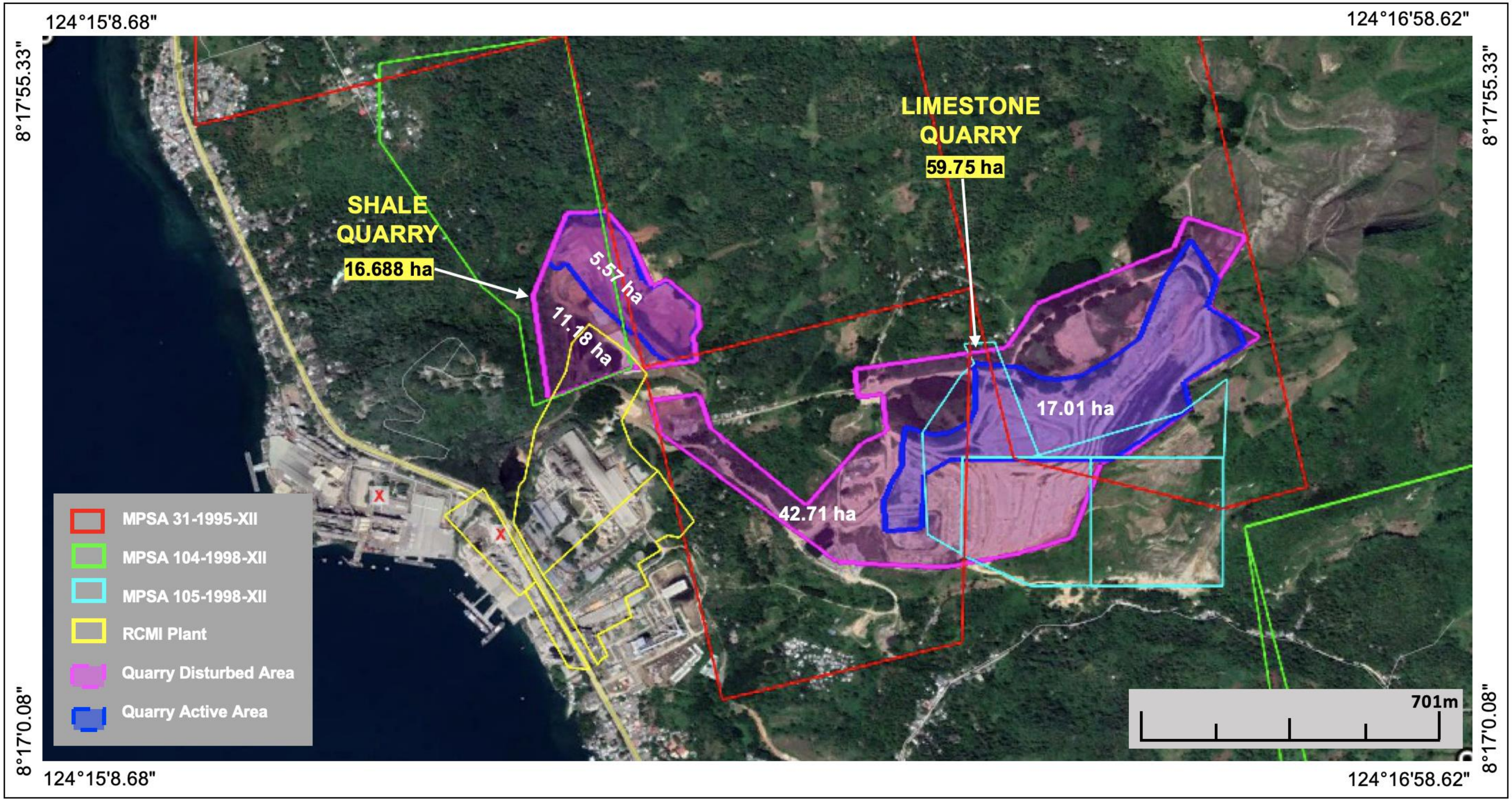


Figure 1-18. Active and Disturbed Quarry Areas as of 2020

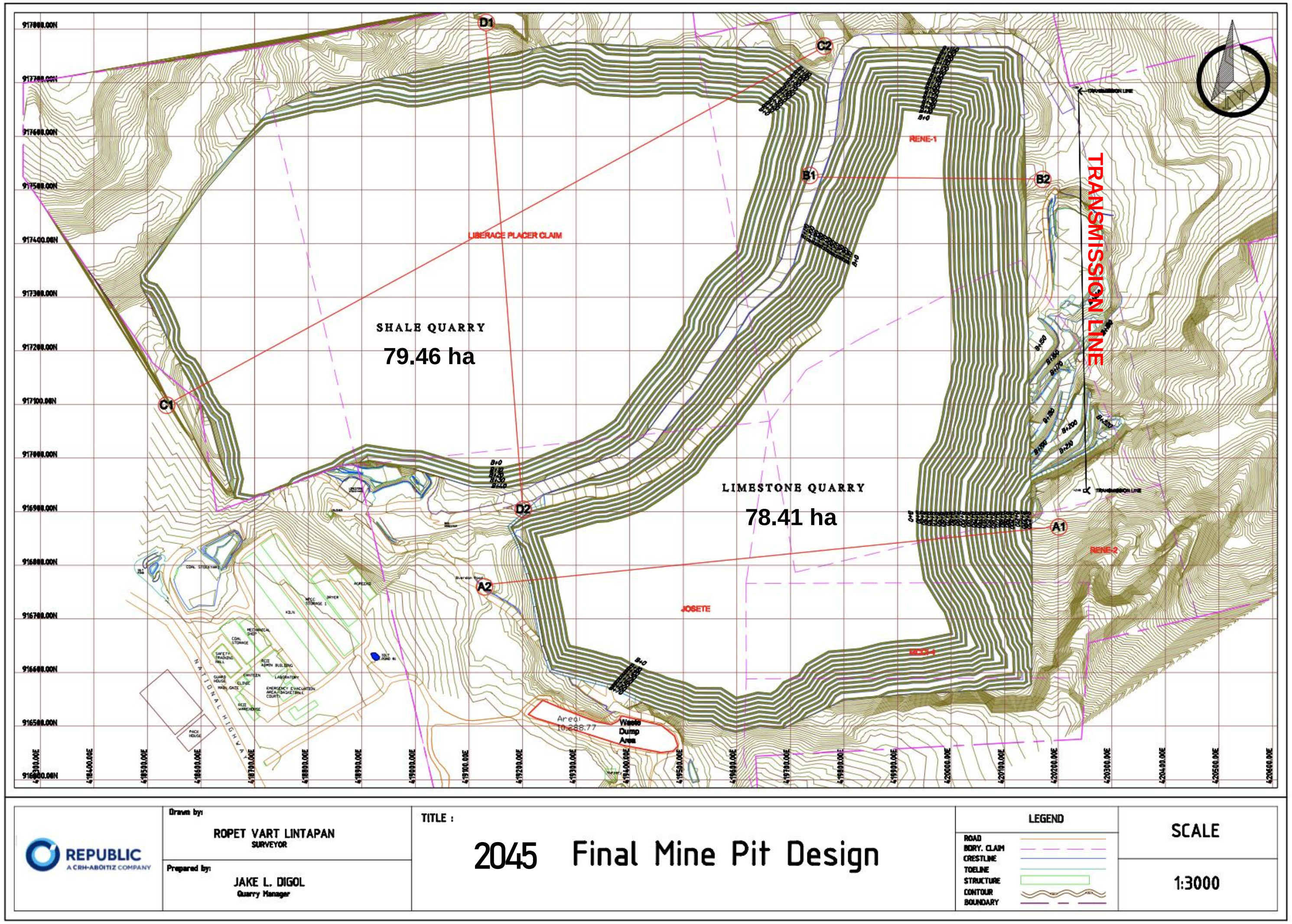
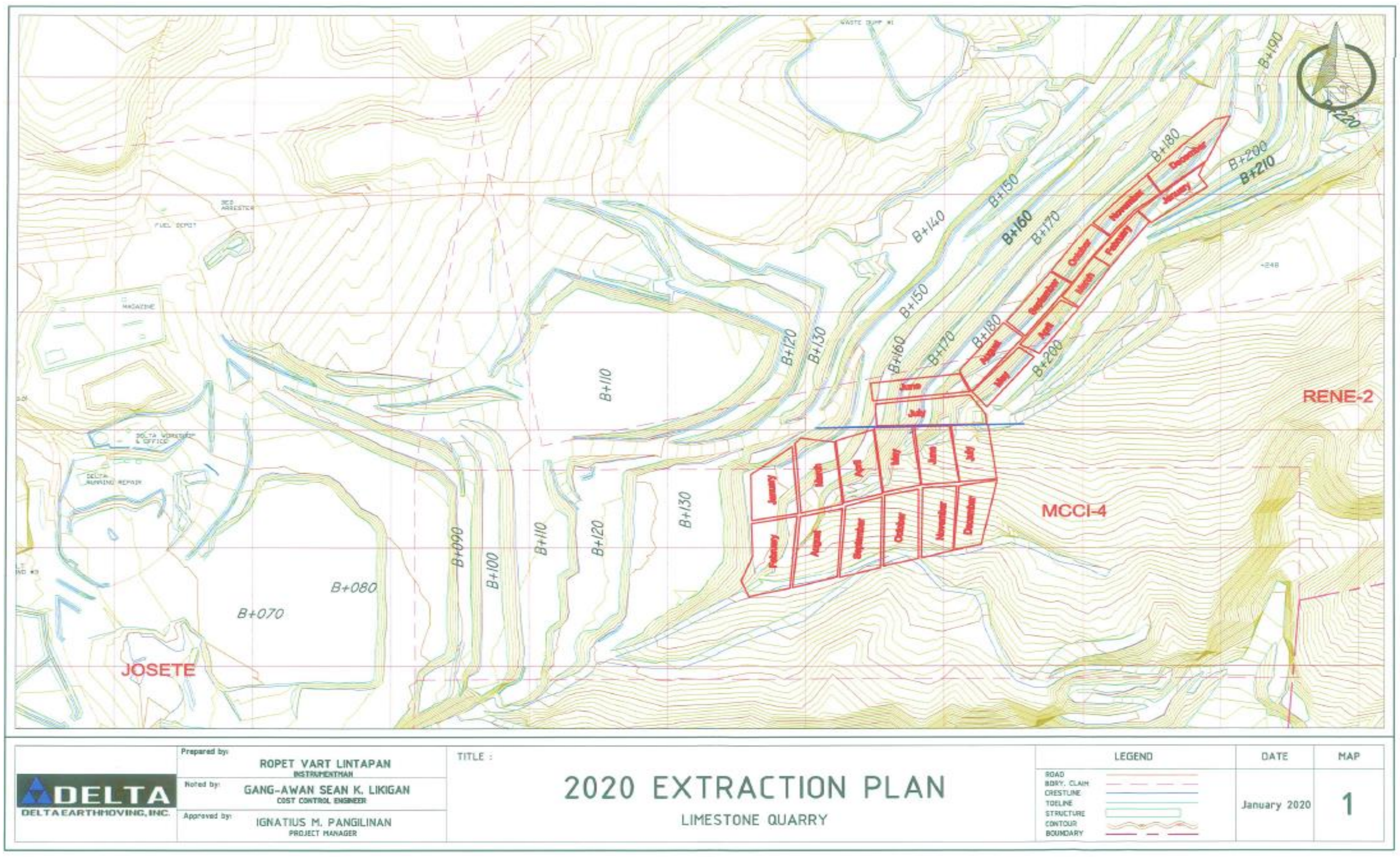
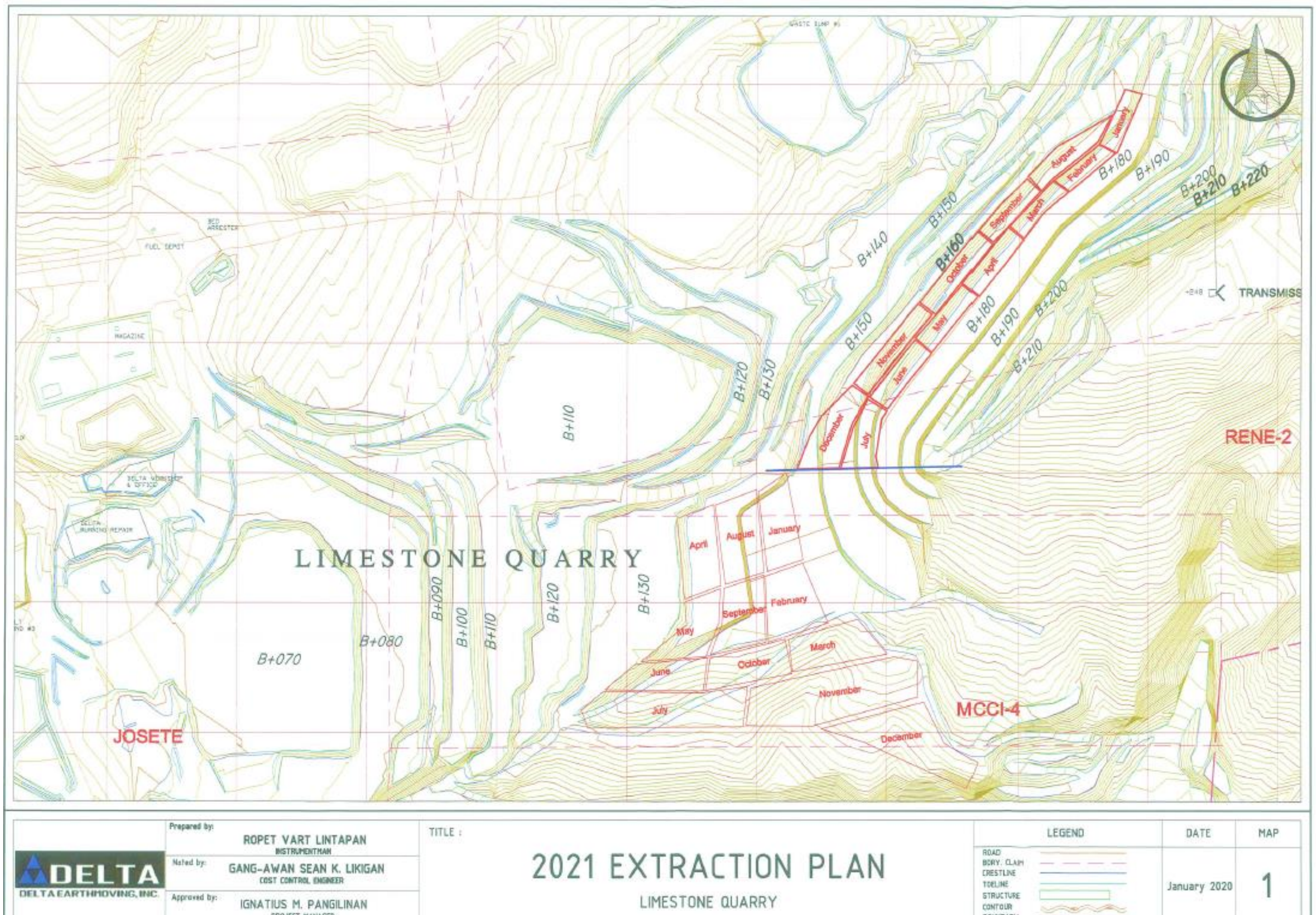


Figure 1-19. Final Mine Pit Design



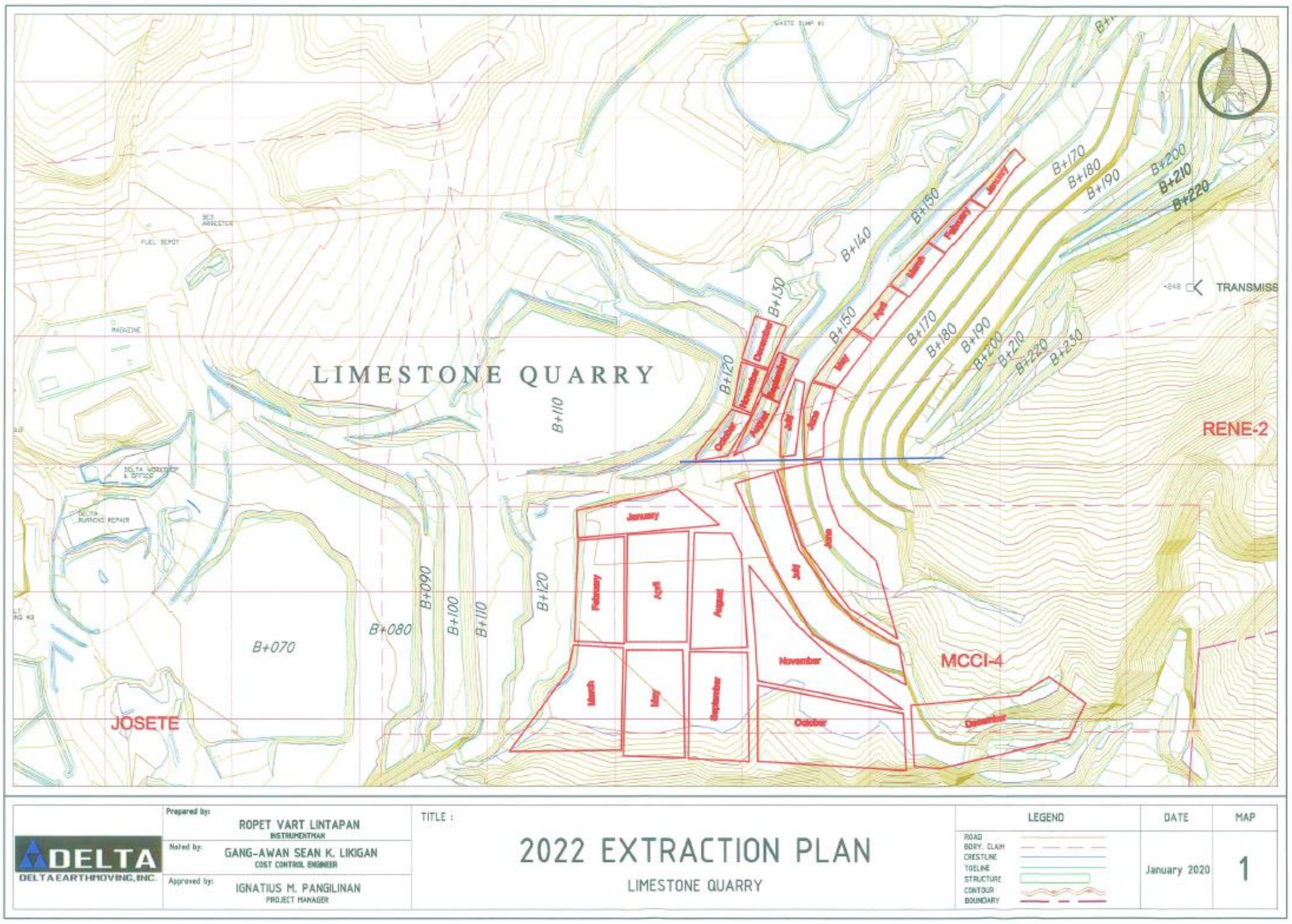
Source: 3-Year Utilization Plan approved by MGB X

Figure 1-20. Limestone Quarry Extraction Plan 2020



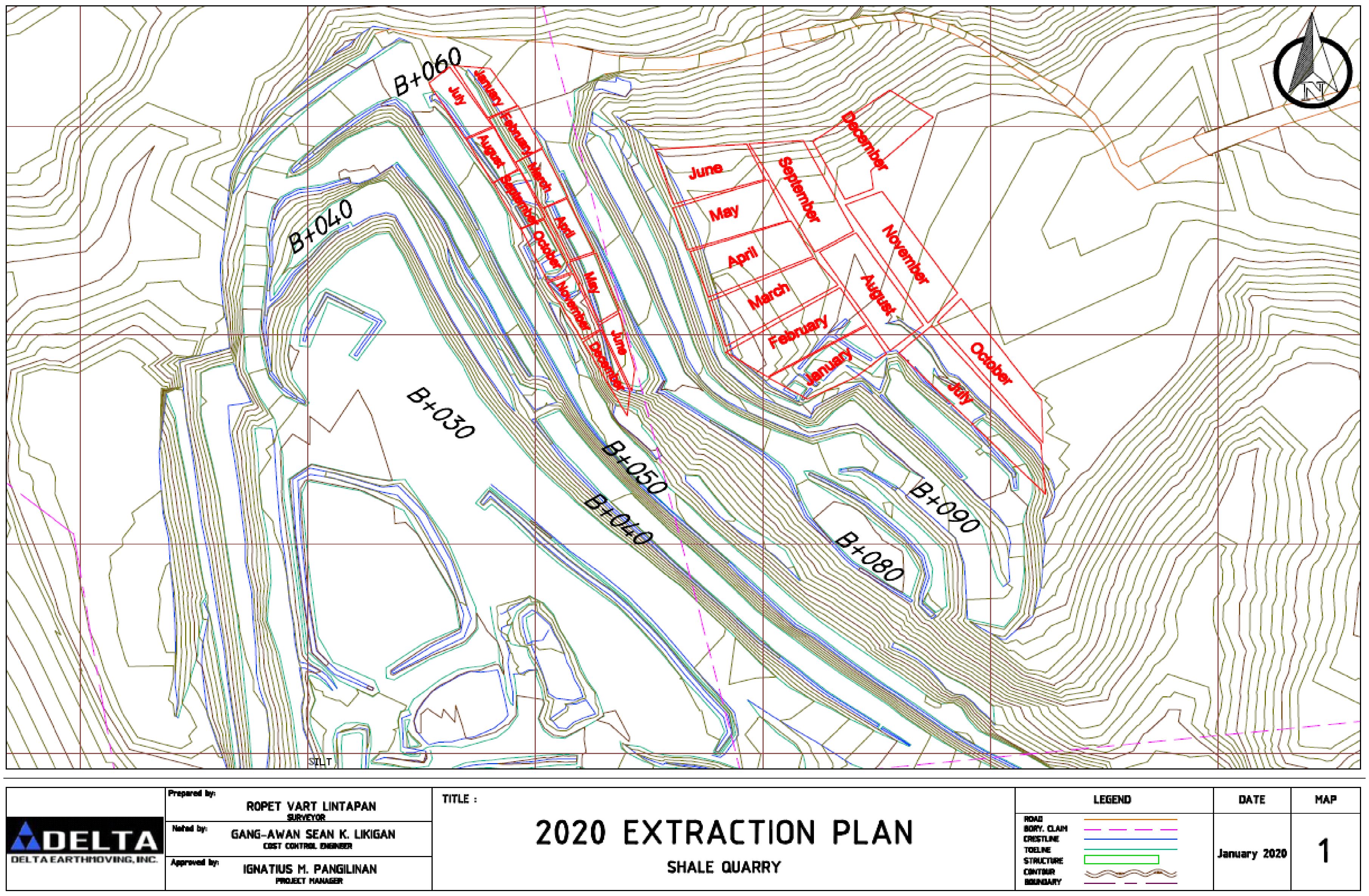
Source: 3-Year Utilization Plan approved by MGB X

Figure 1-21. Limestone Quarry Extraction Plan 2021



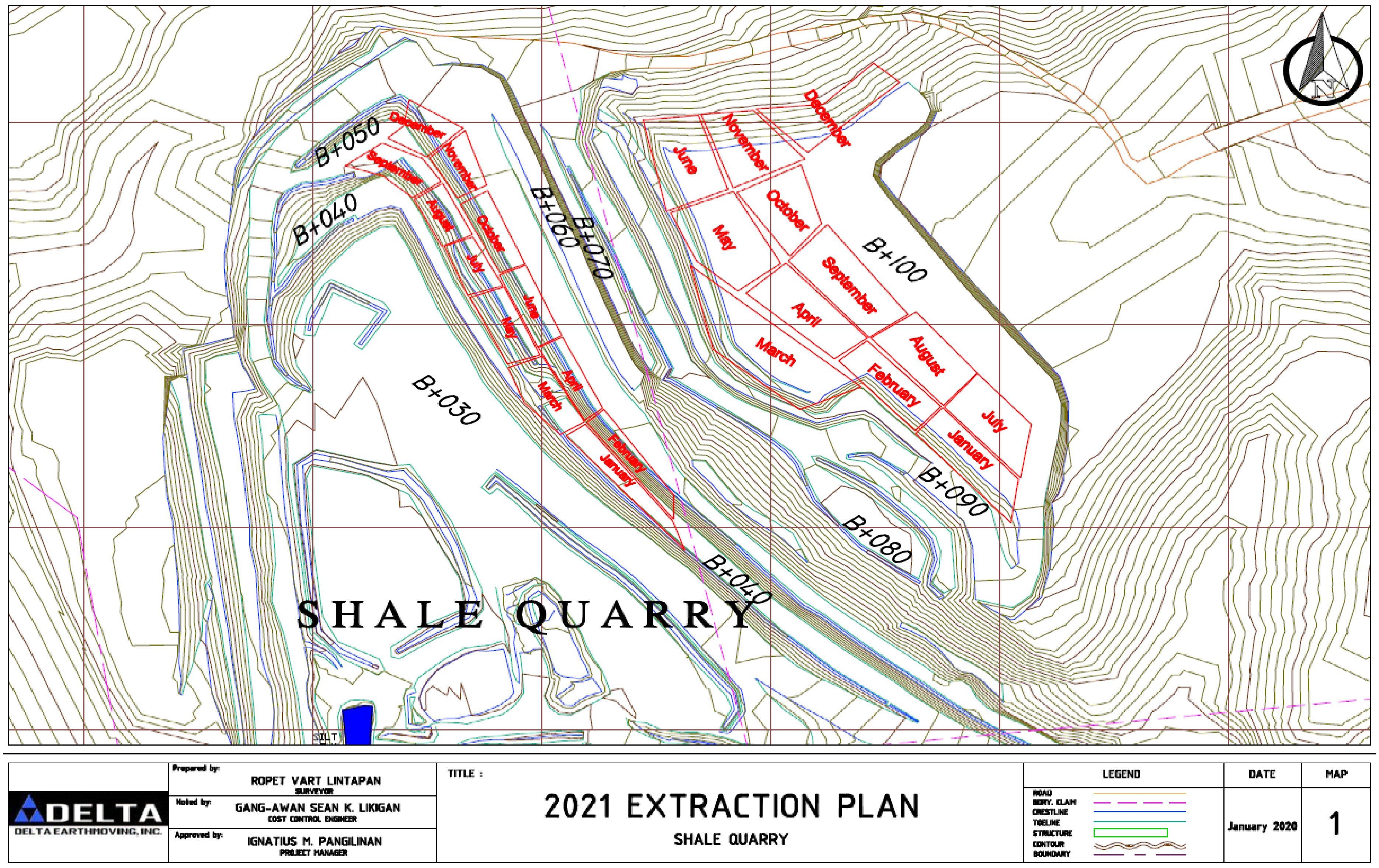
Source: 3-Year Utilization Plan approved by MGB X

Figure 1-22. Limestone Quarry Extraction Plan 2022



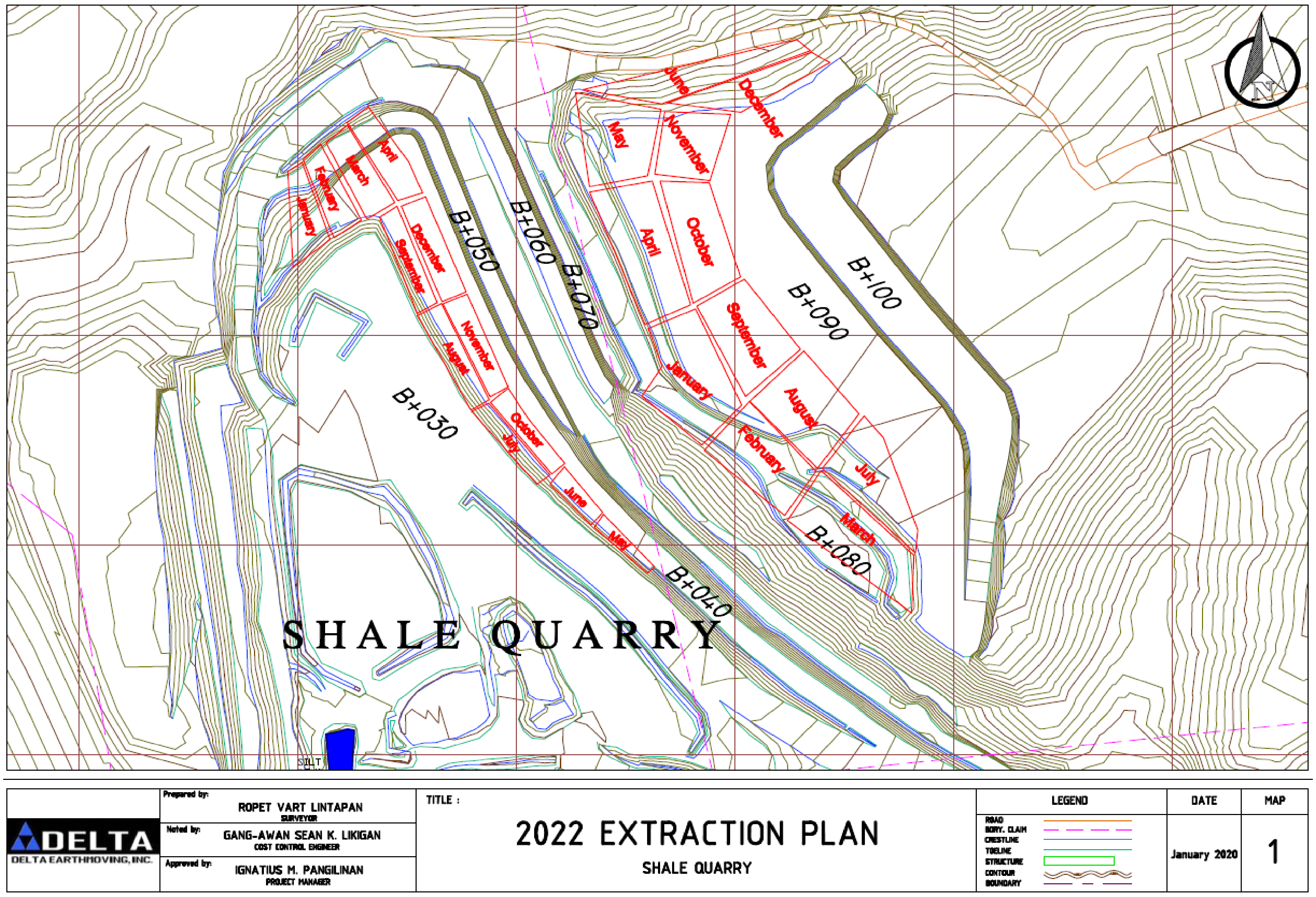
Source: 3-Year Utilization Plan approved by MGB X

Figure 1-23. Shale Quarry Extraction Plan 2020



Source: 3-Year Utilization Plan approved by MGB X

Figure 1-24. Shale Quarry Extraction Plan 2021



Source: 3-Year Utilization Plan approved by MGB X

Figure 1-25. Shale Quarry Extraction Plan 2022

1-4.4 Identification and description of support facilities and infrastructure requirements such as energy/power generating facility (if any) or energy source, water supply/storage, storm water drainage, septage and sewerage treatment, telecommunications, safety/emergency facilities, accommodation and similar facilities

1.4.4.1 Power Generation and Water Supply Systems

Power

There will be no major facilities to be constructed in the area to provide additional power supply facilities. The state-owned National Power Corporation supplies the power requirement. The proposed expansion will utilize the same power supply, which is being tapped from the National Power Corporation (NPC) lines. The cement plant operates in medium and low voltages. The medium voltage requirement is above the 440 volts but not exceeding 69,000 volts (69 KV). The low voltage refers to requirement of up to 440 volts. The power cables used in the transmission of the medium voltage are in cable trenches and in some areas underground with manholes used during maintenance check. RCMI maintains a 13 MW Power Plant facility for standby power or to augment the supply, if needed.

On the other hand, other fuel requirements for the plant are sourced from other countries (coal, petcoke) and local oil companies for bunker oil and diesel oil. The rice hulls are brought in from Lanao del Norte and Zamboanga provinces.

The table below lists down the supply requirements for power, water and fuel.

Table 1-13. Power and Water Requirements

Operation Activity/Area	Utilities Requirements	Unit of Measure	Existing	Proposed	Source
Processing Plant	Power	kWh/year	63,850,000	550,400,000	NPC lines/Grid Plus own power generation by quarrying equipment
		kWh/ton of cement produced	132	128	
Quarrying		kWh/year	30,000	Essentially same with own power generation by quarrying equipment	
Processing Plant (clinkerization and cement grinding)	Water	m^3/day	703.3	3,100	2 existing RCMI deep wells (rated discharge of 385 gpm or 87.6 m^3/hr
		m^3/MT of cement produced	0.41	0.41	

Records of electricity consumption show that from 2015 to 2018, a total of 351,489,655 kWh (ave 7,332,700 kWh/mo) was used by RCMI.

Alternative Fuels and Raw Materials

RCMI is constantly looking at opportunities to reduce its environmental footprint with measures including the use of alternative fuels and alternative raw materials, educating the public on more efficient ways to use cement, and introducing alternative cement product types that use less clinker, among others.

For some time, RCMI has been marketing their fly ash cement under the type 1P or the blended category which uses less clinker content than the traditional Portland cement. Adding cementitious materials such as fly ash limestone, high ash by-products such as bottom ash, pozzolan, EP Dust, escombro, volcanic tuff, shale, microsilica, slag and other pozzolanic materials in the cement mix reduces the need for clinker.

It is during the clinker manufacturing process that the most carbon dioxide is emitted since coal is burned in order to reach the high process temperatures required to calcine limestone and produce clinker. Within its manufacturing process, RCMI is aggressively pursuing carbon footprint reduction in two key ways: (1) by minimizing the clinker factor of its cements by developing and selling blended cements with more environmentally friendly cement additives with equivalent market advantages of durability and workability, and (2) use of alternative fuels and raw materials in the cement manufacturing process.

RCMI uses alternative fuels to complement coal and these include tire-derived-fuel and plastic-derived fuel, such as scrap tires and nonrecyclable plastics, refuse-derived fuel and biomass, such as rice hulls as well as other manufacturing and industrial wastes allowed under its co-processing and TSD permit.

The sustainable approach to operating has the following effects and advantages:

1. Reduced use of fossil fuel, hence reduced CO2 and other greenhouse gas emissions (aligned with our commitment under Sustainability Ambitions);
2. Maximize energy recovery from industrial by-products and qualifying wastes; and
3. Reduced dependence on fossil fuels, i.e. oil and coal; prolong non-renewable fossil fuel sources.
4. Use of RDF and plastic derived fuels will divert volumes from sanitary landfills in the Philippines and hence becoming a part of the waste management solution in the country;
5. Minimize flooding caused by improper disposal of garbage; and
6. Conserving natural resources and energy.

Water

In the existing set-up, water for domestic consumption, water spraying for dust control along roads, and process water are taken from 2 existing company-owned deepwells.as well as rainwater collection.

Records of water consumption show that from 2015 to 2018, a total of 300,075 m^3 (ave 6,252 m^3/mo) was used by RCMI.

For the proposed expansion, treated water shall be used for the process water requirements. A Reverse Osmosis (RO) water plant shall be installed for treatment of raw water from the existing deepwells at the plant. RO water shall be pumped to plant treated water tanks. Battery limit of water intake shall be from the scope of water, storage tanks, till the source points and return water tank, and cooling tower.

The plant cooling water installation shall be provided with closed circuit system, i.e., make-up water shall be supplied while re-circulating water in closed loop. Appropriate chilling cooling system with radiators shall be provided to cool the return hot water from the plant. At least one chilling unit with radiator shall be provided as stand-by. New water pipelines will be installed and all will be overhead line. Any underground pipeline will be HDPE only.

Water supply piping shall be designed to relevant local Philippine standard or local international standards and shall be of outside and inside corrosion protected pipes. The whole water supply has to be designed and installed in such a manner, that it shall be protected and proof against mechanical, electrical and chemical attack and shall be tested for 1.5 times operating pressure.

Existing water treatment facility includes Oil-water separator (with discharge permits) and 3 chamber septic tanks. This is to ensure compliance on DAO 2016-08.

The existing water balance for the project is shown in **Figure 1- 26** below and the proposed water distribution system in the succeeding figure.

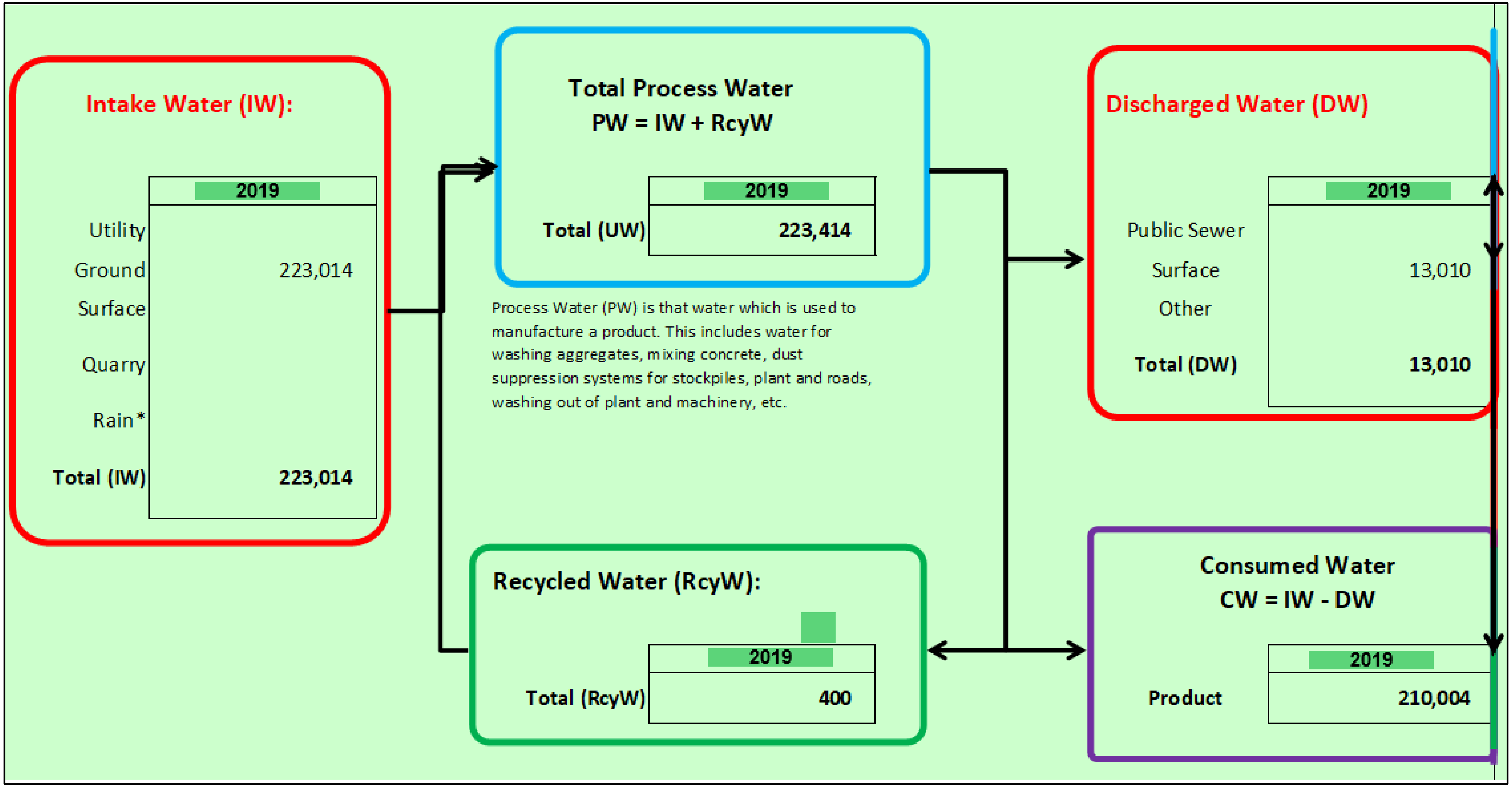


Figure 1-26. Existing Water Balance (2019)

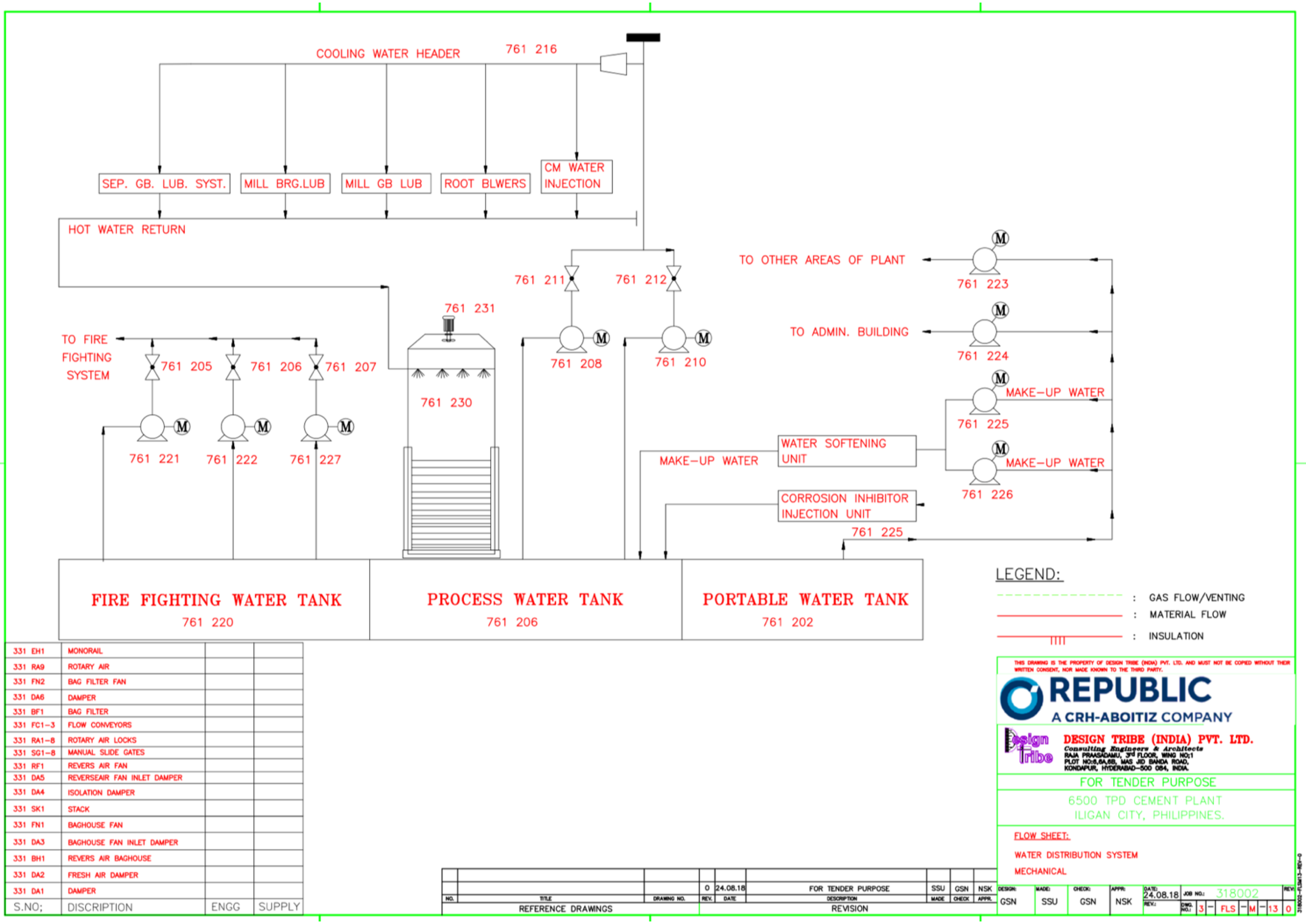


Figure 1-27. Proposed Water Distribution System

1-4.5 Identification and description of pollution control devices and waste management system for the waste materials; wastewater, air emissions, domestic wastes, toxic and hazardous wastes, non-toxic and non-hazardous wastes, etc.

Table 1-14 shows the existing list of major components, support pollution control devices and other environmental management safeguards used in project operation.

For the proposed new kiln line with a capacity of 3.70 million metric tons per year, it has new raw material storage, raw mill, kiln and cooler, and other support facilities equipped with bag filter dust collector as pollution control device, shown in **Figure 1-13** above. In addition, the new kiln line will be equipped by state of the art New Bag House System as air pollution control device which is more efficient compared to the conventional Electrostatic Precipitator.

Table below shows the proposed additional cement mill list of major components, support pollution control devices (the dust collectors) and other environmental management safeguards used in project operation.

Table 1-14. List of Major Components and Support Pollution Control Devices

Area	Section	Type of APCF	Existing		Proposed	
			Capacity (CMH)	Operating Hours per Day	Capacity (CMH)	Operating Hours per Day
DRYER	Rotary Drum Dryer	Bag Filter Dust Collector	135,000	24	- same	- same -
	Auxiliary (at dryer discharge)	Baghouse Dust Collector	8,232 m³/hr	24	- same	- same -
	Bucket Elevator, Belt Conveyors, Material Storage	Baghouse Dust Collector	8,700	24	- same	- same -
RAW MILL	Weigh Feeders	Baghouse Dust Collector	11,300	24	- same	- same -
	RGM Separators	Multiclones	42,000	24	- same	- same -
	Air Blending Silos	Bag Filter Dust Collector	6,630	24	- same	- same -
	Raw Mix Silos	Bag Filter Dust Collector	7,200	24	- same	- same -
PYRO-PROCESS	Rotary Kiln	Electrostatic Precipitator	146,160	24	- same	- same -
	Air Quenching Cooler (AQC)	Electrostatic Precipitator	265,980	24	- same	- same -
	Air Quenching Cooler (AQC) - discharge to storage	Bag Filter Dust Collector	5,700	24	- same	- same -
COAL SUPPLY	Coal Vertical Roller	Bag Filter Dust Collector	41,340	24	- same	- same -
	Fine Coal Silo	Bag Filter Dust Collector	5,100	24	- same	- same -
FINISH MILL 1	Weigh Feeders	Bag Filter Dust Collector	10,140	24	- same	- same -
	Mill	Bag Filter Dust Collector	100,800	24	- same	- same -

Area	Section	Type of APCF	Existing		Proposed	
			Capacity (CMH)	Operating Hours per Day	Capacity (CMH)	Operating Hours per Day
	Fly Ash Feeding System	Bag Filter Dust Collector	30.43 – 79.13 m^3/hr	24	-same	-same
Packhouse 1	Rotopacker No. 2	Bag Filter Dust Collector	19,500	24	- same	- same -
	Rotopacker No. 4	Bag Filter Dust Collector	24,840	24	- same	- same -
	Rotopacker 1/5 (2 units)	Bag Filter Dust Collector	11,400	24	- same	- same -
	Cement Silos	Bag Filter Dust Collector	16,210	24	- same	- same -
	Tonner bag loading	Bag Filter Dust Collector	13,800	24	-same	-same

For the Quarry Operations, the Pollution Control Measures and the environmental protection systems are embodied in the Environmental Protection and Enhancement Plan (EPEP) as submitted to the MGB.

These are summarized hereunder.

Table 1-15. Summary of AEPEP

Project Phase /Activity	Environmental Component Likely to be Affected	Potential Impact	Options for Prevention or Mitigation* or Enhancement	Responsible Entity	Cost	Guarantee / Financial Arrangements
Site Clearing	Land	Disturbance of Fauna	Avoidance (RCMI is operating mostly on pre-existing/disturbed areas wherein land is already cleared. Progressive rehabilitation	Quarry Manager	Part of Annual fund (P 13.5 M)	ECC Condition and Commitment to MGB
Blasting	Land	Micro change of topography and dispersal of sediment	Avoid whenever possible. Adapt Accepted Procedure. Blasting applied to only 80% of limestone and none for shale.	Quarry Manager	Part of Annual fund (P 13.5 M)	Part of Management Plan
	Air	Fugitive Dust Dispersal and Noise		Quarry Manager		
Natural activity/ Rainfall	Water	Possible Flooding	The runoff water will be redirected from settling ponds before releasing to Iligan Bay. Maximum capacity of the pond should not exceed 50% of its capacity. Will be **desilted** quarterly but as needed (more often) during rainy days.	Quarry Manager/ Pollution Control Officer	120,000.00	Part of Management Plan

Project Phase /Activity	Environmental Component Likely to be Affected	Potential Impact	Options for Prevention or Mitigation* or Enhancement	Responsible Entity	Cost	Guarantee / Financial Arrangements
Vehicular Movement/ Operation of Heavy Equipment	Air	Noise Generation and Fugitive Dust Dispersion	equipment are installed with mufflers thus the roads area is sprinkled with water	Quarry Manager	80,000.00	Part of Management Plan
Dust Particles from grinding powdering and packing operation	Air	Dust from Process area	Management of Dust Generation	Plant Manager	2,400,000.00	Part of the Management plan
Conservation of Species	Land	Loss of important species	Inventory and rehabilitation program	Quarry Manager	1,121,668.00	Part of Rehabilitation Plan
Preservation of Visual Aesthetics	Land	Degradation of Visual Aesthetics	Landscaping & reforestation	Plant Manager	Part of Annual fund (P 13.5 M)	Part of Rehabilitation Plan

Table 1-16. Major Components of Additional Cement Mill

COMPONENTS	EXISTING		PROPOSED	
	RATE	OPERATING HOURS/DAY	RATE	OPERATING HOURS/DAY
COMBI MILL (PROJECT)				
Assorted Conveyor Equipment	nil	nil		24
Assorted Material Bins & Feeders	nil	nil		24
Roller Press	nil	nil	3200.0 kW	24
Ball Mill	nil	nil	2100.0 kW	24
V Seperator	nil	nil		24
High Efficiency Separator	nil	nil	335.0 kW	24
Hot Gas Generator	nil	nil	11.1 Mkcal/hr	24
311BF1 Dust Collector	nil	nil	6700.0 m3/hr	24
311BF2 Dust Collector	nil	nil	12500.0 m3/hr	24
311BF3 Dust Collector	nil	nil	7750.0 m3/hr	24
311BF4 Dust Collector	nil	nil	7750.0 m3/hr	24
511BF1 Dust Collector	nil	nil	12000.0 m3/hr	24
531BF1 Dust Collector	nil	nil	12500.0 m3/hr	24
531BF2 Dust Collector	nil	nil	11000.0 m3/hr	24
531BF3 Dust Collector	nil	nil	11000.0 m3/hr	24
531BF4 Dust Collector	nil	nil	9000.0 m3/hr	24
531BF5 Dust Collector	nil	nil	6000.0 m3/hr	24
531BF6 Dust Collector	nil	nil	13500.0 m3/hr	24
531BF7 Dust Collector	nil	nil	3500.0 m3/hr	24
541BF1 Roller Press Dust Collector	nil	nil	30000.0 m3/hr	24
541BF2 Dust Collector	nil	nil	2100.0 m3/hr	24
591BF1 Separator Bag Filter	nil	nil	195000.0 m3/hr	24
591BF2 Dust Collector	nil	nil	3000.0 m3/hr	24
591CN1-4 Separator Cyclones	nil	nil	3200.0 mm	24
561BF1 Ball Mill Bag Filter	nil	nil	52000.0 m3/hr	24
561BF2 Dust Collector	nil	nil	3000.0 m3/hr	24
561BF3 Dust Collector	nil	nil	5000.0 m3/hr	24
562BF1 Dust Collector	nil	nil	12000.0 m3/hr	24
562BF2 Dust Collector	nil	nil	7500.0 m3/hr	24
562BF3 Dust Collector	nil	nil	7500.0 m3/hr	24
591BF3 Dust Collector	nil	nil	6500.0 m3/hr	24
591BF4 Dust Collector	nil	nil	5000.0 m3/hr	24
New cement silo	nil	nil	11000.0 T	24

The other pollution control components that are existing in the project area are the following:

1. Mine Waste Dumpsite and Plant Waste Dumpsite

2. Settling Ponds
3. Drainage System
4. Wastewater Treatment Facility
5. Co-processing and TSD Facility
6. Wastewater Treatment Facility
7. Fire Fighting System

1.4.5.1 Waste Dumpsite

This is located at the depressed area of Parcel Rene 1 of MPSA 031. It is where the mine wastes (spoils, overburden, and recovered silt from settling ponds) are temporarily stored for future use in the rehabilitation (including recontouring) efforts. See **Figure 1-13**.

Based on the submitted Mine Waste Utilization Plan to MGB-X on July 10 2020, a total of **57,409.55 MT** have been stockpiled in this dump. Mine wastes generated from 2015 to 2020 amount to 46,685 MT but 1,421 MT of this was utilized in berm construction and other road/quarry maintenance purposes. See table below.

Table 1-17. Mine Waste Generation (2015 to 1st Sem 2020)

Period	PRODUCED (MT)	CONTAINED (MT)	UTILIZED (MT)
S1 2015	9,125	9,125	0
S2 2015	0	0	0
S1 2016	2,067	1,457	610
S2 2016	2,451	1,909	542
S1 2017	9,125	9,125	0
S2 2017	8,041	8,041	0
S1 2018	5,730	5,730	0
S2 2018	5,033	5,033	0
S1 2019	0	0	0
S2 2019	3,414	3,145	269
S1 2020	1,700	1,700	0
TOTAL	**46,685**	**45,264**	**1,421**

1.4.5.2 Drainage System and Settling Ponds

The RCMI drainage system encompasses the current active quarry areas approximately 76.438 hectares in size. Ditches and canals are built at the toes of quarry benches, to contain/receive the surface runoff and direct it into the siltation ponds (by gravity) for temporary storage and settling of suspended particles/sediment before they are discharged into the main drain lines/spillway and ultimately into Iligan Bay.

The drainage system at the plant site consists of concrete-lined ditches, 30 to 60 cm wide and 60 to 90 cm deep, bounding road verges and buildings. The ditches, which are either covered or open, empty into the 2 main drain lines. One drain line, 80 cm wide and 50 cm deep, joins the canal along the National Highway at the Plant Main Entrance. The highway canal flows southwards and connects to the other drain line. This 2nd drain line forms the lower reaches of a small creek draining the quarry areas. This channel is concreted and measures about 1.2m wide and 1.5m deep before it crosses the highway and widens to about 3.6m at the vicinity of the Packhouse, where it finally drains to Iligan Bay.

There are nine (9) existing settling ponds installed in strategic places, 7 for the limestone quarry and 2 for the shale quarry. Ponds 1 and 4 were built in series/stages so as to maximize settling of silt/sediments. The 9 ponds occupy 6,572 sqm of land and has a combined capacity of 31,967.53 cubic meters.

For the near future, it is planned to add 1 more settling pond with approximately 2,500 sqm area and capacity of 9,000 cubic meters.

In the final stages (2044), the drainage system will have been reconfigured in accordance with the changes in pit layouts for shale and limestone quarries. Water pumps shall be installed to bring the water from the pits down to the drainage, the settling ponds, and ultimately into Iligan Bay. Consequently, there will be 2 settling ponds (in series) for each of the quarries to be located at the edges of the Plant Complex.

Collected silt is removed regularly as required and stockpiled in the waste dump. Desilting records from 2nd Semester of 2018 to 3rd quarter of 2020 shows total recovered silt amounted to 11,165.2 m^3. This does not include data from SP 6 and SP 7. Average rate of silt migration into the ponds is 2,554 m^3 per semester or 426 m^3/month. In general, settling ponds in the shale area need to be desilted more frequently than those in the limestone areas where siltation is much lesser.

The table below shows the design details of the ponds while the next figure shows the drainage system of the area indicating therein the location of the settling ponds. Please see **Figure 1-28** for the Map of Existing Drainage System showing also the location and layout of the settling ponds, while **Figure 1-29** is for the future drainage system (2044).

Table 1-18. Settling Pond Design Parameters

	Area (m^2)	Depth (m)	Capacity (m^3)
MPSA 031-95-XII			
Settling Pond No. 1 (Stage 1)	113.05	3.0	339.15
Settling Pond No. 1 (Stage 2)	175.13	3.0	525.39
Settling Pond No. 2	2,570.96	3.5	8,998.43
Settling Pond No. 3	133.59	1.5	200.38
Settling Pond No. 4 (Stage 1)	149.53	3.5	523.34
Settling Pond No. 4 (Stage 2)	149.53	3.5	523.34
Settling Pond No. 5	149.53	3.5	523.34
MPSA 105-98-XII			
Settling Pond No. 6	1,783.35	8.0	14,266.8
Settling Pond No. 7	456.99	5.0	2284.95
MPSA 104-98-XII Amended			
Settling Pond No. 8	444.1	5.0	2220.5
Settling Pond No. 9	446.26	3.5	1561.91
TOTAL	**6,572.02**		**31,967.53**

Photos of Settling Ponds


Desiltation of Settling Pond No. 1 Stage 1 (left) and Settling Pond No. 4 (right)

Newly De-silted Settling Pond

1.4.5.3 Wastewater Treatment Facility

This is composed of oil-water separator used for the primary treatment of domestic wastewater and 3-chamber septic tank system for the sewage.

In addition, used process water will be recycled but first it will be cooled down prior utilizing for operation.

1.4.5.4 Co-processing and TSD Facility

Co-processing is the reuse or recovery of mineral or energy content of waste materials while simultaneously manufacturing cement in a single combined operation. Cement co-processing utilized alternative fuels which refers to non-traditional fuels, such as waste materials, that provide thermal energy in the production of cement and alternative raw materials which refers to non-traditional raw materials, such as waste materials, providing minerals essential in the production of cement.
RCMI has existing co-processing and TSD facility and it will be replicated in the proposed kiln expansion project. The existing RCMI Treatment, Storage, and Disposal (TSD) Facility permit (OL-TR-R10-35-000074) that will expire on January 09, 2021 authorized to treat the following waste: Sulfuric acid (B201), Hydrochloric acid (B202), Nitric acid (B203), Hydrofluoric acid (B205), Mixture of sulfuric and hydrochloric acid (B206), Other inorganic acid (B207), Organic acid (B208), Other acid wastes (B299), caustic soda (C301), Potash (C302), Alkaline cleaners (C303), Ammonium hydroxide (C304), Lime slurries (C305), Other alkali wastes (C399), Selenium and its compounds (D401), Arsenic and its compounds (D402), Selenium and its compounds (D401), Arsenic and its compound (D403), Cadmium and its compounds (D404), Chromium compounds (D405), Fluoride and its compounds (D408), Other wastes with inorganic chemicals (D499), Solvent based (F601), Ink formulation (F603), Resinous materials (F604), Other mixed (F699), Halogenated organic solvents (G703), Non-halogenated organic solvents (G704), Grease wastes (H802), Used industrial oil including sludge (I102), Tallow (I103), Oil-contaminated materials (I104), Containers previously containing toxic chemical substances (J201), Pharmaceutical and drugs (M503).

In addition, RCMI has Co-processing facility with Co-processing ID Pemit:10-35-0001 issued by DENR-EMB Central Office and will expire on May 4, 2020. The following are the wastes authorized to co-process, Biomass (i.e chicken litter, rice hay, corn cobs, wood chips, etc); Manufacturing By-products (i.e activated carbon cake, saw dust, wood shavings, etc); flyash; plastic shredded laminates; high silica by-products; and gypsum by products.

1.4.5.5 Fire Fighting System

A complete, fire-fighting system shall be provided, mainly comprising of:

- A suitable high pressure fire hydrant system consisting of suitable number of fire hydrants covering entire plant area, passing through all the plant and buildings. It should be extended to preheater floors, cooler floor, kiln burner platform and warehouse. The fire hydrant system should encircle the whole fuel storage tanks area fitted with posts and monitors.
- Fire hydrant system should be complete in all respects and should comprise of high-pressure fire pumps operated with separate diesel engine connected to the raw water tank, separate (elevated) water tank for feeding the hydrant.
- Heavy duty ABC powder type fire extinguisher trolley industrial type shall be provided at important electrical area, particularly, e.g. Switchgear and motor control center (MCC), C.C.R, fuel station, preheater and kiln fuel supply area. ABC portable extinguishers shall be provided in office buildings.
- Portable CO_2 extinguishers shall be provided throughout the plant.
- Automatic fire extinguishing system for fuel storage tanks, e.g. aero-foam system (inbuilt system) with all the fuel storage tanks. Water sprinklers (external) for tank cooling.
- High-pressure water & foam system equipped with overheat jet monitor for fire station shall be provided.

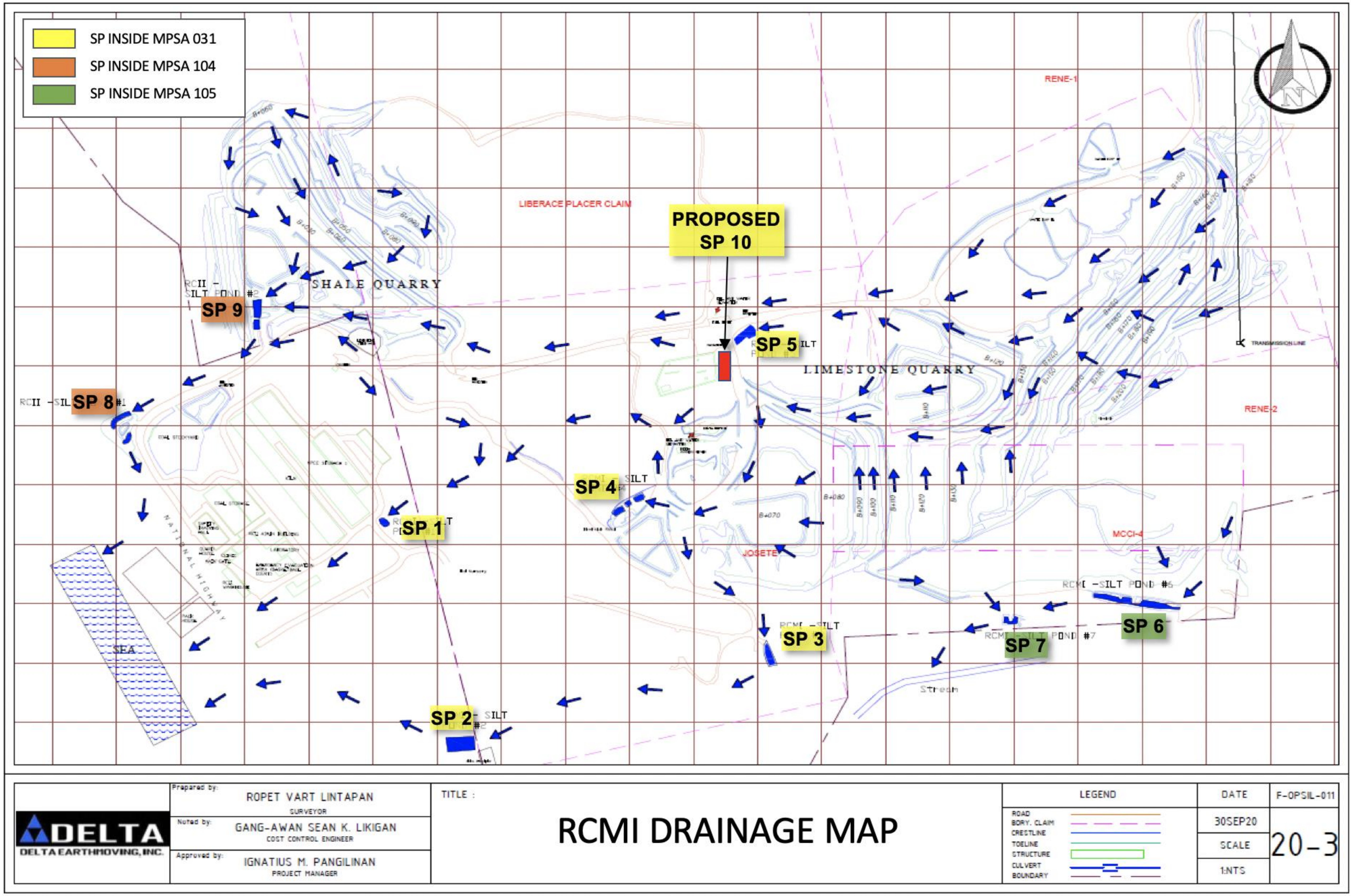
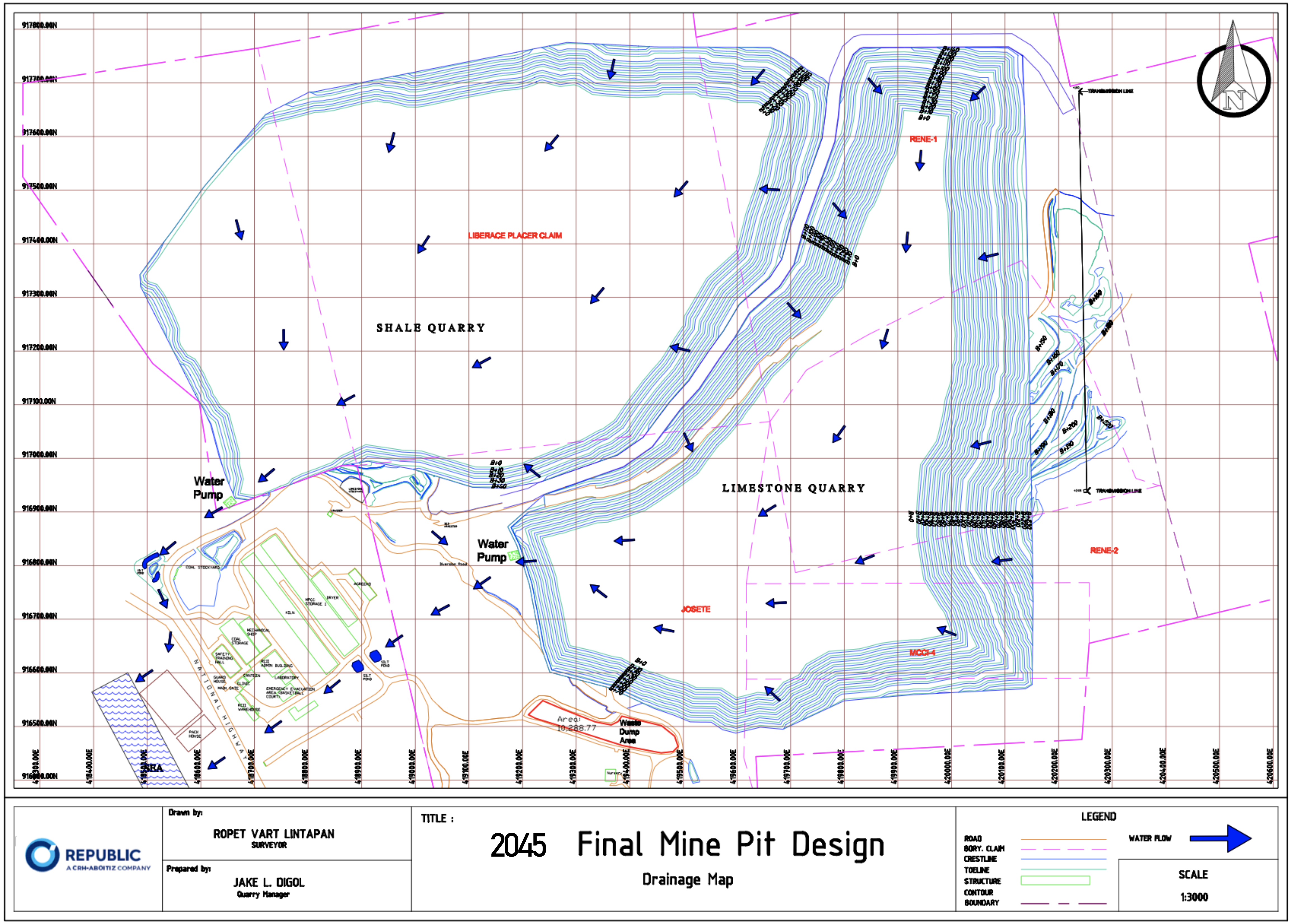


Figure 1-28. Map of Existing Drainage System Showing Location of Settling Ponds



Notes: This subject to finalization noting the future drainage system is to be constructed several years yet in the future. The rainfall density is inherent in a drainage system design, which in turn is influenced by climate change effects on rainfalls.

Figure 1-29. Map of Future Drainage System Based on Final Mine Pit Design

1-5 Process / Technology

The process involved in the planned project expansion is illustrated diagrammatically below:

The limestone quarry is being operated by RCMI. The existing shale quarry operation is within the AQL-41 parcel of MPSA No. 104-98-XII Amended and Parcel I of MPSA 031. The limestone quarry, on the other hand, is within Parcel II of MPSA 031 and the whole of MPSA 105.

The map of the shale quarry and limestone quarry areas is shown in **Figures 1-1** and **1-11** above.

The standard process and technology will be applied by RCMI with updated and improvements thereof; based on the standards and process/technology of the Republic Cement Group adopting global standards and technologies and best practices.

The process involved in the planned project expansion is illustrated diagrammatically below. The proposed expansion project covers Quarrying process up to Cement Milling. The processes highlighted in yellow are the proposed expansion project covered in this EPRMP.

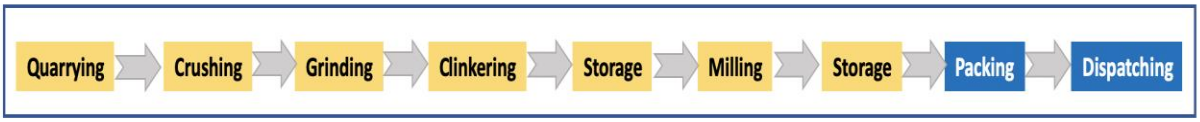


Figure 1-30. Simplified Process Flow

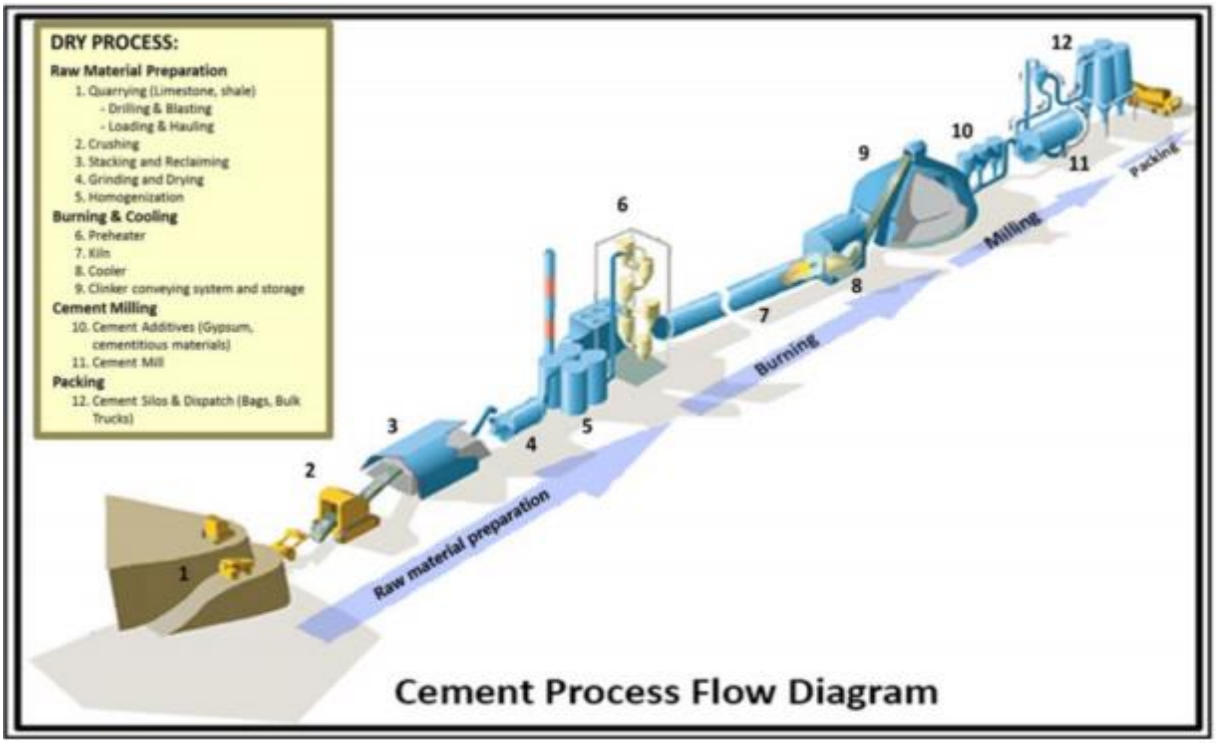


Figure 1-31. Overall RCMI Cement Manufacturing Process

1.5.1.1 Quarrying Process Technology

RCMI adopts the open-cast quarrying method. This is a type of quarrying procedure, which it has successfully been employing in all its quarry/cement plant projects. Extraction of raw materials shall be done from top to bottom of the quarry area. Mining and extraction of limestone involves drilling, controlled blasting, dozing, loading, hauling and dumping to the crusher. For the shale and other siliceous materials, extraction is done by ripping and dozing only.

Land Clearing

This is done only when new/additional areas are to be quarried. For most of the time, RCMI extracts from pre-existing mining-disturbed areas wherein the land is already cleared of vegetation, topsoil and overburden.

More recently in late 2019, RCMI started to expand into green areas in its shale quarry where land clearing is required. During this phase, the vegetation and overburden in the green area will be stripped off, stockpiled and preserved for future rehabilitation. Nevertheless, it would not immediately strip off the entire area since the quarry will be limited to a smaller area for the years to come. As soon as the new proposed quarry section is needed, this would be the time that the area is cleared.

Stripped wastes, spoils or overburden is disposed in the existing waste dumping site, which is regularly maintained in accordance with environmental rules and regulations.

The total current active and disturbed areas cover 76.438 hectares. For the proposed expansion, another 81.432 ha shall be opened. Hence, total disturbed area at the end of the project shall be 157.87 hectares.

During the final rehabilitation, the topsoil to be backfilled is 0.5 meters thick X 1,313,837.27 m^2 = 656,919 m^3. Note that for the area to be backfilled using topsoil, the total area is only 131.3837 hectares since we only considered to backfill the benches (bench widths) and we excluded other areas for backfilling such as slopes and drainage canals per bench.

Quarry Development and Utilization

In order to gain access to the proposed areas, new access/haul roads (all within the MPSA parcels being operated) will be opened leading to the new areas. At present, all roads heading to the present active limestone quarry are already established. Regular maintenance of existing roads will be done to guarantee the safety and consider its environmental aspect. Moreover, it is at this stage that the quarry benches will be developed and the loading areas are prepared.

Limestone materials are broken with combinations of drilling and blasting and bulldozer ripping. About 80% of all limestone materials are broken by explosives, while the 20% by bulldozer ripping. Broken materials are then loaded by 6-7 cubic yard pay-loader on to 35-ton off-highway trucks, for delivery to the crusher over a 1.0 km. haulage road. Blasting is done twice a month using the “full system” initiation technique. Powder factor will be maintained at 0.12 kg explosive per MT limestone quarried. Main explosive charge will be ANFO; with one (1) 55 mm X 400 mm dynamite (emulsion explosive) as primer. In-hole delay will be at 300-400 MS while surface delays will be at 25MS and 42/65MS for control and echelon rows, respectively. Hydraulic track drill is being used to bore 10cm-diameter holes of up to 8.5m depth and hole spacing of about 3m x 4m with 89 mm diameter blast-hole, depending on the lithology of the material to be quarried.

Shale quarry operations involves mainly bulldozer ripping, dozing and stockpiling to designated loading levels. Stockpiled shale materials are loaded by 6-7-yard wheel loaders to 35-ton off-highway trucks for delivery to the nearby crusher. Active benches will be pushed back at 5-meter bench heights but final bench height will be at 10 meters’ height with 7 meters sub-benches to guarantee slope stability.

- **Drilling and Blasting Techniques**

Drill and controlled blasting will be employed for about 80% of all limestone materials to be quarried while the remaining 20% by ripping. In order to minimize vibrations, fly rock, air blast and noise impacts, full initiation system technique is utilized. Blasting activity is done twice a month and performed only during the daytime.

The Initiation System is more effective than delay system, which only uses in-hole delays. The combination of surface and in-hole delays adds delay time through the blast, starting with the first blast hole to be initiated. This ensures that the timing of the blast holes toward the back of the blast is dependent on the blast holes immediately in front. Actual firing times are calculated by adding surface delay times of every blast hole connected in sequence to that particular blast hole.

Safety precautions will always be implemented with appropriate signaling, sounding of sire, guarding at possible entry points, personal warning to nearby households and other safety rules and regulations in handling and storing of explosives.

The explosive magazine is located beside the active limestone quarry area. It is fully secured with double fence and guards are posted 24/7. Entry is fully controlled by issuing Entry Permit by the Quarry Manager, particularly during maintenance work (housekeeping and grass cutting). It has 4 storage compartments separated about 20m and 30m away from each other with rock barriers. There are two keys for each compartment that are in the custody of the PNP and the quarry contractor. Both are present during withdrawal time.

Absolutely no blasting will be done in areas near the caves. This is to ensure that the caves will be protected as well as the groundwater resource it may contain.

RCMI notes that there are existing caves in areas outside of the quarries. There is absolutely no blasting activities being done in areas near caves to ensure their protection. Cave No. 9 is in Champaca parcel of MPSA-104, which is not part of quarry.

It is ensured that the penetration of aquifers below the limestone deposits is avoided. Quarrying is conducted above the natural springs w/ buffer of at least 50m. The final pit bottom will be at +60 masl for limestone and at +30 masl for shale.

Hauling of Raw Materials from Quarry to Plant

The stockpiled broken materials will be loaded into the dump trucks (37MT). The materials loaded into the trucks will then be hauled from the quarry are to the crusher. Limestone and shale from the mines shall be conveyed to the plant dumping into Crusher house.

1.5.1.2 Cement Processing

Crushing Process
Existing

Crushed materials are made to pass through a series of screen to filter out larger sized materials. Maximum size of 800mm will be reduced to 150mm in the primary jaw crusher. The secondary crusher product is passed thru a screen to maintain a product output of 25-40 mm particle size. Oversized materials are then feed back to the secondary crusher for further size reduction. All crushed materials are stored in the storage building ready for drying.

Those crushed materials at correct sizes are dried using two drum dryers with a capacity of 145 TPH. These dryers are fired with mixed fuel; bunker, coal and alternative furl to dry the material to the desired moisture content. Materials are fed at the feed inlet of the cylindrical drum and counter currently dried by hot gas produced from the dryer furnace. Controlled drum revolution, and dryer internal lifting flights allow sufficient materials surface dispersion inside the dryer to effect moisture removal.

Dried materials are then conveyed to the storage building ready for raw milling.

Proposed

Limestone/shale shall be crushed in a 1400 tph double shaft hammer crusher. The system shall be having provision for bypassing/pre-screening before feeding to the crusher to avoid the overloading of the crusher based on the sieve analysis done by the bidder. Maximum feed size of Limestone/Shale shall be 1000mm edge to edge and the product size shall be 95% < 75 mm (max 80 mm). The limestone/shale is then transported through stacker conveyor to the stockpile, which are located in quarry area.

A cross belt analyzer is envisaged for monitoring and correction of raw materials (limestone & shale) quality. The signal/reports from the analyzer shall be accessed from both Quarry Office and laboratory.

Limestone shall be stored in a covered circular pre-blending chevron type stockpile of 45,000t capacity. A luffing and slewing type boom stacker is envisaged to stack the material. The pre-blending stockpile for limestone shall reduce the quality variations in the limestone as received from the mines. The stockpile shall be able to achieve the desired blending efficiency of 10:1. Bridge type reclaimer with harrow is envisaged to reclaim the material from stockpiles. Design of reclaimer shall be circular, i.e., without retaining wall stockpile design. Stacker / Reclaimer rails fixing shall be with expansion bolts.

Shale shall be stored in a covered circular non-blending chevron type stockpile. A luffing and slewing type boom stacker is envisaged to stack the material. Bridge type reclaimer is envisaged to reclaim the material from stockpiles. Design of reclaimer shall be circular i.e. without retaining wall stockpile design. Stacker / Reclaimer rails fixing shall be with expansion bolts.

Both the Stackers and Reclaimers shall be operated through microprocessor-based PLC control with a provision for interfacing with plant PLC through wireless communication.

Reclaimed limestone and shale from the separate Reclaimers shall be transported and fed to raw material hoppers through a set of common belt conveyors. A belt weigher and magnetic separator shall be considered on the conveyor after reclaim conveyor.

Clinkering Process
Existing

The raw meal from the raw mix silo is conveyed through a bucket elevator onto the four-stage preheater tower. The meal is then fed to the first stage cyclone at a feed rate of 110 TPH and feed temperature of normally 50°C. The meal is then suspended from the first stage cyclone (top) to the fourth stage cyclone (bottom). This preheating process ensures efficient heat transfer to dry and preheat the meal before the calcination process in the kiln. The available hot gas exhausted from the kiln is responsible for this heat transfer preparing the meal for the kiln burning.

The prepared meal is then fed from the fourth cyclone to the feed end. It is then calcined at temperature from 805°C to 1,200°C at the calcining zone. Formation of liquid phase and other minerals is observed in the transition zone at 1200°C to 1400°C. clinkering then finally occurs at the sintering zone of the kiln where the zone temperature reaches the peak temperature of 1450°C. Clinker is formed and is slowly cooled bringing the temperature down from 1450°C to 1290°C in the cooling zone of the kiln.

Clinker is then discharged from the kiln to the Air Quenching Cooler for further quick cooling from 1290°C to 100°C. From the cooler, the clinker is transported to the clinker storage for stocking and ambient cooling.

Proposed

One continuous flow inverted cone /flat bottom type homogenizing silo of capacity 15,000Mt shall be considered for storing and homogenizing of raw meal. 3D scanner type level monitoring system and a high-level switch are to be provided to indicate the level of raw meal in the silo.

The raw meal silo system shall reduce the quality variation in the raw meal so that the kiln feed is of a sustained desired quality within the permissible range. Degree of silo emptying shall be minimum 98%. Blending efficiency of the silo shall be 10:1. Roots blowers shall be provided to supply air needed for the purpose of silo aeration. Standby roots blowers shall be provided for silo aeration.

Raw meal shall be extracted by a set of flow control gates and air slide, and fed to Kiln feed bin, located under raw meal silo. Kiln feed bin shall be aerated by roots blowers. Stand-by roots blowers shall be provided for kiln feed bin aeration. Capacity of kiln feed bin shall be 100t. For control system, kiln feed shall be with gravimetric feed control.

Material from kiln feed bin shall be extracted through two sets of shut off gates and dosing valves. Two extraction systems, one each for 2 preheater strings shall be provided for the kiln feed bin. The material shall be weighed through “Roto” weigh scale (pfiester or corriolis) or Solid Flow meter.

After extraction and metering of kiln feed material, it shall be fed to preheater through belt type bucket elevators. At the elevator discharge, air slide shall be provided to pre-heater feeding with 4th or 5th stage cyclone feeding options through a set of air slides.

Screw samplers shall be provided downstream the kiln feed before kiln feed bucket elevators and Raw Meal Silo Feeding Bucket Elevators for extraction of raw meal samples. Sample collection and transport shall be automated.

Finish Grinding

The finish milling section consists of 3 units of feed bins for clinker, gypsum and pozzolan. Currently, finish grinding operations also utilize the grinding mill. Clinker and gypsum are conveyed to the ball mill at a pre-determined proportion to produce Type 1 cement, while Clinker, gypsum and pozzolan are conveyed to ball mil to produce T-P cement. These are the two main types of cement the Company is producing, although there are experimental type and other trials done to suit the requirements of the customer. The ball mill is capable of reducing material feed size to specific surface area of 3100cm2/g for type 1 and 4100 cm2/g for T-P. In terms of fineness, this ball mill can reduce to at most 4% retained residue on a 200 mesh Tyler screen (or 75μm diameter). After the ball mill, the product is stored at the cement storage silo and ready for packing.

A small amount of gypsum (3-5%) is added to the clinker to regulate how the cement will setting time. The mixture of clinker with gypsum will produce cement. Republic Cement also uses different cementitious materials such as fly ash, bottom ash, limestone, EP Dust, escombro, shale, and pozzolanic materials fly-ash and pozzolan in order to reduce its carbon footprint while maintaining world class quality standard.

Packing

Cement product from finish grinding mill is conveyed by pneumatic transport pump into Cement Silos. Currently, packing operations also utilize the packing plant of Republic Cement Mindanao, Inc. From cement silos it is being withdrawn into control bins and bagged by three packers at 25,000 bags production per shift for two shifts daily. This is equivalent to monthly production of 1,000,000 bags or 12 million bags annually. Sixty-five percent of it is on offshore, loaded to ships and barges by means of conveyor and boom cranes, while 35 percent is on overland trucking. Aside from the conventional 40 kg type bag cement, RCMI is also producing 1- ton big bag type cement, which is about 4% of the total annual production.

The Process Flow sheets for the proposed expansion are given in **Figures 1-32 to 1-37**.

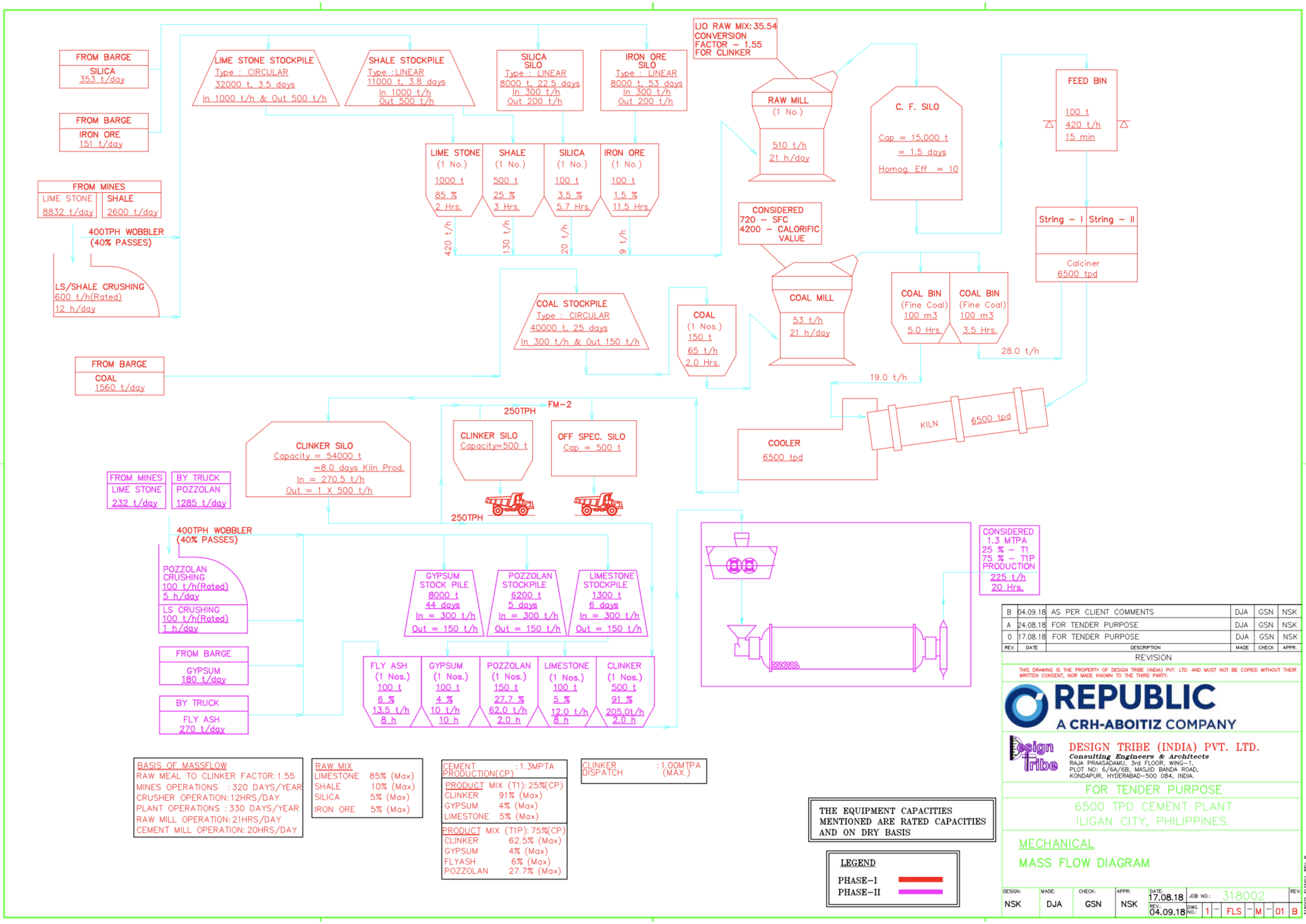


Figure 1-32. Mass Flow Diagram

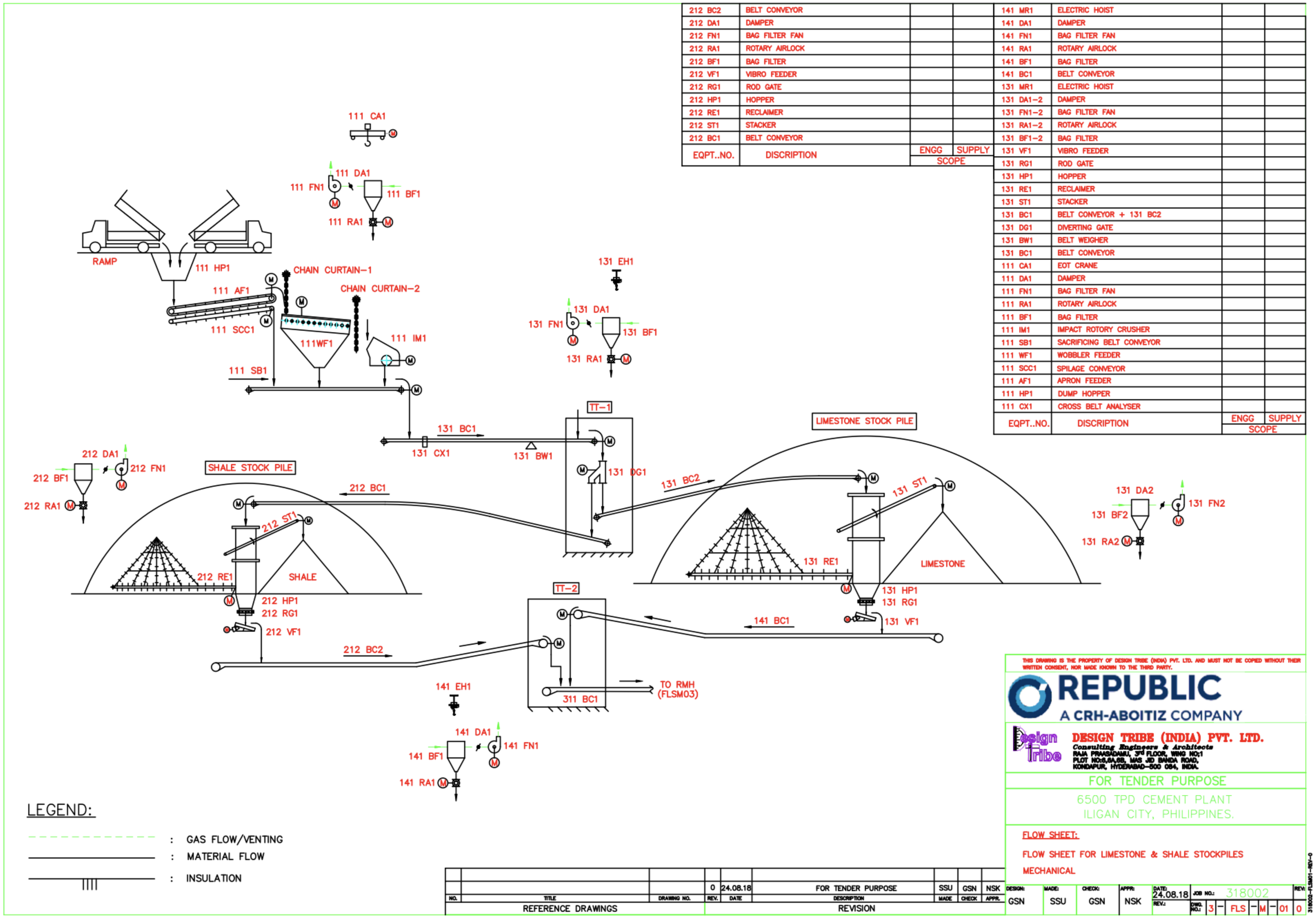


Figure 1-33. Flow Sheet for Limestone and Shale Stockpiles

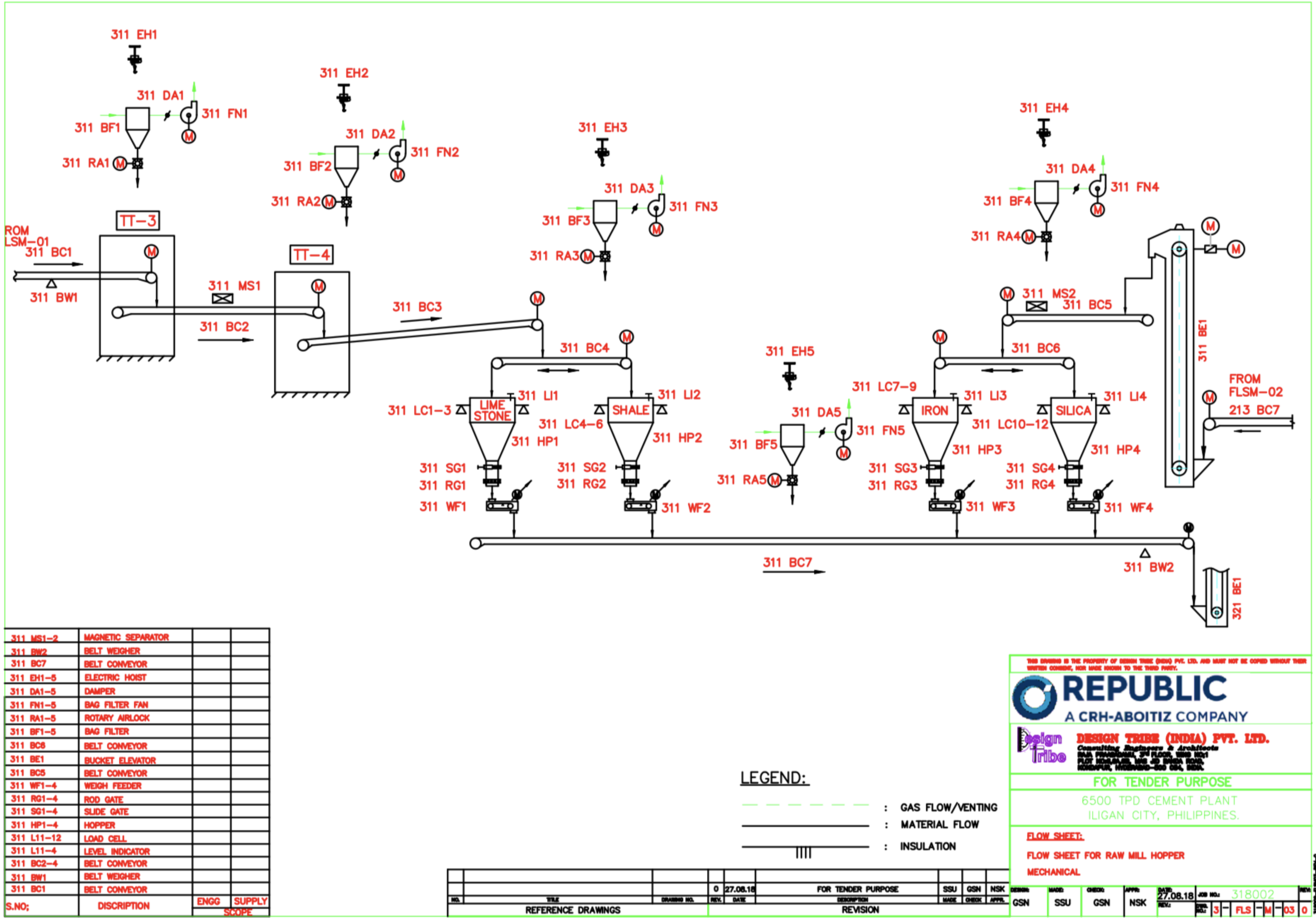


Figure 1-34. Flowsheet for Raw Mill Hopper

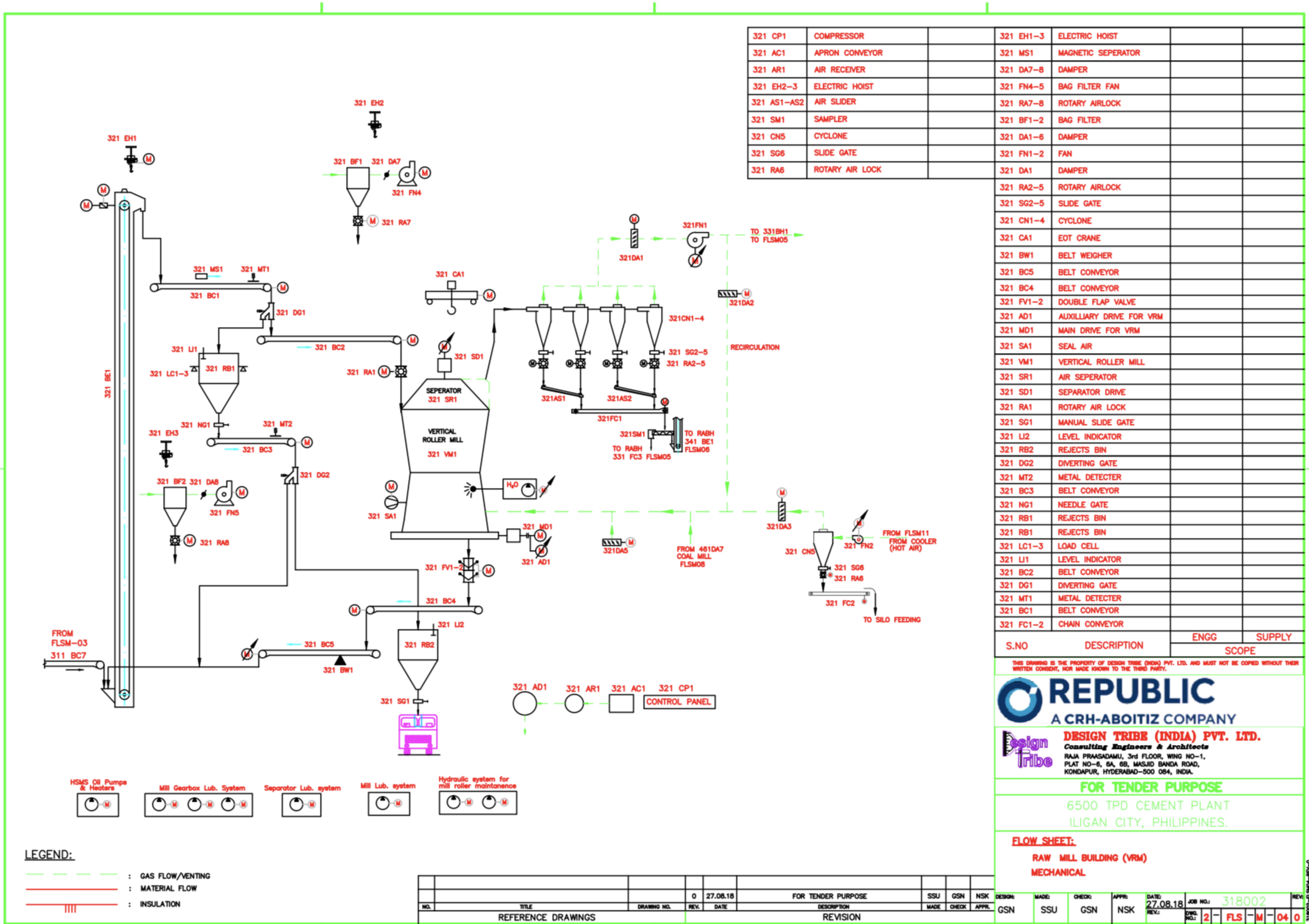


Figure 1-35. Flow Sheet for Raw Mill Building (VRM)

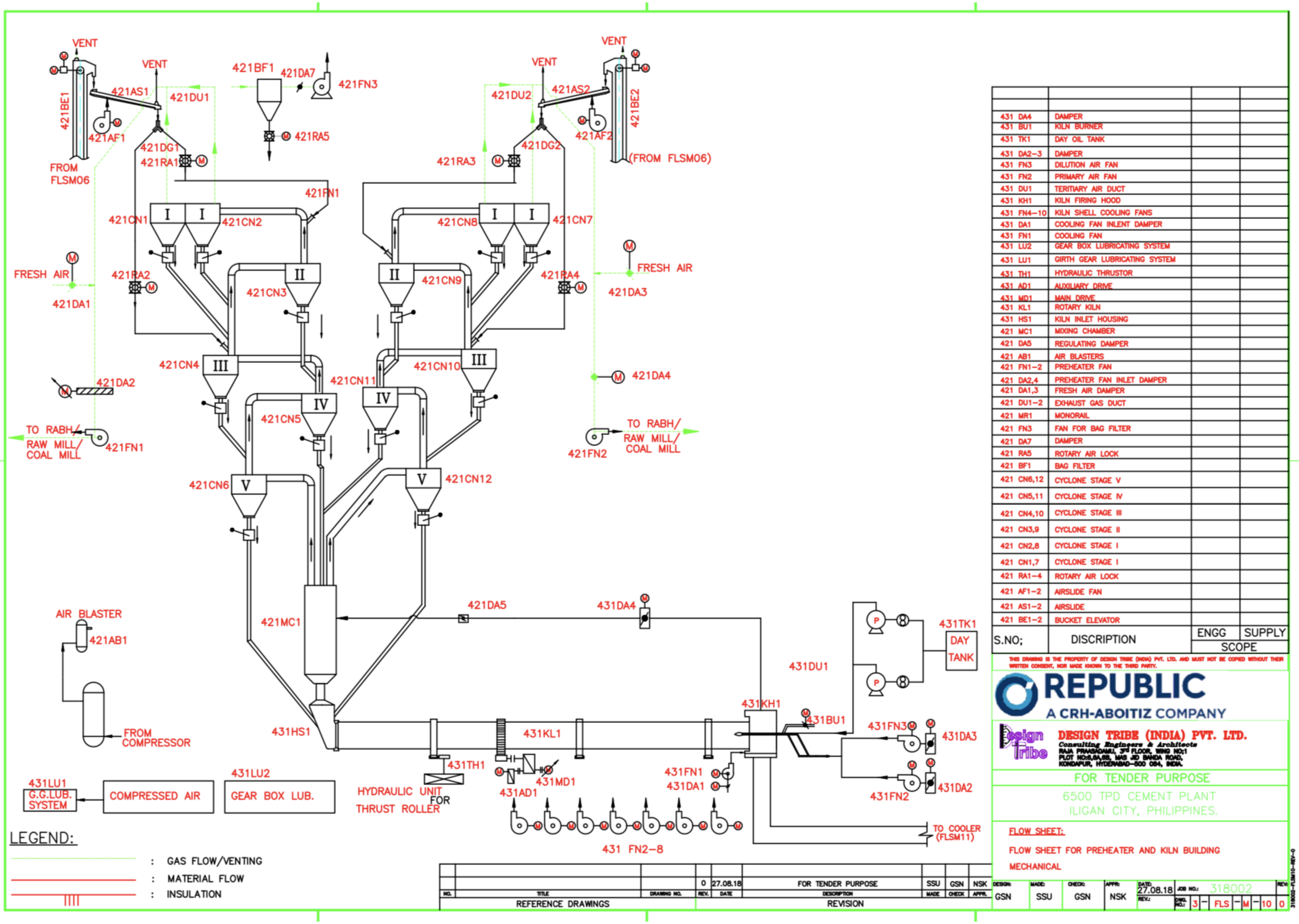


Figure 1-36. Flow Sheet for Pre-Heater and Kiln

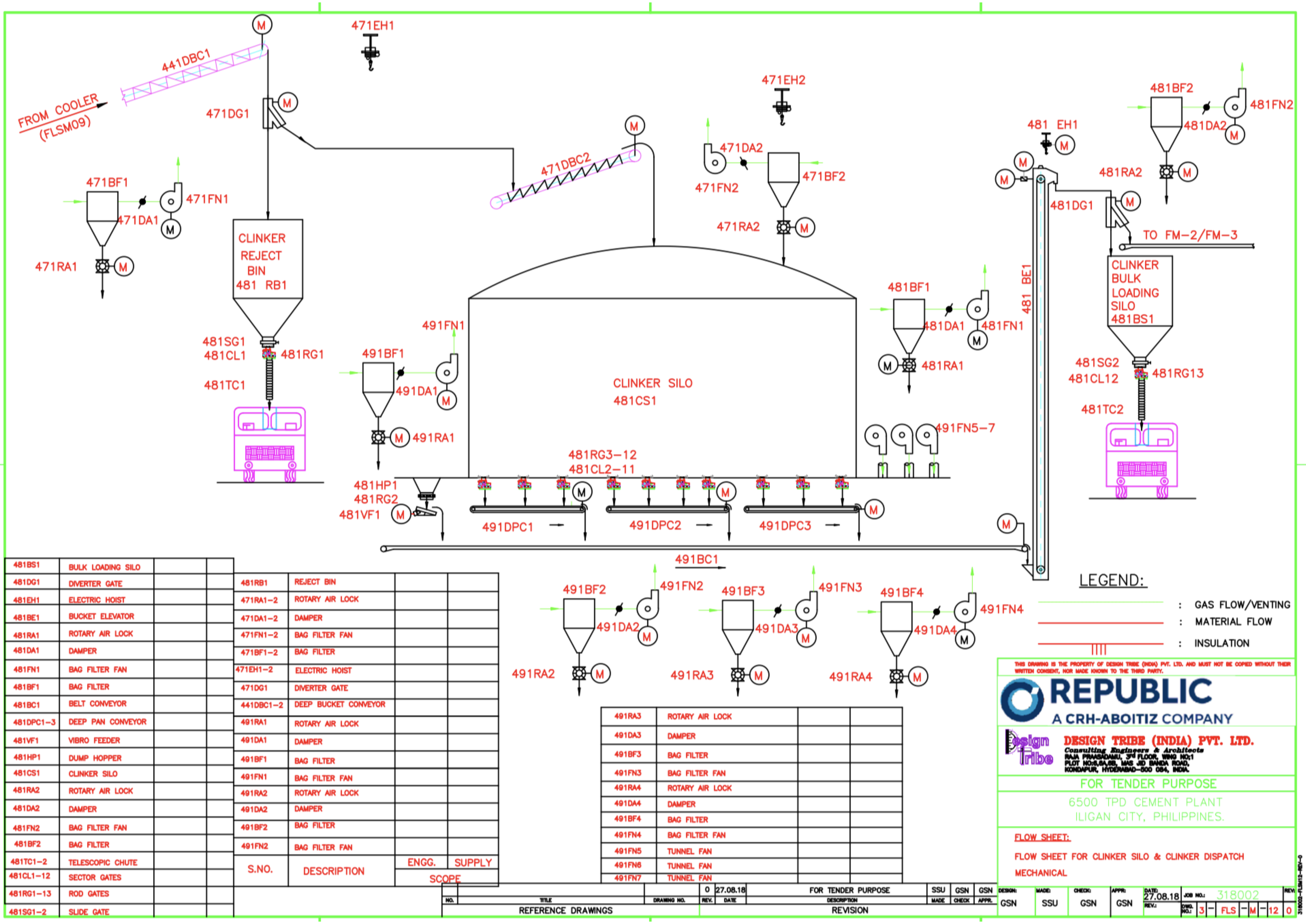


Figure 1-37. Flowsheet for Clinker Silo and Dispatch

1-5.2 Description of the pollution control devices and waste management system
1.5.2.1 Waste Management System

Solid Wastes

RCMI is an ISO 14000:2015 accredited company. Part of the accreditation is the establishment of a solid waste management system in all phases of the operation. Pursuant to RA No. 9003, the Company implements on-site waste segregation as embedded in its Solid Waste Management Program.

There are 3 levels for collection/disposal of solid wastes. Level I is for offices and control rooms installed with collecting bins labeled as paper, food wastes and plastics, cans and glasses. Level II is for color-coded bins strategically located throughout its plant and quarry sites. Level III are storage facilities for waste recovery as follows:

a. Scrapyard: metal scraps only
b. Material Recovery Facility (MRF): for non-biodegradable/recyclables for use as Alternative Fuel
c. Hazardous Wastes Storage Facility: for hazardous solid wastes
d. Temporary Used Oil Storage: for waste oil and oil-contaminated wastes
e. Reusable Parts: reusable mechanical parts
f. Compost Pit: for biodegradable wastes.

The garbage/biodegradable wastes are collected daily and disposed in a compost pit. Residual wastes (plastics/flecon bags) are collected daily by a service contractor (RC Barretto) as scheduled and are disposed to the MRF at Brgy. Bonbonon with a charge of Php 200/m^2.

Metal scraps, glass/bottles are collected periodically and placed in the designated scrapyards while waiting for its disposition. Scrap buyers regularly come to the plant for these. The scrapyard is located near the MRF and Hazardous Waste Storage (new facility constructed in 2018), which are at the back of the storage area. Please see **Figure 1-10**.

There are no by-product wastes generated because if and when the clinker is off-specs, the same is recycled into the system.

With regards to hazardous wastes, RCMI handles the management, which complies with RA 6969. The company was issued the following permits: DENR registration ID, Chemical Control Order (CCO) for Asbestos and PCB, and TSD Permit. The plant was also granted with Cement Kiln Co-processing Registration Certificate, which permits the company to use acceptable wastes as alternative fuel and raw materials provided that it shall comply with the requirements of RA 6969 and other related regulations and guidelines. The generated/disposed quantity of each type of hazardous waste is monitored, recorded and reported. The Company has an existing P.O. with Pyrotech Solutions for the disposal. As reported in the SMRs, the hazardous wastes generated by RCMI and its Contractor Aggreko from 2015 – 2018 are as follows:

- Used Oil /Bunker sludge /Contaminated Oil - 83,892 L
- Used Vegetable Oil - 418 L
- Asbestos Roofing - 267,922 m^3
- Fluorescent lamp/bulb - 534 m^3
- Rugs contaminated with Oil - 105 kg
- Used Truck Oil Filters - 3,372 kg
- Damaged Batteries - 2,711 kg
- Pathological Wastes - 22 kg

Used oil as well as used truck filters, rags/gloves contaminated with oils are separately contained in drums provided with secondary containment for future disposal. Waste electrical transformers using PCB oil are temporarily stored in a building with secondary containment for future treatment and disposal.

Asbestos-containing materials, clinical wastes and other hazardous wastes are temporarily stored and segregated at the Hazardous Wastes Storage Facility with proper labeling and with second containment. Busted fluorescent bulbs are placed inside plastic drums and sealed to prevent spillage in case the bulbs are broken. Emergency oil spill kit is also provided.

In case of spillage of bunker fuel stored at the tanks within the plant and when the secondary containment cannot prevent the flow of oil to the drainage canals, the steps outlined below will be undertaken. Bunker fuel oil (BFO) for process use is presently contained in 2 tanks within the plant.

1. Control the spill by sealing the source (tank)
2. Report the incident to the local Coast Guard for assessment of the spill
3. Alert the Oil Spill Response Team to conduct clean-up operations
4. Report the incident to EMB

In the case of pier operations, RCMI must ensure that in the loading and unloading of raw materials, solid fuel and cement, the risk of occurrence of accidental spill must be minimized. This is achieved through the proper implementation of the EMS.

Overburden/Quarry Wastes

The overburden/soil wastes represent the largest volume of solid wastes. These are temporarily stockpiled in designated quarry waste dump area. Overburden are used as backfilling materials for low-lying areas, and/or for the progressive rehabilitation of mined-out areas. These are likewise used for safety berms along haul roads.

A total of 46,685 MT of mine wastes was generated from 2015 to 1st Semester of 2020. 1,421 MT was utilized in the berms while the remainder was brought to the dumpsite (See **Table 1-16** above). Considering that there is only a small amount of overburden at the quarry areas, limited amount of mine waste is generated during the extraction. Some of the overburden will be blended with high-grade materials, which will be delivered also to the crusher. The remaining overburden is used as backfilling materials for low-lying areas, and/or for the rehabilitation of mined-out areas. Overburden is also used as safety berms at haul roads.

Wastewater

Wastewater produced within RCMI is associated with both domestic use and the process water.

Water coming from the toilets would flow through concrete drainage canals and into the specific 3 chambered septic tanks located within the cement plant. On the other hand, the water from the sinks would flow to the sewerage draining into the canals. A network of drain ditches are available within and around the RCMI plant vicinity, which catches runoff water and allows the passage of water into the nearby creek.

The plant has 3 major oil-water separators to ensure no oil leaks will reach the receiving water bodies. The canals exit towards the box culvert located at the highway. From the culvert, water passes through the highway and is fed to the creek that exits into Iligan Bay. Effluent monitoring was religiously conducted every quarter with the presence of MMT during the actual sampling.

At the quarries, surface runoff is directed into the ditches/drainage canals and then into the siltation ponds for temporary storage and settling of suspended particles/sediment before they are discharged into the spillway. In the active quarry area and along the benches, drain canals are constructed at the toe of the benches to allow rainwater to flow towards the ponds. Collected silt is removed regularly as required, stockpiled in nearby area and set aside as materials for backfilling. There are 9 existing siltation ponds in the quarries and one pond shall be added in the future.

1-5.3 Operation and Maintenance of Facilities

At the Plant

All transfer points shall be properly de-dusted. Maintenance cranes, hoists and monorails shall be provided for maintenance, wherever required.

VRM shall be under covered shed/building. A suitable capacity of EOT crane to be considered for maintenance.

A dozer entrance shall be provided in the Clinker Silo for enabling trucks/dozers to enter it for maintenance / emergency requirements.

The fuel handling system shall be provided with isolating valves for maintenance and check valves to prevent reverse flow in the system.

Required facilities for the plant maintenance shall include:

1. Extra quantity of Refractory, Castable, Insulation to be on hand
2. Mechanical /Electrical Maintenance

   Maintenance cranes (fixed, double girder type) for: Workshop (Mechanical, Electrical and Warehouse (optional)); Burner's platform; and fixed facilities for various departments as per maintenance requirement.

   Beam with trolley for: Coal Mill; all bucket elevator; all process fans; Mill feed building; Preheater tower; all silos; and wherever required for proper maintenance. Monorail hoists, lifting hooks etc. as per maintenance requirement.

All necessary commissioning tools, special tools and insurance tools are to be stored in the plant including spare parts required for 2 years normal operation of plant.

At the Quarry

To offset the impact of heavy vehicle traffic, the access and haul roads within the project site are regularly maintained in safe conditions. Ditches/canals on the sides to contain and direct surface runoff water. The dust, on the other hand, is controlled by regular water sprinkling as well as requiring vehicles to maintain low speed.

For the vehicles and quarrying equipment, the Contractor has its motorpool where the equipment are regularly checked, and repaired if necessary.

At the Pier

- Coordination of the schedules of vessel arrivals and departures with the PPA, PCG, and Maritime Command
- Adequate waste holding and pump-out trash disposal facilities
- Collection and treatment of used oil and grease generated from pier facility repair, operations and maintenance.
- Provisions installed to prevent soil erosion, siltation and turbidity of Iligan Bay waters.

1-6 Project Size

Table 1-19. Total Amount of Ore/Mineral Reserves

	2002 (EXISTING ECCs)		2019	
Category	Tonnage (MT)	Grade (%CaCO3)	Tonnage (MT)	Grade (%CaCO3)
LIMESTONE				
Proven	285,864,000	Incomplete Data	248,891,497	90 – 95

	2002 (EXISTING ECCs)		2019	
Category	Tonnage (MT)	Grade (%CaCO3)	Tonnage (MT)	Grade (%CaCO3)
Probable	64,400,000	Incomplete Data	64,400,000	90 – 95
Potential	-	-	132,800,000	90 – 95
TOTAL	**350,264,000**	Incomplete Data	**446,091,497**	90 – 95
SHALE				
Proven	88,827,000	46.62	76,595,979	42.27
Probable	19,900	NO DATA	19,900	NO DATA
Potential	NO DATA	NO DATA	NO DATA	NO DATA
TOTAL	**88,846,900**	**46.62**	**76,615,879**	42.27-

The total limestone reserve (mineable) is 248.89 MMT and the shale reserve is 76.6 MMT.

Table 1-20. Total Amount of Ore/Mineral to be Extracted

Particulars	Current/ Existing ECC	Proposed Expansion
Limestone	1.72 MMPTY	5.91 MMPTY
Shale and other siliceous materials	0.51 MMPTY	2.29 MMPTY

Table 1-21. Annual Cement Milling Capacity:

Mineral Processing	ECC	Existing	Proposed
Cement Milling	ECC No. 0803-009-2231	2.0 MMTPY	4.30 MMTPY
Clinker Production	ECC No. 0505-004-105	0.61 MMTPY	3.70 MMTPY

Table 1-22. Project MPSA and Quarries Total Area

ECC NO.	MPSA NO.	MPSA AREA Covered by Existing ECC		ACTIVE PARCELS FOR LIMESTONE QUARRY		ACTIVE PARCELS FOR SHALE QUARRY	
		EXISTING (ha)	PROPOSED (ha)	EXISTING (ha)	PROPOSED (ha)	EXISTING (ha)	PROPOSED (ha)
0803-009-2231	031-95-XII	323.0953	323.0953	131.0954	131.0954	191.9999	191.9999
9611-03-302	105-98-XII	26.7867	26.7867	26.7867	26.7867	0	0
0505-004-105	104-98-XII Amended	519.0879	519.0879	0	0	24.7434	24.7434
Total		**868.9699**	**868.9699**	**157.8821**	**157.8821**	**216.7433**	**216.7433**

It should be noted that the 3 ECCs being held by RCMI cover the whole MPSA contract areas (868.9699 ha) for its quarrying production activities. It is only based on the Proponent's discretionary development planning that it focused its current quarrying activities in the abovementioned active parcels.

The quarry development plans for the near future shall cover the present active parcels only, after which, may also include other parcels after ten years or later, if exploration results are favorable.

In addition, RCMI holds ECC No. 10(35) 02 08-26 3037-50200 for Pier & Loading Facilities for the operation of its Pier and Loading facilities.

1-7 Development Plan, Description of Project Phases and Corresponding Timeframes

Phases to be described in terms identifying specific activities (with special attention on those with significant environmental impacts as well as climate change adaptation options relevant to the project and project activities) and corresponding projected implementation timeframes:

A description of the activities during the various project phase will provide inputs for impact Identification, environmental management plan and social impacts/appropriate socially-oriented program.

1-7.1 Pre-construction (e.g. planning, acquisition of rights to use land, etc.)

This involves the exploration stage, project planning, the securing of appropriate Clearance(s) and permit(s) from the DENR / EMB principally the ECC and from the MGB, such as the MPSAs. Feasibility studies which include economics evaluation are integral part of this phase.

1-7.2 Construction (e.g. land/site clearing, temporary housing, transport of materials, health and other services for the workforce, discussion of temporary facilities including the progress of works/milestones and the number workers required per milestones)

During this phase, additional equipment will be purchased and assembled on site. Proper occupational safety and health procedures would be implemented to ensure the welfare of the workers. As the facility upgrade would proceed along with the operation of the existing facilities for a certain period, additional guidelines on work delineation and management would be implemented to avoid any delays and conflicts of both activities.

1-7.3 Operation (projected period of start-up/commission/full operation of various project components) include discussion on the operation of various components (as identified above) in terms of raw materials, fuel requirements, waste management and infrastructure requirements

Major activity of the plant will involve 24/7 operation of the clinker & cement production and of quarrying of raw materials. Skilled workers will be employed. The same strict observation of occupational health and safety during construction would be followed.

1-7.4 Decommissioning/Abandonment/Rehabilitation

A decommissioning or abandonment plan will be prepared and submitted for approval by the EMB before the plant operation shall cease. Cessation will be occasioned by factors such as reaching the MPSAs contract term; the mine life; non-viability of the operation; etc.

An Environmental Site Assessment (ESA) will be conducted and submitted to the EMB in partial support of the decommissioning plan.

Inasmuch as the plant has not been implemented as of this time and the abandonment will not take place until after several years, e.g. 25 years, the Abandonment Plan cannot yet be established. However, generically the contents of a Plan shall include the following:

- Identification of Possible Site Residual Contaminants principally
  Metallic elements
  Organic contaminants

For the quarrying operations, the abandonment shall be subject to the requirements and regulations of the MGB and the conditions for the MPSAs. The EPEP and FMRDP for both MPSA 104-98-XII and MPSA 031-95-XII have been approved. See **Annexes 1-1 and 1-2**, respectively

1-8 Manpower

Tabulate the following per project phase (pre-construction, construction, operation and maintenance): Manpower requirements; Expertise/skills needed; Nature & estimated number of jobs available for men, women and indigenous peoples (if in IP ancestral land); Current policy/Scheme (and amendments, if any) for sourcing locally from host and neighboring LGUs

Table 1-23 summarizes the manpower requirements for RCMI throughout the various phases of the proposed project while **Table 1-24** lists down the manpower for both RCMI and its service contractors. Around 1,000 workers will be employed for the expansion project during the construction stage.

The existing manpower for operations of RCMI totals to 166 for both the plant and the quarries. Its quarrying Contractor (Delta Earthmovers) maintains 68 personnel, while all other contractors for arrastre/stevedoring, janitorial, security, and account for 745 workers.

During the operations phase of the proposed expansion, the number of RCMI workers shall go up to 184 (additional 18) while the workers for the contractors shall remain the same. In total, there will be 813 workers.

RCMI will prefer hiring of locals whose skills and experience match the specific needs of the project. The proponent will also provide the necessary training of locals for possible hiring as the need arises.

Table 1-23. Manpower Complement (RCMI)

Division/ Department Job Titles	Existing	Proposed Expansion
Management	22	22
Production	79	86
Finance	3	4
Human Resource & Admin	2	2
Land & Security	2	2
Health & Safety	2	2
Project Team	0	3
Maintenance	44	49
Laboratory & Quality Control	10	12
Environmental & Community Relation	2	2
TOTAL	**166**	**184**

Table 1-24. Manpower Requirements for Proposed Expansion

Project Phase / Activity	Estimated Manpower Requirements	Skills Requirements
CONSTRUCTION	1,000	Engineers, Project Managers, Skilled and non-skilled laborers
OPERATIONS		
RCMI	184	Management and administration skills; over-all knowledge on the operation including key environmental, labor and local ordinances
Delta Earthmovers	68	Engineers, Project Manager, Skilled and non-skilled laborers
Other Contractors	745	
Cement packing and stevedoring	264	Skilled and non-skilled laborers
Security	63	Trained guards
Janitorial Services	22	non-skilled laborers
Guesthouse Maintenance	5	non-skilled laborers
Warehouse housekeeping	3	non-skilled laborers
Mechanical Contractors	36	Skilled mechanics
Internal Hauling and Scaffolding	110	Skilled and non-skilled laborers
Clinic	5	Doctors, nurses, medical aides
Canteen	13	Skilled and non-skilled food service workers
Electrical	9	Skilled electricians
Special Projects	215	Professionals, skilled and non-skilled laborers
Total Operations	**813**	

1-9 Indicative Project Investment Cost

The indicative project investment cost is approximately **PhP 18 Billion**.

SECTION 2. ASSESSMENT OF KEY ENVIRONMENTAL IMPACTS

2.1 LAND

2.1.1 Land Use and Classification

2.1.1.1 Impact in terms of compatibility with existing land use

This application for ECC amendment covers the proposed increase in clinker production, cement finish mill production; and shale and other siliceous quarrying production. All these shall be conducted inside the existing plant and quarry areas.

The land for the plant facilities (the clinker and cement production), the quarrying operation, and the pier facilities are at the pre-existing sites. The plant site is privately-owned land of RCMI composed of 4 adjacent lots, while the quarries are within the existing MPSAs of RCMI, including the recently acquired Limestone Quarry Project from MCCI. Both the plant and mining tenements are within Alienable and Disposable (A&D) land. Please refer to **Figure 2.1-1**.

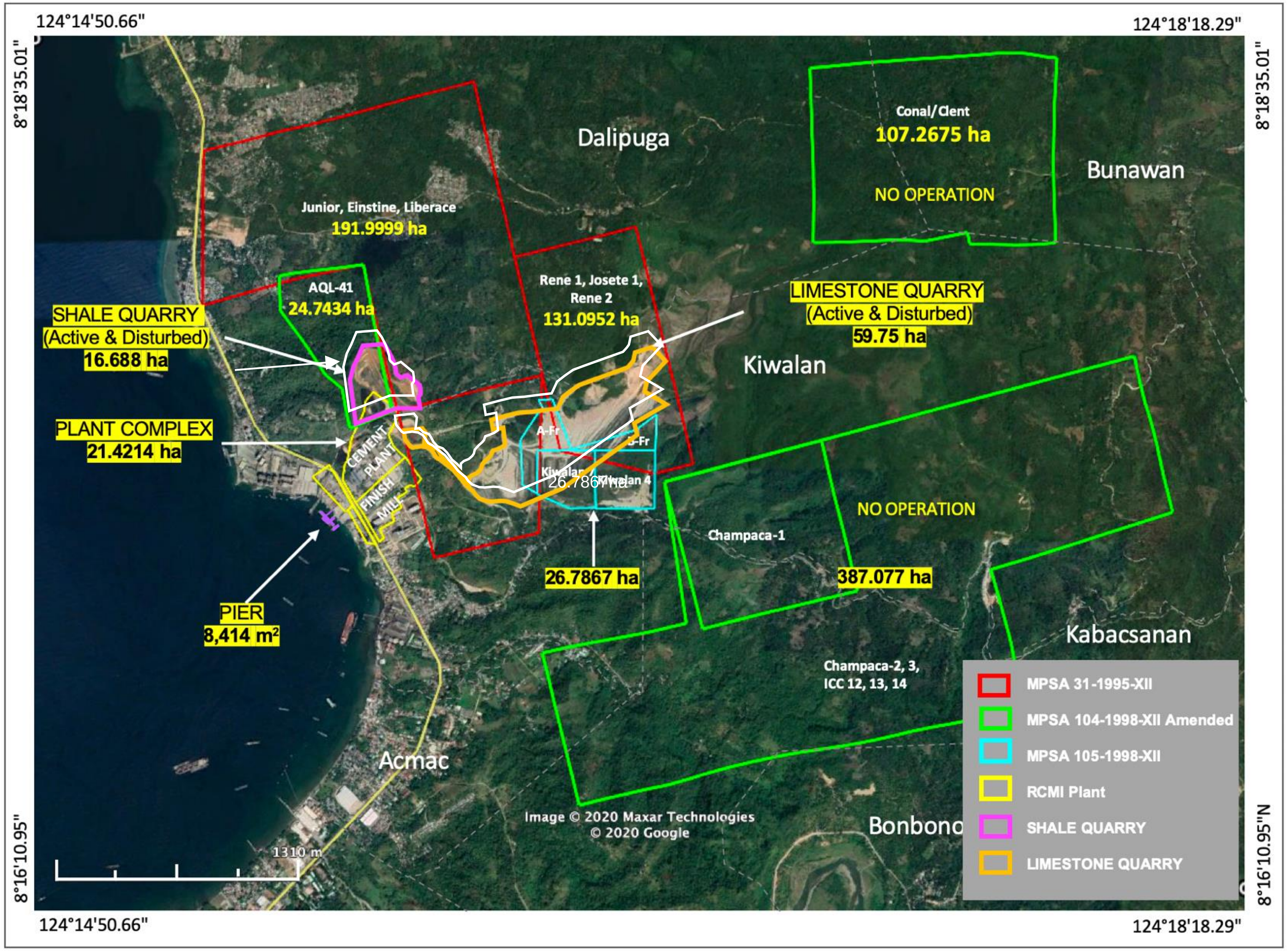
The active and disturbed quarry sites are located within certain parcels of MPSAs as follows: shale quarry: MPSA No. 031-95-XI (Parcel Junior, Einstine, Liberace) and MPSA 104-98-XII Amended (Parcel AQL-41); and limestone quarry: MPSA 031-1995 (Parcel Rene 1, Josete 1, Rene 2) and MPSA 105-1998.

As discussed under Project Description, the original 25-year contract term of MPSA No. 031-95-XI expires on December 2020 for which an application for its first renewal for another 25 years was approved by DENR-MGB Central Office on January 17, 2020 (**Annex ES-3)**

In addition, the Proponent has surface ownership of some portions of its mining tenements and some other lots outside its tenement boundaries.

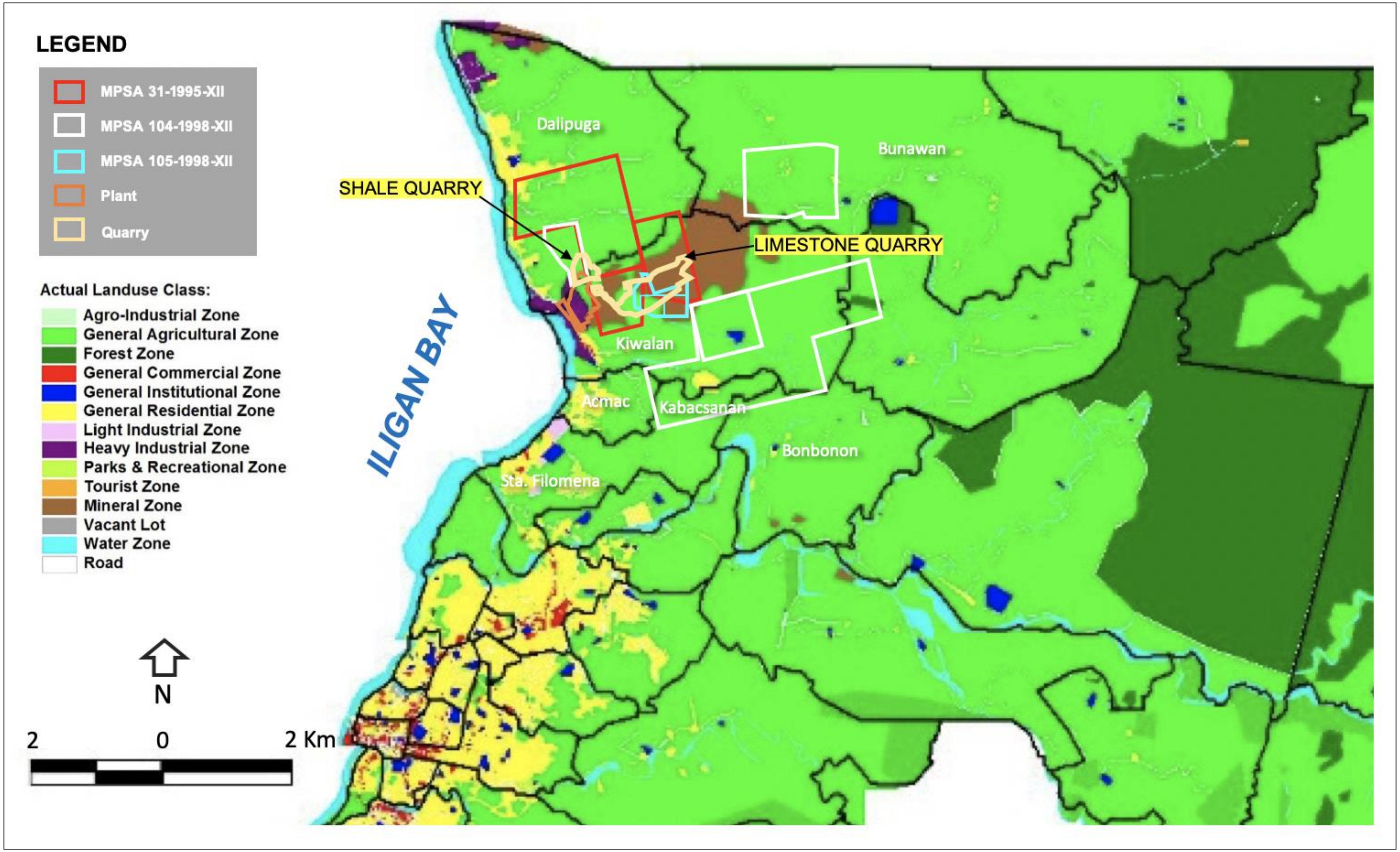
The pier area and beach pad are covered by Foreshore Lease Agreements (FLA No.103504-84 and FLA No. 103504-20) with a Provisional Permit No. 2019-000029 and a Revocable Permit No. 2020-00002, respectively. There will be no additional structures to be developed, rather, the Company shall be using the existing pier and beach pad facilities.

Figure 2.1-2, which is the Existing Land Use Map of Iligan City, shows that the plant site is largely within the "Heavy Industrial Zone" and partly in the General Agricultural Zone (GAZ). The shale quarry is within the GAZ while the Limestone Quarry largely falls within the classification of "Mineral Zone", with a smaller portion in the GAZ. Nevertheless, the fact that the quarry sites are covered by mining tenements and Permit to Operate shows that quarrying operation is allowed in the said areas. Furthermore, in the Comprehensive Land Use Plan of Iligan City (2013-2022), it is stated that mining and quarrying zones in barangays Dalipuga and Kiwalan were designated as mineral zone in support to mining companies such as Portland Cement (now RCMI).



Source : RCMI December 2018, Updated MPSA September 2020

Figure 2.1-1. Project Location Map



Source: Iligan City CLUP, 2013-2022

Figure 2.1-2. Existing Landuse Map

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

Inasmuch as the proposed project site is located within the private land and the mining tenements of Republic Cement and was previously the project sites of Mindanao Portland Cement Corporation (MPCC) and Iligan Cement Corporation (ICC), there are no known protected area within or near the proposed project site. Moreover, other industrial establishments are located near the site, e.g. Pilmico, Granex, some of which have their own private piers as well.

With respect to proclaimed Protected Areas, the nearest are:

1. Bacolod-Kauswagan Protected Landscape and Seascape located in Bacolod and Kauswagan, Lanao del Norte, which is 24.4km to the southwest of the project site; and
2. Initao-Libertad Protected Landscape and Seascape located in Initao and Libertad, Misamis Orientcal, which lies 26.5km to the northeast of the project site.

These are both distant enough from the cement plant/mine area and shall not be affected by the project.

Other protected areas are much farther away from the project site such as:

1. Mt. Malindang Range Natural Park – 69.4km to the northwest;
2. Mt. Kitanglad Range Natural Park – 52km to the southeast;
3. Mt. Kalatungan Range Natural Park - 62km to the southeast; and
4. Lake Lanao Watershed Reserve – 31.8km to the south of the project site.

With respect to the Expanded National Integrated Protected Areas System (E-NIPAS) Act of 2017, the thereby-declared Protect Areas in Region 10 shown below are distant from the project site and therefore not within the impact areas.

Table 2.1-1. The E-NIPAS Protected Areas in Region 10

Protected Area	Location
Mt. Kalatungan Range Natural Park	Bukidnon
Mt. Timpoong Hibok-hibok Natural Moniment	Camiguin
Mt. Inayawan Range Natural Park	Lanao del Norte
Balianao Protected Landscape and Seascape	Misamis Occidental
Initao-Libertad Protected Landscape and Seascape	Misamis Oriental
Mt. Balatukan Range Natural Park	Misamis Oriental

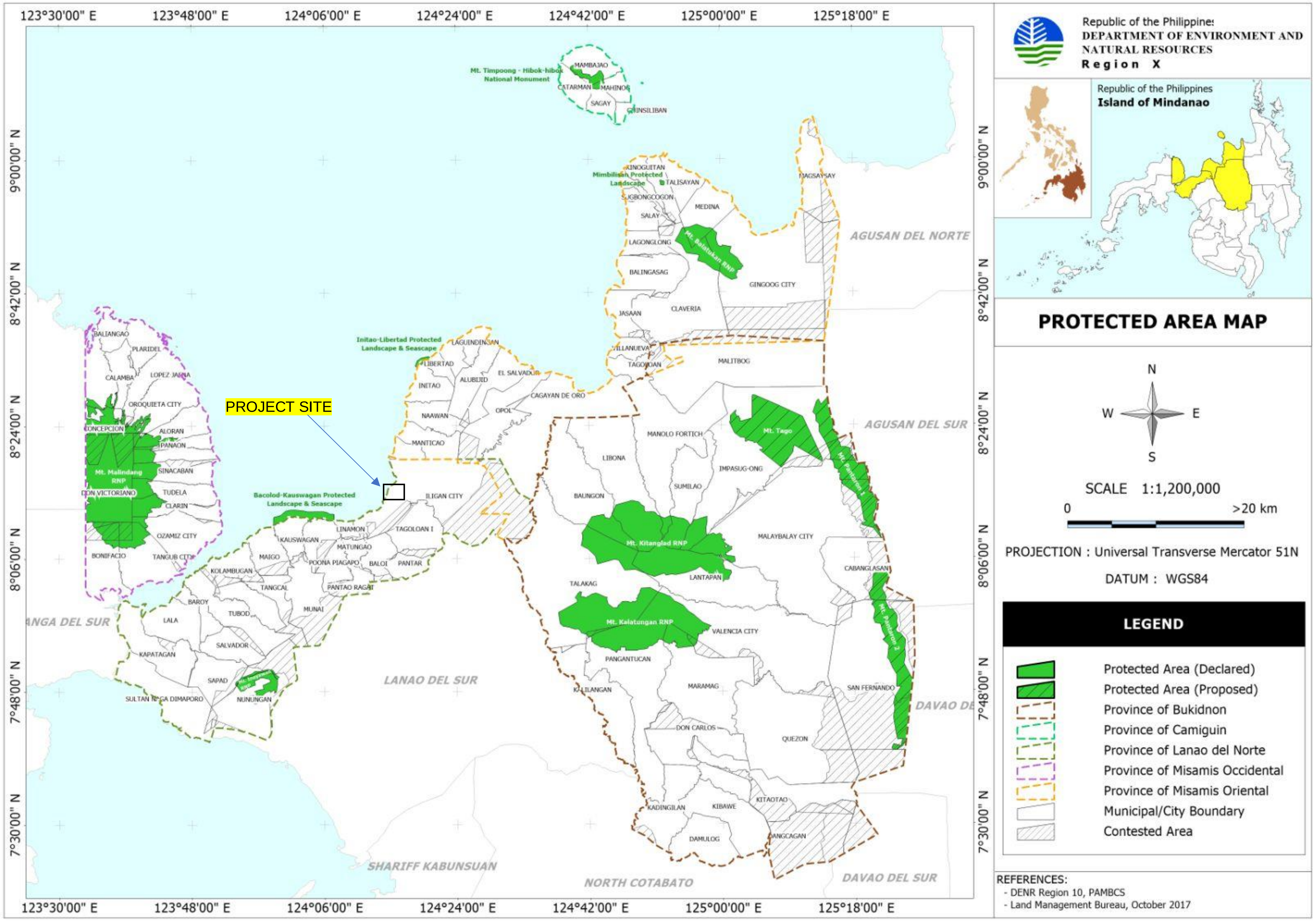
Table 2.1-2 shows the categories of Environmentally Critical Areas (ECAs) while **Figure 2.1.3** shows the Map of the Protected Areas in Region 10.

Table 2.1-2. Categories of Environmentally Critical Areas

CATEGORIES OF ECA	PRESENCE WITHIN THE PROJECT SITE	REMARKS
1. All areas declared by law as national parks, watershed reserves, wildlife preserves and sanctuaries;	Not present	Not Applicable
2. Areas set aside as aesthetic potential tourist spots;	Not present	Not Applicable
3. Areas which constitute the habitat for any endangered or threatened species of indigenous Philippine Wildlife (flora and fauna);	Not present	Not Applicable

CATEGORIES OF ECA	PRESENCE WITHIN THE PROJECT SITE	REMARKS
4. Areas of unique historic, archaeological, or scientific interests;	Not present	Not Applicable
5. Areas which are traditionally occupied by cultural communities or tribes;	Not present	The project site is not occupied by cultural communities or tribes. The site does not overlap an ancestral domain nor populated by Cultural Communities or Indigenous Peoples (IPs).
6. Areas frequently visited and/or hard-hit by natural calamities geologic hazards, floods, typhoons, volcanic activity, etc.	Present within and outside the project site	The project site is not frequently visited by typhoons though Ty. Sendong hit the other areas of Iligan City in 2011. The project site is susceptible to ground shaking, tsunami, subsidence, landslide, flooding, and minor storm surge. It is safe from ground rupture and liquefaction Discussed under **Section 2.1.2.3**
7. Areas with critical slopes	Plant site is flat and low-lying while the shale quarry has moderate to rolling topography. The limestone area within the has a more rugged topography but is not yet in active mining production status (not covered in present ECC and other permits).	Not Applicable
8. Areas classified as prime agricultural lands;	Present outside the project site	Other parcels of the MPSA is being utilized for farming but these are currently under exploration stage only.
9. Recharge areas of aquifers;	Present	**Topography and Hydrology** (Sec 2.1.2.1**).** The areas to the east, with higher elevation, are the recharge areas of aquifers underlying the project site and vicinity. There are community water sources near the quarries which may diminish in yield or dry out as the quarries widen and deepen. The RCMI wells will similarly be affected. If and when needed, future RMII wells and/or replacement community wells should be sited along the coastal plain where groundwater is relatively abundant. The wells should be far from the shoreline to avoid seawater contamination and also far from existing wells to prevent well interference.
10. Water bodies characterized by one or any combination of the following conditions; a. tapped for domestic purposes; b. within the controlled and/or protected areas declared by appropriate authorities; c. which support wildlife and fishery activities.	Not present	The E-NIPAS did not declare the project site as within the controlled and/or protected area. The site does not support wildlife – as these have long migrated to nearby areas that has thicker vegetation. The area fronting the pier is designated as

CATEGORIES OF ECA	PRESENCE WITHIN THE PROJECT SITE	REMARKS
		Municipal Fishing Zone. This is discussed under **Section 2.2 Marine Resources**
11. Mangrove areas characterized by one or any combination or the following conditions a. with primary pristine and dense young growth; b. adjoining mouth of major river systems; c. near or adjacent to traditional productive fry or fishing grounds; d. which act as natural buffers against shore erosion, strong winds and storm floods; e. on which people are dependent for their livelihood.	Not present	Not Applicable
12. Coral reef characterized by one or any combination of the following conditions: a. with 50% and above live coralline cover; b. Spawning and nursery grounds for fish; c. Which act as natural breakwater of coastlines	Not present	Not Applicable



Source: EMB-DENR Region 10, Iligan City Agriculture Office

Figure 2.1-3. Protected Areas Map of Region 10

2.1.1.2.1 Areas vulnerable/susceptible to natural hazards where the project is located or near the project area (including map/s)

These are discussed in **Section 2.1.2.3**. – Inducement of subsidence, liquefaction, landslides, mud / debris flow, etc. The project site is susceptible to ground shaking, tsunami, subsidence, landslide, flooding, and minor storm surge. It is safe from ground rupture and liquefaction.

In the light of experiences with strong typhoons such as "Sendong" causing severe damages in the Iligan region and of "Yolanda" in Tacloban, vulnerability/susceptibility to met-ocean hazards cannot be ignored.

Mindanao, including the Cagayan de Oro-Iligan corridor, which historically has rarely experienced tropical cyclones, was hit during the period December 13 – 20, 2011 by a severe Tropical Storm "Sendong" (Washi), which brought 10 hours of torrential rains that triggered disastrous flash flooding over Mindanao. More than 200 mm of rain was reported in places where rivers were already swollen. During the overnight hours, hundreds of people were killed as flood waters and landslides destroyed homes along mountain sides. In some locations, flood waters rose by 3.3m in less than an hour. Residents impacted by these flood waters were forced to seek refuge on their roofs amidst 90 km/h winds. The Iligan LGU regarded the floods as "the worst in the city's history".

The amount of rainfall reached 200mm to over 250 mm (~8 to 10 inches along Mindanao's east coast where Sendong made landfall, but the highest amounts are along the northwest coast, where rainfall reached 300 to over 400 mm.

Moreover, as experienced during the heavy rains brought by Typhoon Sendong, the floodplains along the Mandulog River are heavily flood-susceptible. The mouth of Mandulog River is about 3.8km to the southwest of the RCMI plant site. The RCMI cement plant and vicinities were not affected by this flooding event.

2.1.1.3 Impact in existing land tenure issue/s.

2.1.1.3.1 Assessment of the compatibility of the proposed project vis-à-vis CARP land or CADC / CADT / CALC/ CALT, with IFMA/CBFMA

There are no Comprehensive Agrarian Reform Programme (CARP or with Certificate of *Ancestral Domain Claim* (CADC) / Certificate of Ancestral Domain Title (CADT) / Certificate of Ancestral Lot Claim (CALC) / *Certificate of Ancestral* Land *Title* (CALT) -related issues within the project site.

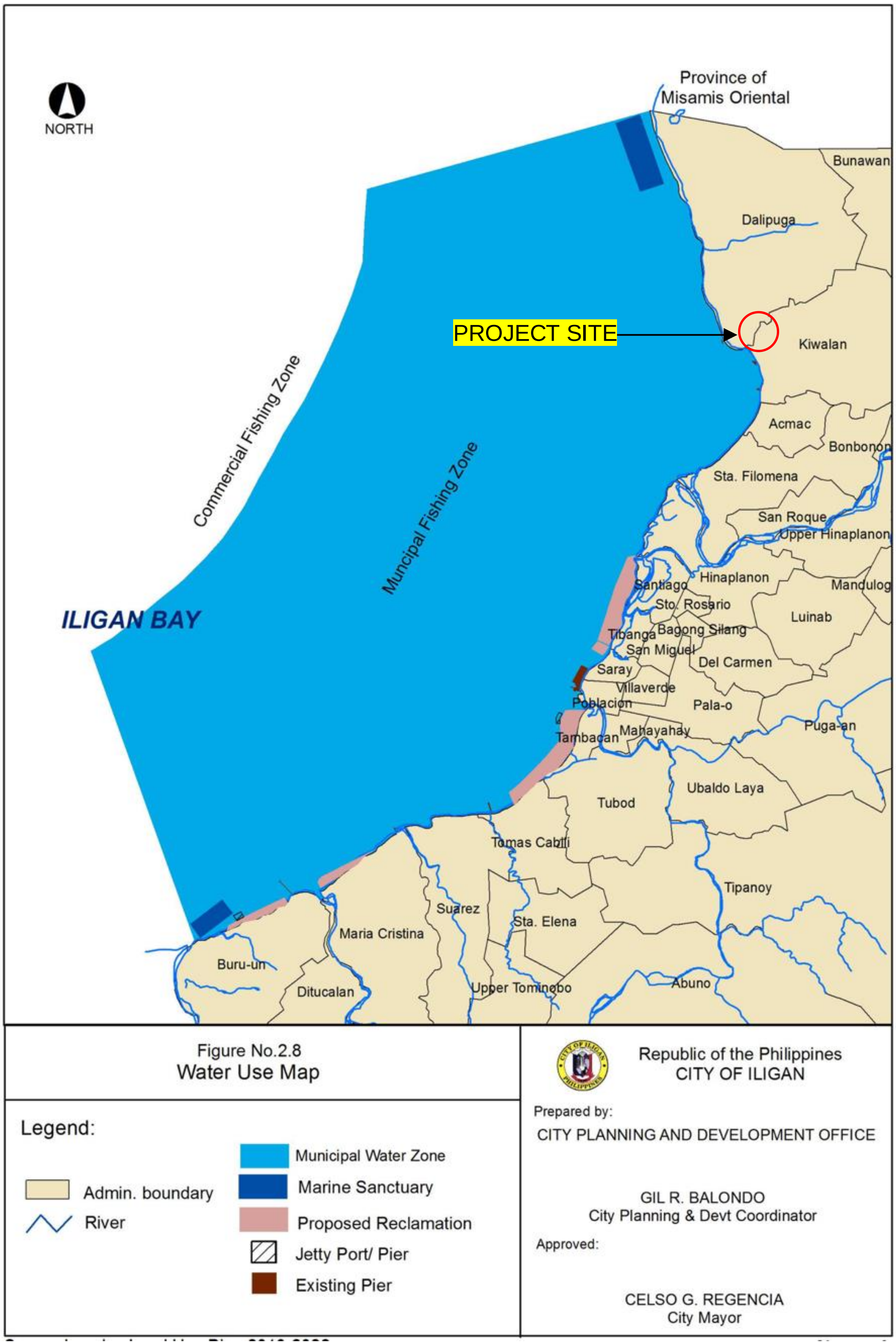
The proposed increase in the annual rate of quarry production is to be conducted in the existing Shale and Limestone quarry, which is situated in areas covered by valid and existing MPSAs denominated as MPSA No. 104-98-XII, MPSA No. 031-1995-XII and MPSA No. 105-98-XII. There will be no increase in area coverage for the quarry.

2.1.1.3.2 Assessment of the compatibility of the proposed project vis-à-vis actual coastal resource management plan of the LGU.

The proposed project is an expansion in terms of production rate. The proposed increase in clinker and cement production rate will need new structures/buildings to be built inside the existing plant. The shale and limestone quarrying will be done in the same existing shale and limestone quarry areas while the start-up pozzolana quarrying will be conducted inside the shale quarry. RCMI shall continue to utilize the existing beachpad facility.

There are several existing industrial plants in barangays Kiwalan and Dalipuga, some of which have their own pier facilities as well. The mining tenements of RCMI are recognized by the LGU as mining zones.

The existing pier of RCMI is covered in the existing ECC and is recognized by the LGU as well. The nearshore area within the municipal waters of Iligan City is designated as Municipal Fishing Zone while the deeper parts is for Commercial Fishing Zone. The 2 marine sanctuaries are distant from the project site. Please refer to **Figure 2.1-4** below.



Source: Iligan City CLUP, 2013-2022

Figure 2.1-4. Water Use Map

2.1.1.4 Impairment of Visual Aesthetics.

Visually significant landforms/landscape/structures

There are no visually significant landforms/landscape and structures in the project site. By nature of the project, the landform in the quarry sites will be modified. Nevertheless, the proposed rehabilitation plan may actually improve the site aesthetics.

The edifice structure of the cement plant beside the National Highway creates a negative visual impact and somehow serves as an obstruction to the natural scenery. In order to lessen the impact, landscaping was done inside the plant to provide a welcoming ambiance. Landscape architectural design is implemented in the entire plant. The property line along the highway is fenced and lined with ornamental plants and trees.

In addition, tree planting in mined-out areas are conducted to improve the aesthetic value of the quarry and the cement plant as well as to increase stability of the slopes, which in effect enhances the scenery. Careful selection of the variety of trees to be planted is conducted to give appropriate visual effects.

Road sweeping is a daily activity done by mechanical road sweeper. The coverage of the road sweeper includes the road from the plant gate up to the area of the dryer and paved access roads. In support for areas where use of road sweeper is impractical, manual sweeping is utilized.

At the end of mine life, all remaining mined-out areas shall be recontoured and reforested. The access/haul roads may be turned over to the government for use of the public, or if not needed, will be recontoured and revegetated as well. Consultation with the stakeholders shall be done in order to determine the best after mine life land use that will be most beneficial to the host community.

2.1.1.5 Devaluation of Land Value as a Result of Improper Solid Waste Management and Other Related Impacts

The improper management of solid wastes generated in the quarries and the plant could lead to problems on foul odor, proliferation of insects that could cause health problems, impairment of visual aesthetics, and could tend to increase the BOD loading and coliform level of nearby waterbodies. All these problems could cause the devaluation of the land value.

This potential impact is being avoided through the Proponents' rigid implementation of its **Management Schemes for Solid Wastes and Other Wastes**. This is discussed in more detail under **Section 1.5.2.1: Waste Management System.** It involves the management of all types of wastes generated in the project such as domestic, plant, and mine wastes.

Solid wastes are segregated according to type, such as:

a. Scrapyard: metal scraps only;
b. Material Recovery Facility (MRF): for non-biodegradable/recyclables for use as Alternative Fuel;
c. Hazardous Wastes Storage Facility: for hazardous solid wastes;
d. Temporary Used Oil Storage: for waste oil and oil-contaminated wastes;
e. Reusable Parts: reusable mechanical parts; and
f. Compost Pit: for biodegradable wastes.

Good Housekeeping System

The plant is strict in implementing its rules in housekeeping. It requires each department to conduct housekeeping before and after work to provide a stimulating work environment. Another effort is the "Balikatan Housekeeping" in which a host department asks for help in cleaning and maintaining the work and in return the host department will provide snacks to be shared among all workers. In that sense, it builds a bonding experience and positive internal relations among departments. In addition, regular road sweeping is conducted as part of the housekeeping efforts. A mechanical Road Sweeper is mobilized under the responsibility of a contracted driver deployed along the process line access road, National Highway fronting the plant, roads from plant gate up to the area of the dryer and pier areas. For areas where the use of mechanical sweeper is impractical, manual sweeping is done.

2.1.2 Geology/ Geomorphology
2.1.2.1 Change in Surface Landform/ Geomorphology/Topography/Terrain/Slope.
2.1.2.1.1 TopographyGeomorphology

Original Topography before Mining Operations (before 1960)

This pertains to the topography of the area before the start of quarrying operations in the 1960s by several other entities.

The topography of Iligan City is characterized by a narrow coastal plain bounded to the south and east by a hilly terrain that becomes more rugged and mountainous further inland with elevations rising to as much as 1,200 masl.

The steeply sloping and highly elevated areas of the highlands are associated with limestone and volcanic deposits. Areas underlain by clastic deposits generally have gentler slopes. The coastal plains and flood plains are underlain by Quaternary Alluvium.

The study area and its immediate surroundings are characterized by moderate to rugged terrain consisting of low mountains and hills that have moderate to steep slopes, narrow and irregular ridges, and narrow and steep river valleys. The mountains in the area rarely rise above 400 meters above sea level (masl) with the highest land feature being a narrow, north-south oriented mountain whose ridge peaks just above 500 masl in several places. This mountain borders the project area to the east and northeast.

A narrow coastal plain that adjoins Iligan Bay marks the western edge of the project area. This coastal plain becomes wider south of the study area but thins out northward.

This is shown in **Figures 2.1-6** and **2.1-7**.

Impact Analysis – Change in Topography/Slope due to Quarrying

The obvious impact of the project is the change in surface landform/topography and the disturbance of the geological/morphological formation due to the extraction of shale and limestone deposits from the earth. This effect is general for all mining/extractive operations.

Change in topography is inevitable due to the nature and extent of quarrying that will be undertaken. The quarry will have a continuous change as mining progresses to its final stage. At the end of quarrying operations, there will be significant alteration of landforms and disturbance of ground surface as a result of quarry operations. The gentle topography of the undisturbed areas will be replaced by a series of benches. The method of extraction in quarrying will be such that the hills shall approach peneplenation or levelling down to the final pit bottom with the perimeter slopes stabilized through a series of benches. Final pit bottom for the limestone quarry will be at +60 masl and for shale quarry will be at +30 masl.

Where quarry limits are reached, extraction floors may become flooded if abandoned outright and not properly planned. Areas with thick profile of overburden or other loose materials that may get oversaturated with water are potential sources of sediment flows especially if the materials are exposed to steep gradients. This happens when pore water pressure exceeds the confining pressure. Gullies and waterways that are filled in because of site preparation but are not provided with adequate drainage and ponds may also invite ground slippage, sloughing, and/or creeping.

The slopes within the area is 60% and the elevation is from 100-300 masl while the slopes to be left after mining is 70% for benches and 59% for the pit slope.

Topography after Mining Operations but Prior to coverage of Existing ECC

From the development stage of the mine site to operational stage, localized changes in the topography has occurred such as: in the development of roads whereby the land was graded; and in the mining operations wherein quarries composed of benches (mining blocks) were created. The extent of these disturbed areas are shown in the October 2004 Google Earth Historical Image in **Figures 2.1-8** and **2.1-9**. Note that there were also disturbed areas to the east of the RCMI MPSA.

The terrain in the limestone and shale quarry areas were altered wherein a series of benches now exist as well as haul roads from the quarry sites down to the old plant.

Existing ECCs

The active areas worked on since 2006 (date of grant of ECCs) where generally on the areas that were already mined (open). The ensuing changes were the lowering and lengthening of the benches. An additional haul road trending NW-SE from the limestone quarry to the shale area was constructed.

To provide a clear picture of the changes in topography, the NAMRIA topographic map of 1956 is provided in **Figure 2.1-6** and **2.1-7** while the topography in succeeding years are provided in **Figure 2.1-8** (note the changes in topography in the historical images from years 2004, 2009, 2015 and 2020). **Figures 2.1-9** to **2.1-13** likewise illustrate these changes.

The total disturbed areas for the limestone and shale quarries of RCMI, including project components such as waste dumpsite, siltation ponds, haul roads, buffer zones, etc., constitute approximately 59.75 ha for limestone and 16.688 ha for shale, for a total of 76.438 ha . Of these, the current active areas are 19.9 ha for limestone and 5.57 ha for shale .**Figures 2.1-13** and **2-14** show the maps of active and disturbed areas.

It can be seen in **Figures 2.1-8** to **2.1-10** that the pre-existing areas with mining footprints as of 2004 is more or less the same as RCMI's existing quarry (disturbed) areas. This is so because RCMI has been quarrying predominantly on areas that were previously disturbed already. Hence, very few virgin/green areas were recently opened, most of which are in the shale quarry area. The change in topography was the increase in number of benches and lowering of ground elevation.

Aside from the quarrying itself, other component activities related to quarrying likewise add to changes in the topography. Stockpiling of overburden/interburden/spoils and other waste earth materials at the dump will also result in the modification of topography. This is a temporary and reversible impact because most, if not all, of the stockpiled mine spoils shall be re-used in the future rehabilitation/recontouring in preparation for reforestation. Constructed in year 2000, the mine waste dumpsite has an area of about 0.4229 hectare and a capacity of 150,000 MT. Its designated height is 5m.

It shoulde be likewise noted, that since majority of the active mine faces are on pre-existing benches, the overburden has long been stripped off, especially for limestone. In the shale, there is a small portion where overburden is being quarried and stocked at the waste dump.

The total volume of shale and limestone extracted from 2007 to 2020 are: 2,374,990 MT and 8,784,236 MT, respectively. Furthermore, the overburden and other mine wastes generated from 2015 to 1st semester 2020 is 46,685 MT, or 1.1% of extracted ore from the same period. To date, RCMI has dumped **57,409.55 MT** of waste earth materials into the dump.

Furthermore, the siltation ponds are constructed by excavating earth materials to form small pits. These are, however, temporary in nature and will be backfilled during the abandonment phase.

Another is the construction of haul roads, but are mostly pre-existing except for the approximately 400m-long NW-SE trending road connecting the limestone quarry to the shale quarry.

The resulting post-quarrying landforms will be visually inconsistent with the surrounding landscape and relatively less stable. The existing topography showing the active and disturbed areas are shown in **Figures 2.1-11** and **2.1-12**.

Proposed Expansion Project EPRMP

This is shown in the proposed 3-Year Mine Development Plan in **Figure 1-16 to 1-21** under **Section 1,** as well as Mine Development Plan up to end of contract term in **Figures 2.1-16 and 2.1-16a.**

The projected change in topography by year 2022 is reflected in **Figure 2.1-15** and for the year 2025 in **Figure 2.1-16.**

With a yearly extraction of 5.91 MMTPY of limestone and 2.29 MMTPY of shale, a total of 147.75 MMTPY and 57.25 MMTPY, respectively, or a total of 205 MMT shall have been extracted by the year 2044. Accordingly, about 2.255 MMT of mine wastes is the projected mine wastes to be generated during this period. In terms of area disturbace, approximately 78.41 and 79.46 ha, , respectively shall be affected upon end of contract terms of the 3 MPSAs.

Mitigating Measures

If these changes are not properly managed, erosion problems will occur, particularly along the slopes. Without proper drainage, surface runoff will occur and siltation is expected at the nearest water body, in this case, the Tag-ibo Creek and eventually to Iligan Bay. Furthermore, the slopes can be unstable and may cause landslides.

The quarrying operations are being done in accordance with the submitted/approved EPEP/FMRDP. Mitigating measures are implemented in all phases of the quarrying activities such as in:

1. **Land Clearing**

This is the phase wherein land is stripped of vegetation and overburden materials. The Quarry Development Plan is an essential tool in assuring minimization of land clearing. As much as possible, this activity should start during the dry season. Nevertheless, majority of the existing and proposed extraction areas are within pre-existing quarry areas that do not require land clearing and the overburden have long been removed. Moreover, progressive rehabilitation is employed.

2. **Bench Development**

This is done through dozing, ripping and blasting when necessary (for 80% of limestone and none for shale). In recent years, quarry activities were focused on elevation 220 (northeastern part of the quarry) to 140 m (B-220 to B-140) of MPSA 031. There were also active benches in the middle part of the quarry. After 2020, limestone extraction is expected to be focused in MPSA 105 but will also include adjacent portions within MPSA 031.

Bench development will be accompanied by the construction of roadside drainage to help direct runoff during rainfall and at the same time prevent impoundment at the road surfaces. Drain canals and ditches are established along the toe of the benches to deviate the rainwater to the location of the settling ponds. Water will then be trapped in the ponds allowing the suspended particles to settle before the water is redirected to the outlets.

Adequacy of drainage also focuses on preventing saturation and instability of loose materials due to water. If stockpiles are needed to be perched on high ground, their volumes and height is controlled/limited. Drainage and barriers are laid out to negate the movement of material.

Benching itself has the advantage of offering slope stabilization mechanism because of its structure. The Company maintains its optimum dimensions as to berm width, bench height, active bench width, and slope.

Benches are formed where quarry equipment find solid support to stand on. Active working benches have average height of 10 meters and minimum width of 30 meters for limestone quarry and height of 5m and width of 30m for shale quarry. For stability, active bench slopes are maintained at 70 degrees. The final pit bottom will be at +60 masl for limestone and at +30 masl for shale. The final pit slope is 59-60 degrees, which is the existing average slope gradient in the project area and vicinity.

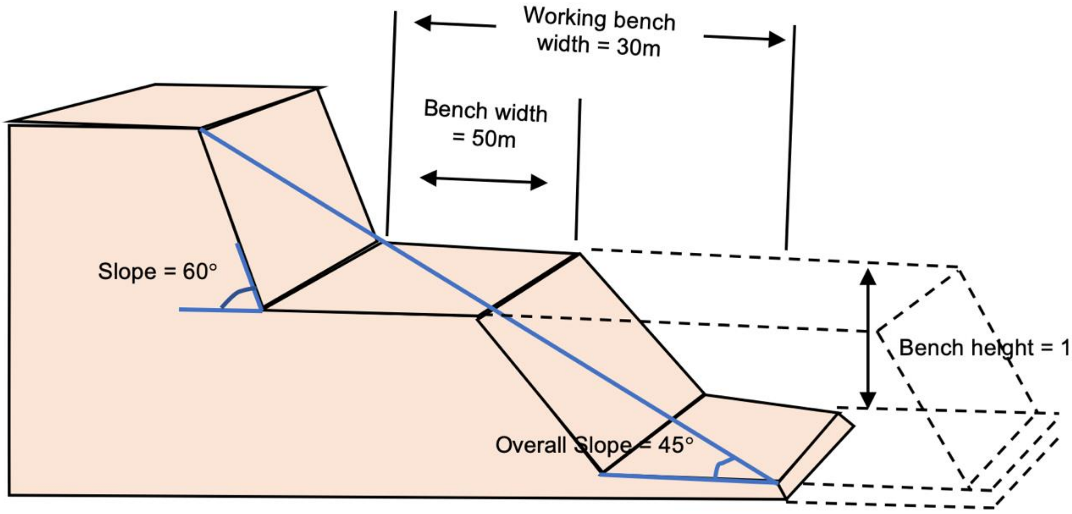


Figure 2.1-5. Bench Configuration at the Quarry Sites

Quarry floors are well maintained to reduce the risk of forming artificial lakes that could cause flooding and sudden gushes of excess water downslope.

3. Construction of Additional Haul Roads

Construction of haul roads will result to minor modification in the natural topography of the area. Road cuts will have to be made to flatten the surface. Surface runoff may occur if the drainage system is not properly designed. To mitigate, these roads have drain canals at the sides so that runoff water will go towards these canals.

4. Construction of Additional Settling Ponds

In the construction of additional settling ponds, a low-lying area with natural depression shall be selected. This will minimize the volume of excavation, change in topography, as well as the visual impact. As discussed under soil erosion, mitigating measures are in place with regards to maintenance of settling ponds such as conitinuous monitoring of the level of impounded silt/water and regular desilting.

5. Loading of Materials

Done with the use of dump trucks and payloaders.

6. Crushing

This is where the materials are dumped into the crusher and undergo reduction in size.

7. Progressive Rehabilitation

Since there are no totally/declared mined-out areas at present, the rehabilitation efforts are targeted on other areas such as buffer zones, permanent road sides within the property, and non-mining sections. The sides of quarry benches and ramps are also planted with quick-spreading grasses or legumes for slope stability and re-greening purposes.

After a specific area is mined-out, progressive rehabilitation will immediately follow. This will involve:

- Recontouring of berm, trimming of banks/slopes to make it stable;
- Construction of ditch on the upper bench to direct water towards the settling pond;
- Removed topsoil during quarrying will be put back by about 0.5m thickness;
  Total disturbed land by end of project is approximately 157.87 ha. For the area to be backfilled using topsoil, the total area is only 131.3837 hectares since it is only considered to backfill the benches (bench widths) and excluded other areas for backfilling such as slopes and drainage canals per bench. Hence, the volume of soil to be used is about 656,919 m^3.
- Conditioning of soil with enhancer prior to planting. Vetiver grass may also be used, especially in the interim, for slope stabilization;
- Application of soil on the benches to be spread by a grader;
- Upper benches will be the first to be rehabilitated then continue towards the lower benches;
- Construction of ditch on the benches up to the pit bottom in order that all water runoff can be collected in the pond prior to discharge to receiving water bodies;

8. Final Rehabilitation

A consolidated EPEP/FMRDP of MPSA 031 and FMRDP of 104 was approved last January 31, 2020 and October 28, 2020 respectively. MPSA 105 FMRDP is still pending for approval. All EPEP are already approved by DENR-MGB. See **Annexes 1-1 and 1-2**.

Among the main features in the FMRDP are:

- The final pit design will conform to the land use based on the plan of Iligan City LGU. It will be converted into agro-forest land in combination with grazing areas for some portions of the quarry. Consultation with stakeholders will be done regarding final land use;
- Progressive rehabilitation, which started many years back, will continue until the end of the MPSAs contract terms;
- Final rehabilitation to follow on the remaining areas. The steps in the progressive rehabilitation are to be followed;
- All catchment ponds/drainage system will be maintained until full rehabilitation of mined-out parcels;
- If the haul roads are considered useful by the host communities, these will be turned over to the LGU. If not, these will be replanted wherin water diversion measures will be installed for runoff interception and to enhance revegetation;
- Unnecessary structures, building and equipment will be removed and revegetation and re-profiling to be done;
- At the end of rehabilitation, slope stability must be ensured wherein the bench slopes are recontoured to make it stable, erosion mitigation has been applied, and proper drainage installed;
- Benching of remaining waste dump, riprap weak portion, slope lowered against angle of repose, 1% gradient of dump floor to direct water away from the crest line, cover with vetiver; and
- Establishment of drainage away from revegetated areas, maintain direction of flow, and plant grasses.

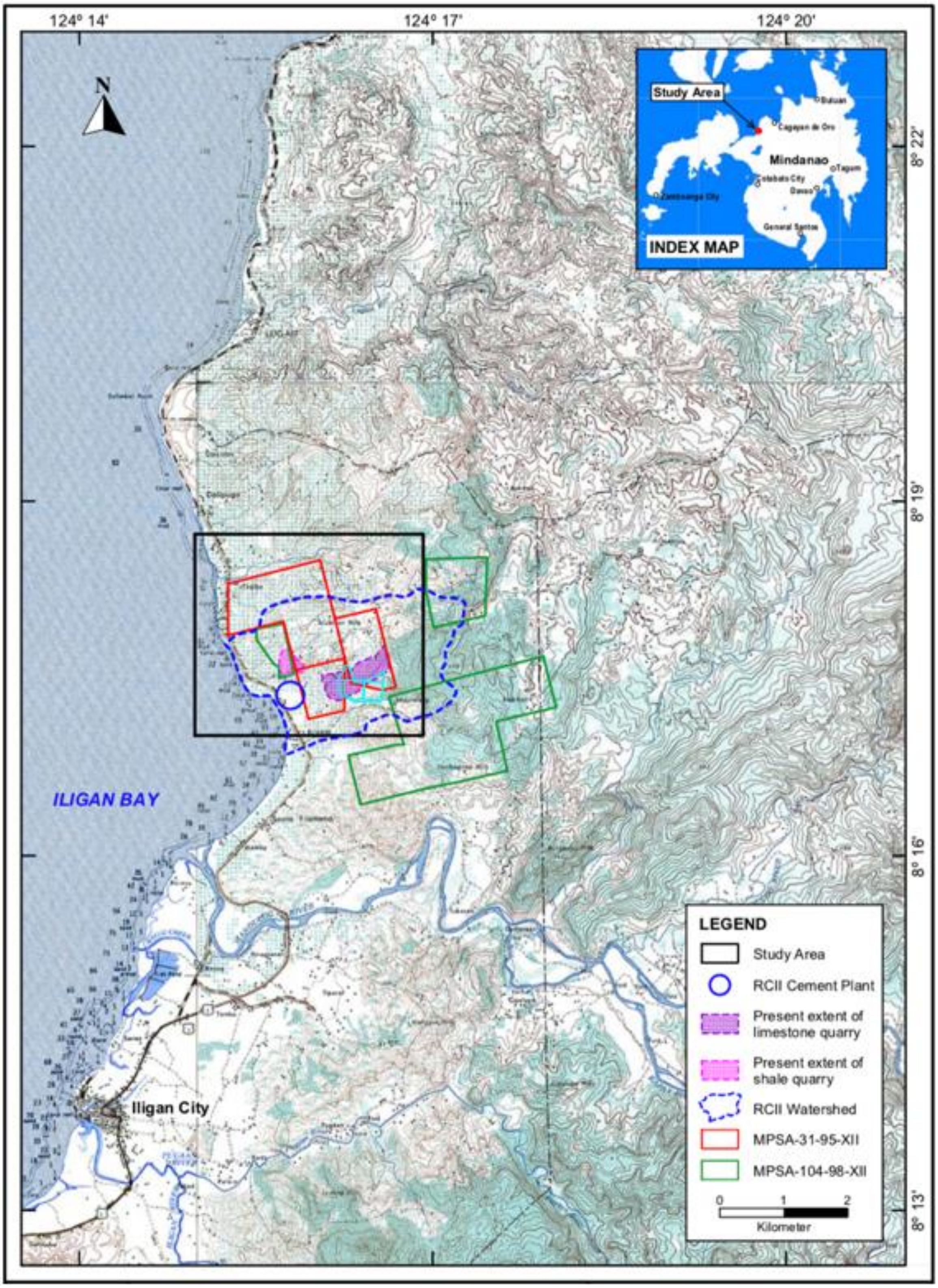
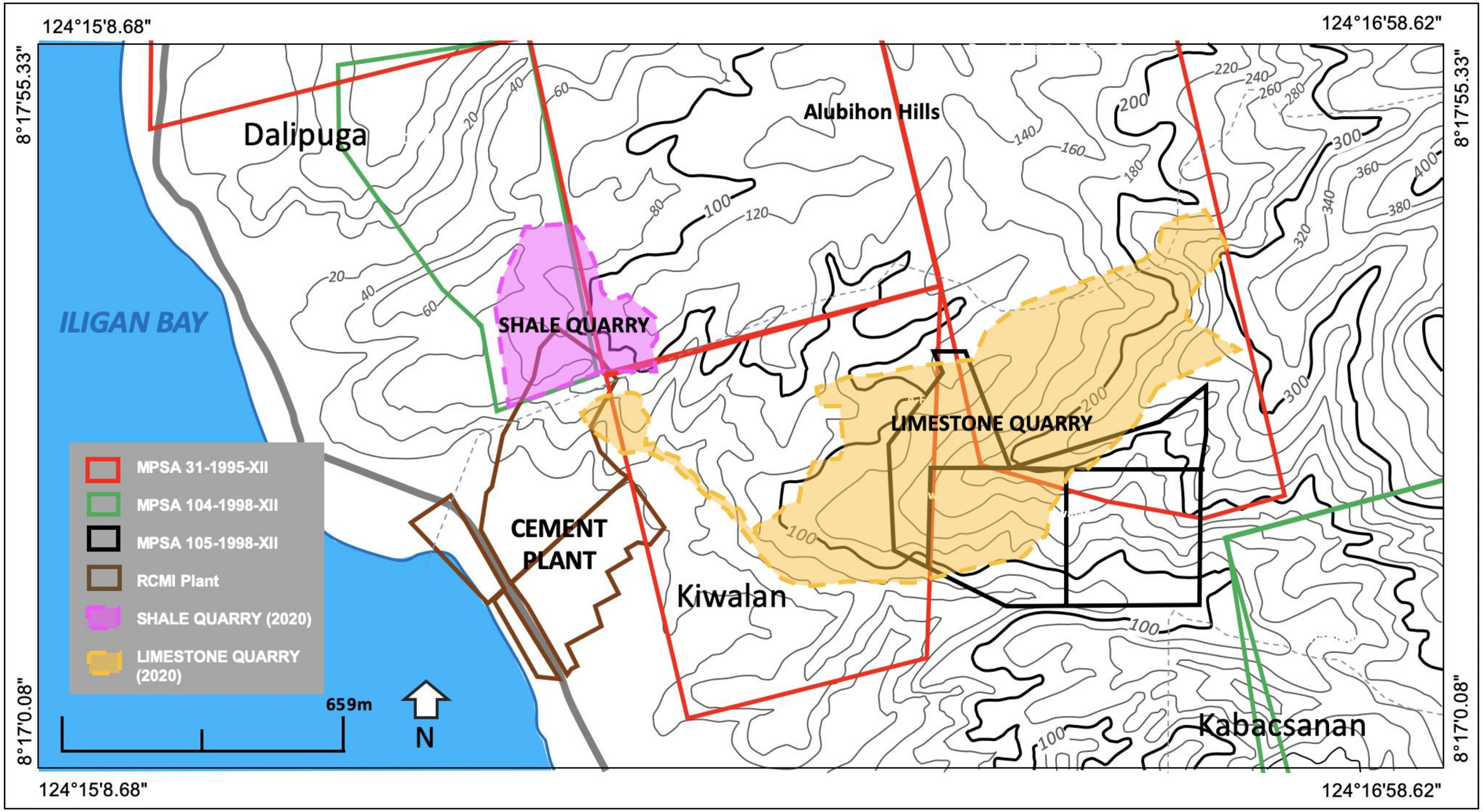
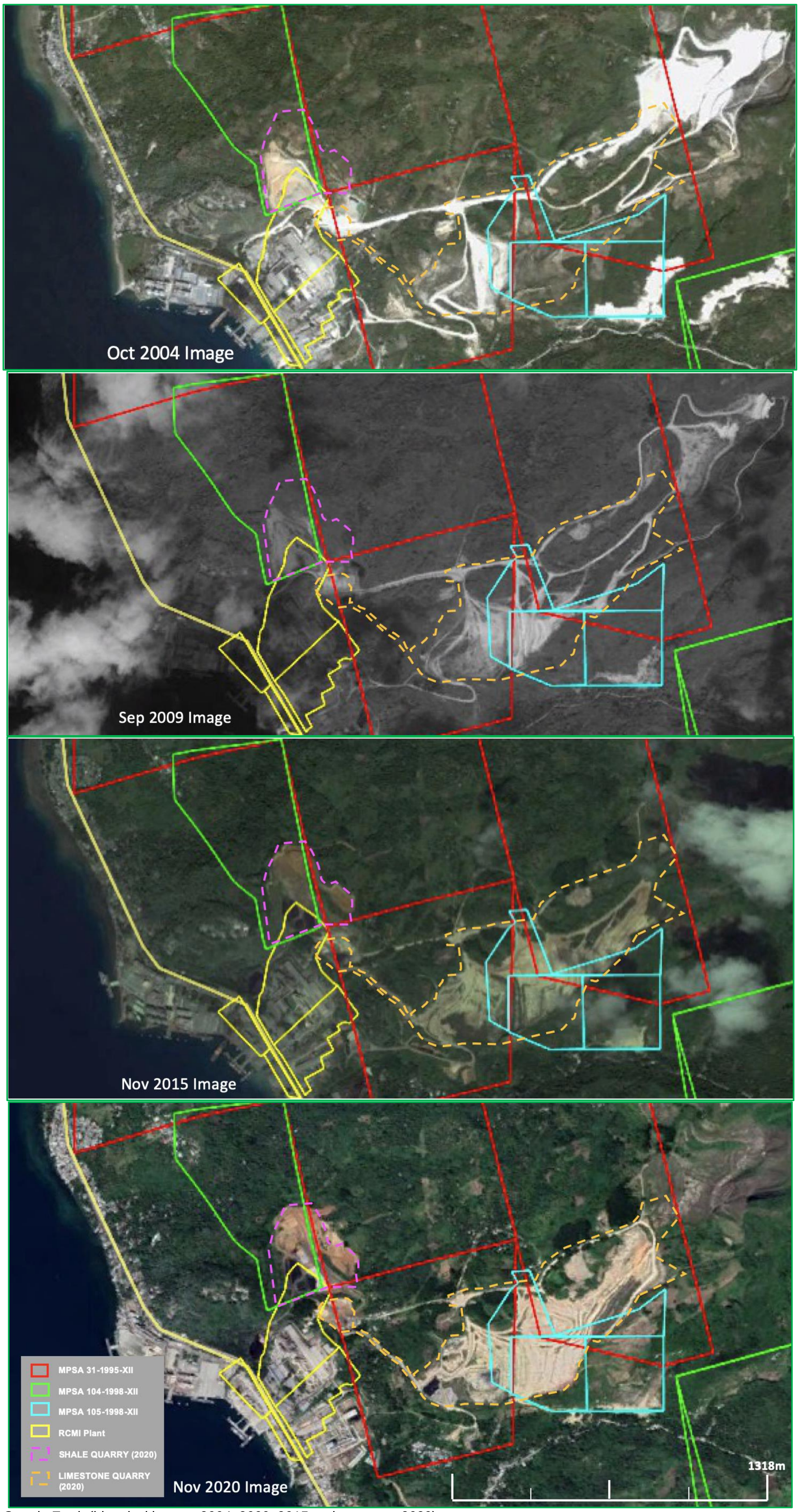


Figure 2.1-6. Topographic Map of the Project Site and vicinities



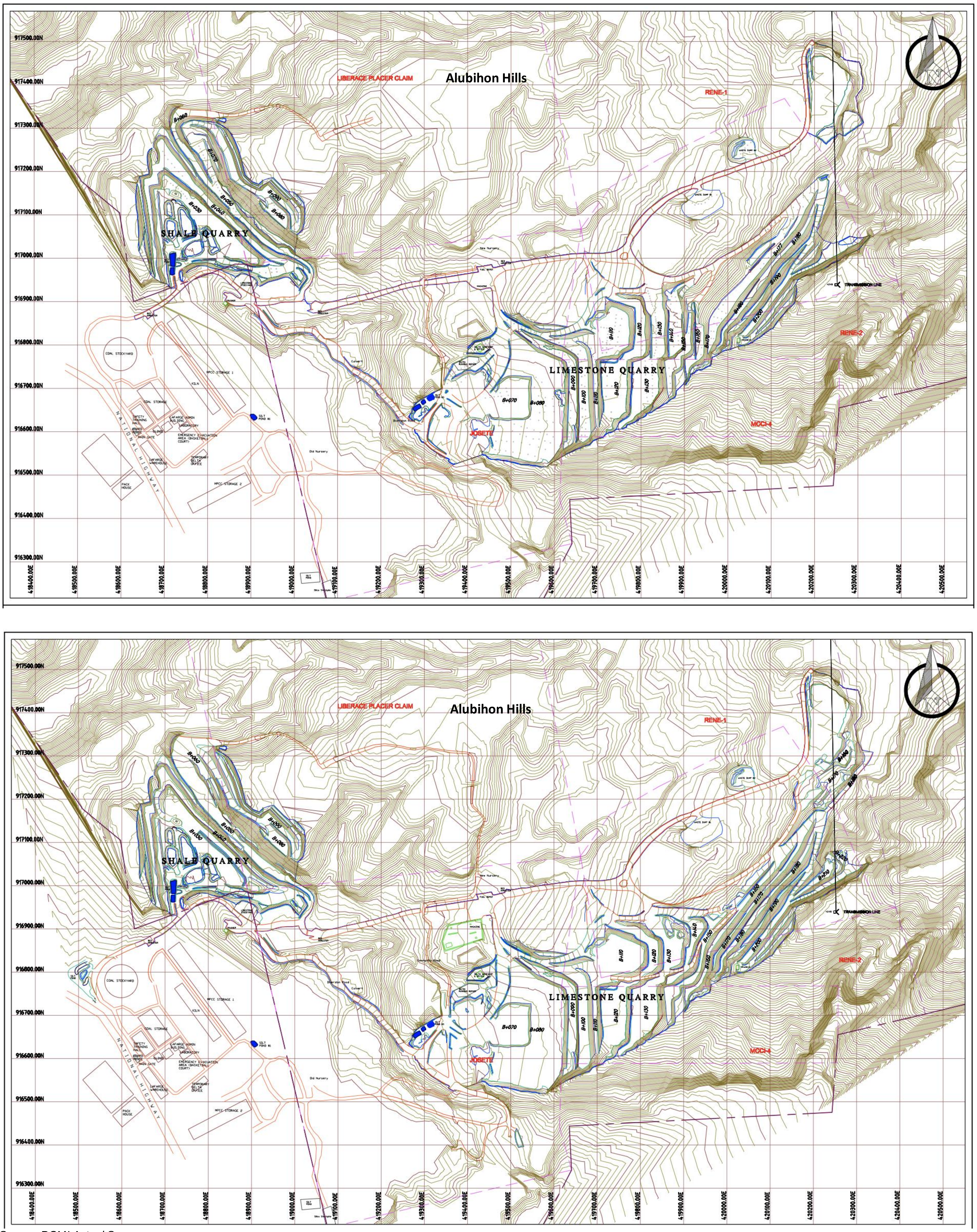
Adapted from: NAMRIA Sheet 3844 I, Data 1956, reprinted 2003

Figure 2.1-7. Topographic Map of the Quarry (Disturbed) Areas and vicinities



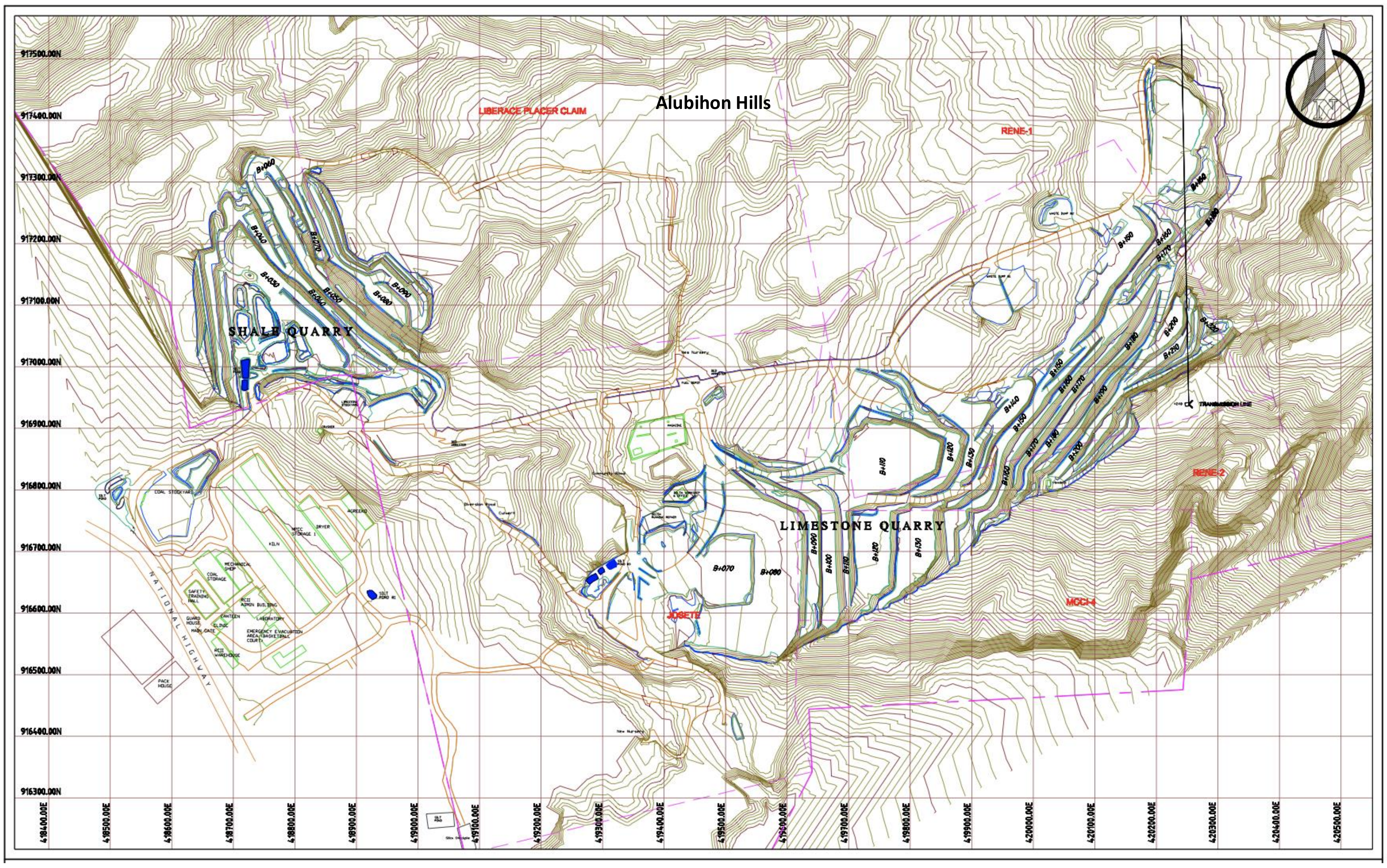
Source: Google Earth (historical images 2004, 2009, 2015 and present – 2020)

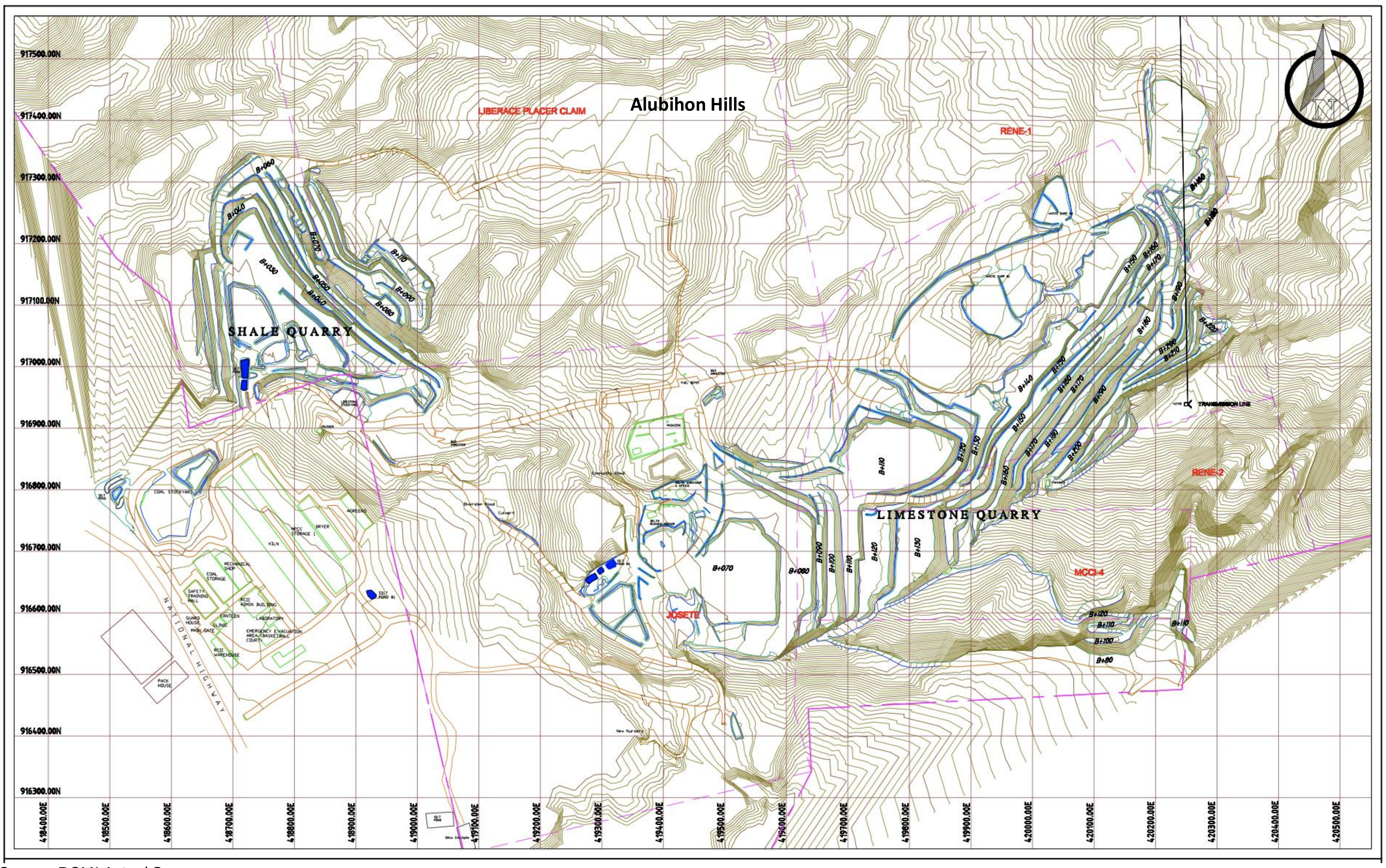
Figure 2.1-8. Changes in Topography at the Project Site (2004-2020) Showing MPSAs and Disturbed Quarry Areas



Source: RCMI Actual Survey

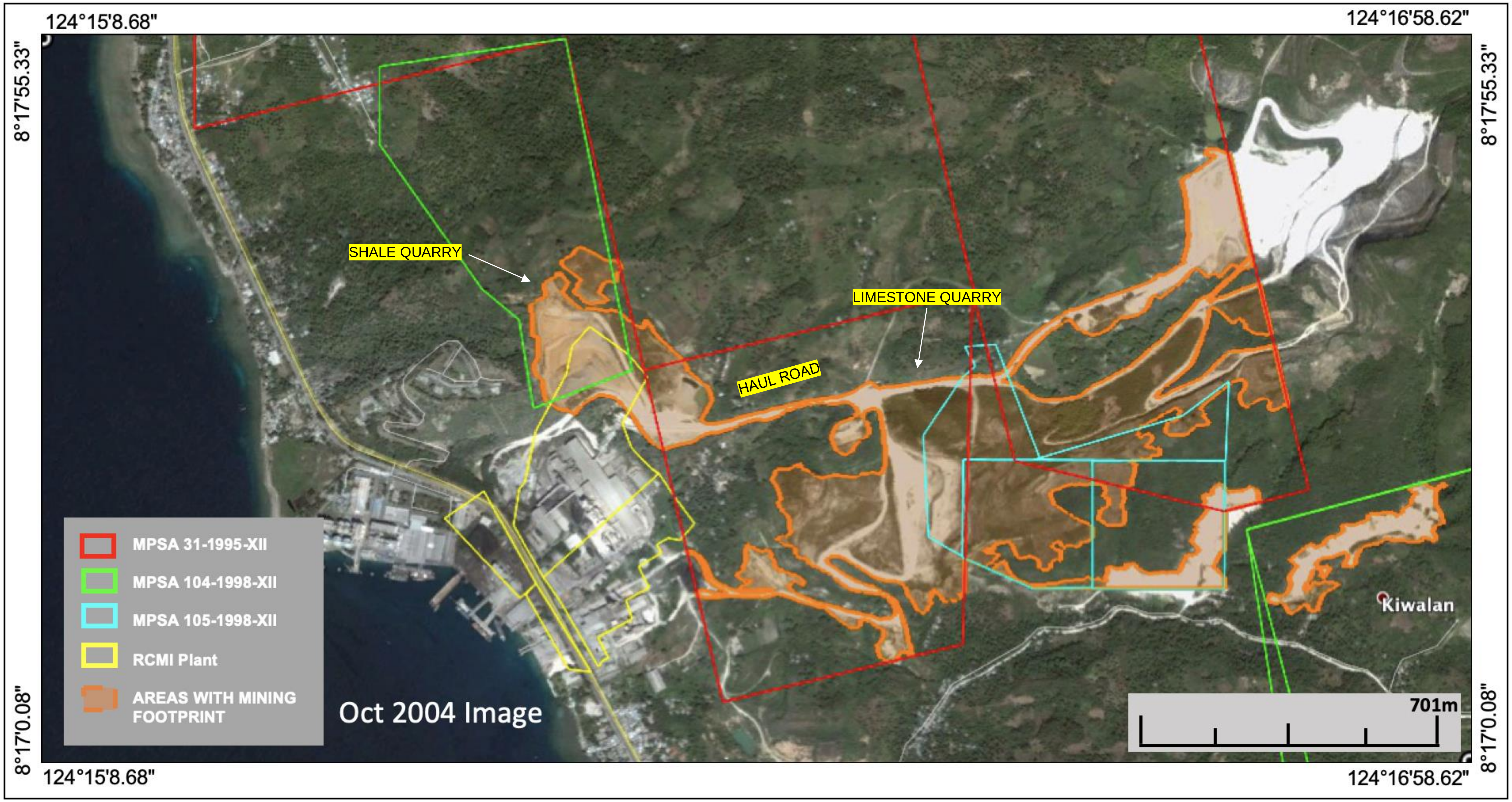
Figure 2.1-9. Changes in Topography at the Project Site (2016-2017) Showing Disturbed Quarry Areas





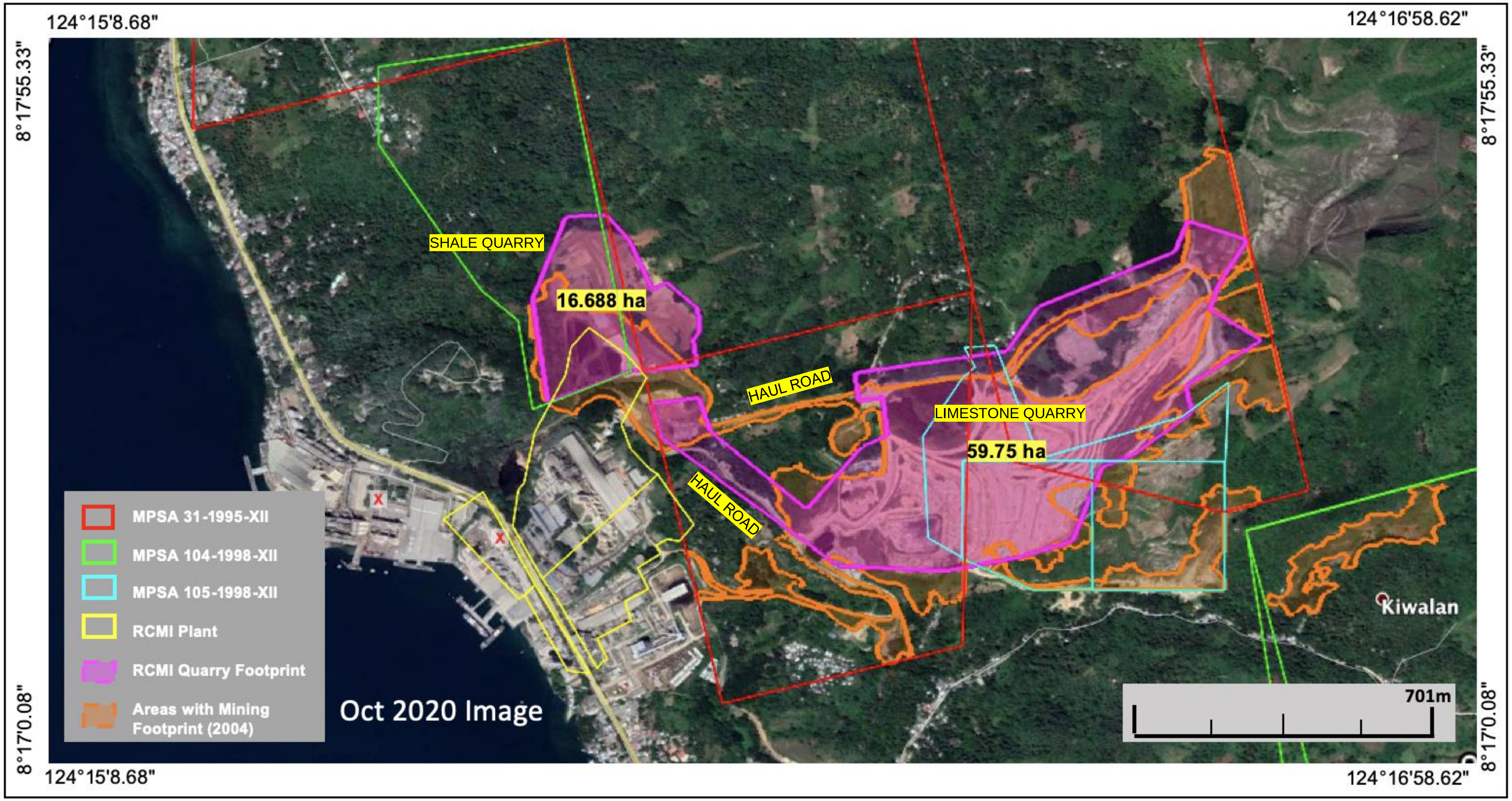
Source: RCMI Actual Survey

Figure 2.1-10. Changes in Topography at the Project Site (2018-2019) Showing Disturbed Quarry Areas



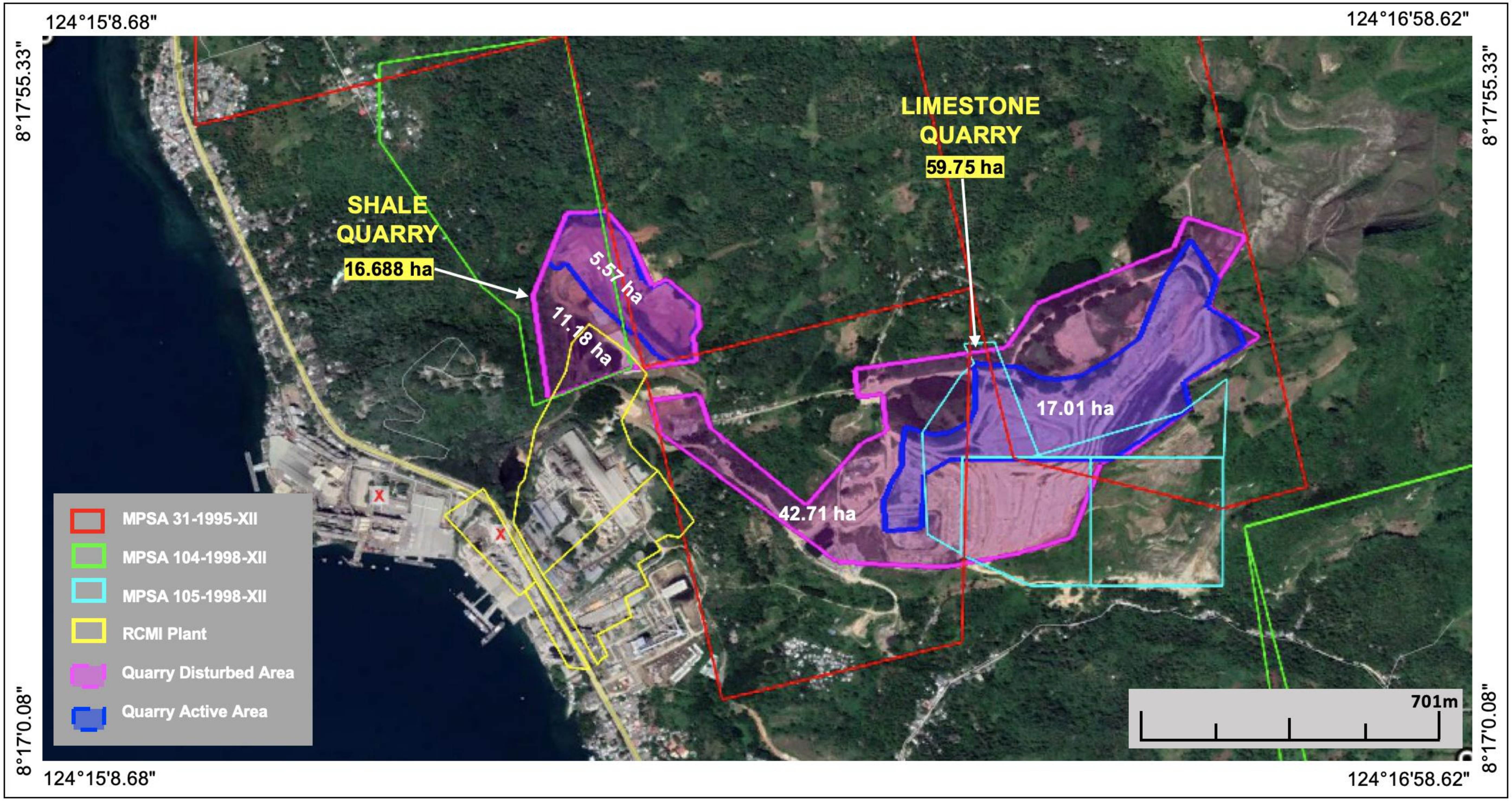
Source: Google Earth (historical image 2004)

Figure 2.1-11. Map Showing Areas with Mining Footprint Inside the RCMI Tenements (2004)



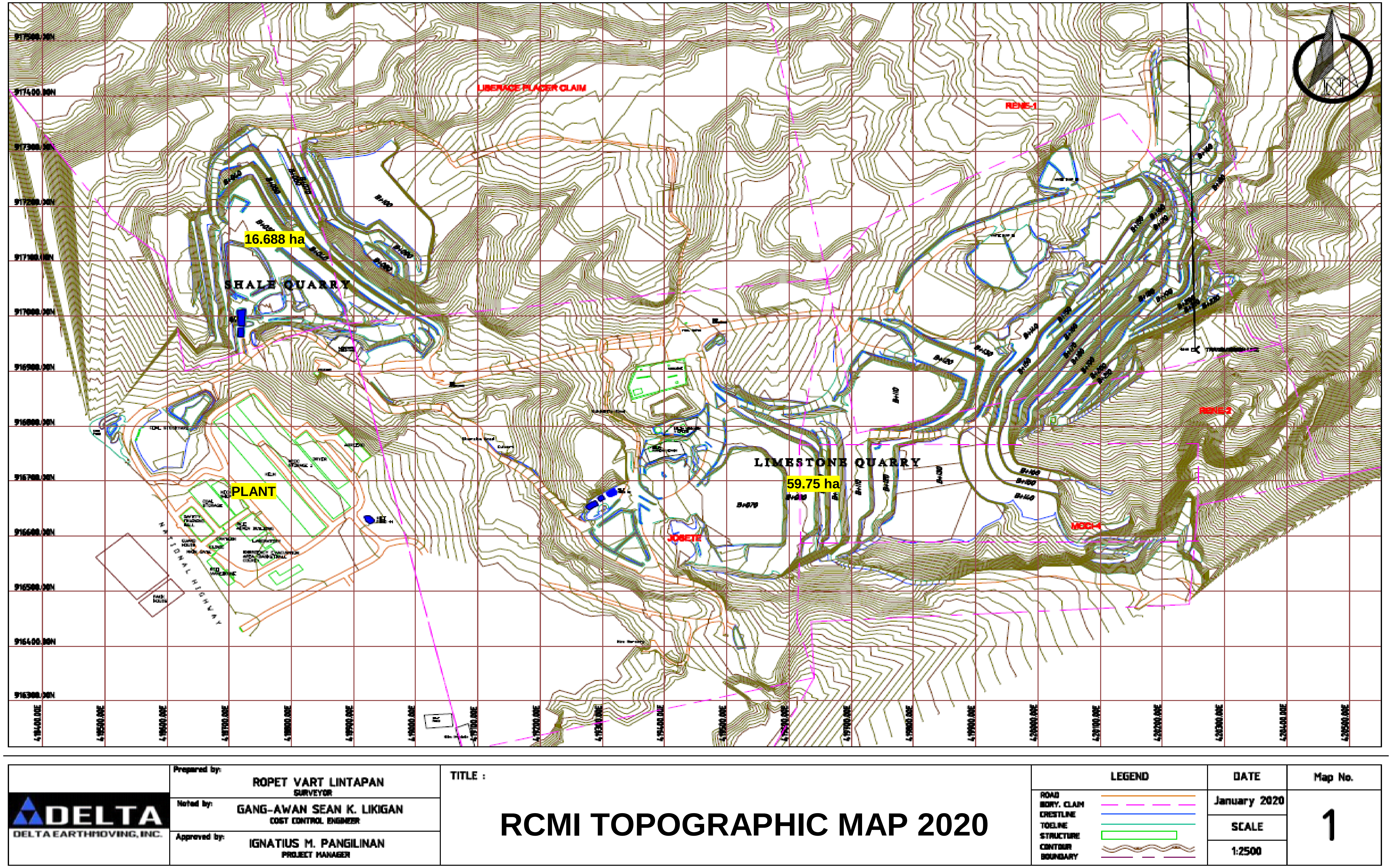
Source: Google Earth (2020 image)

Figure 2.1-12. Comparison of RCMI's Mining Footprint in 2020 and Areas with Mining Footprint as of 2004



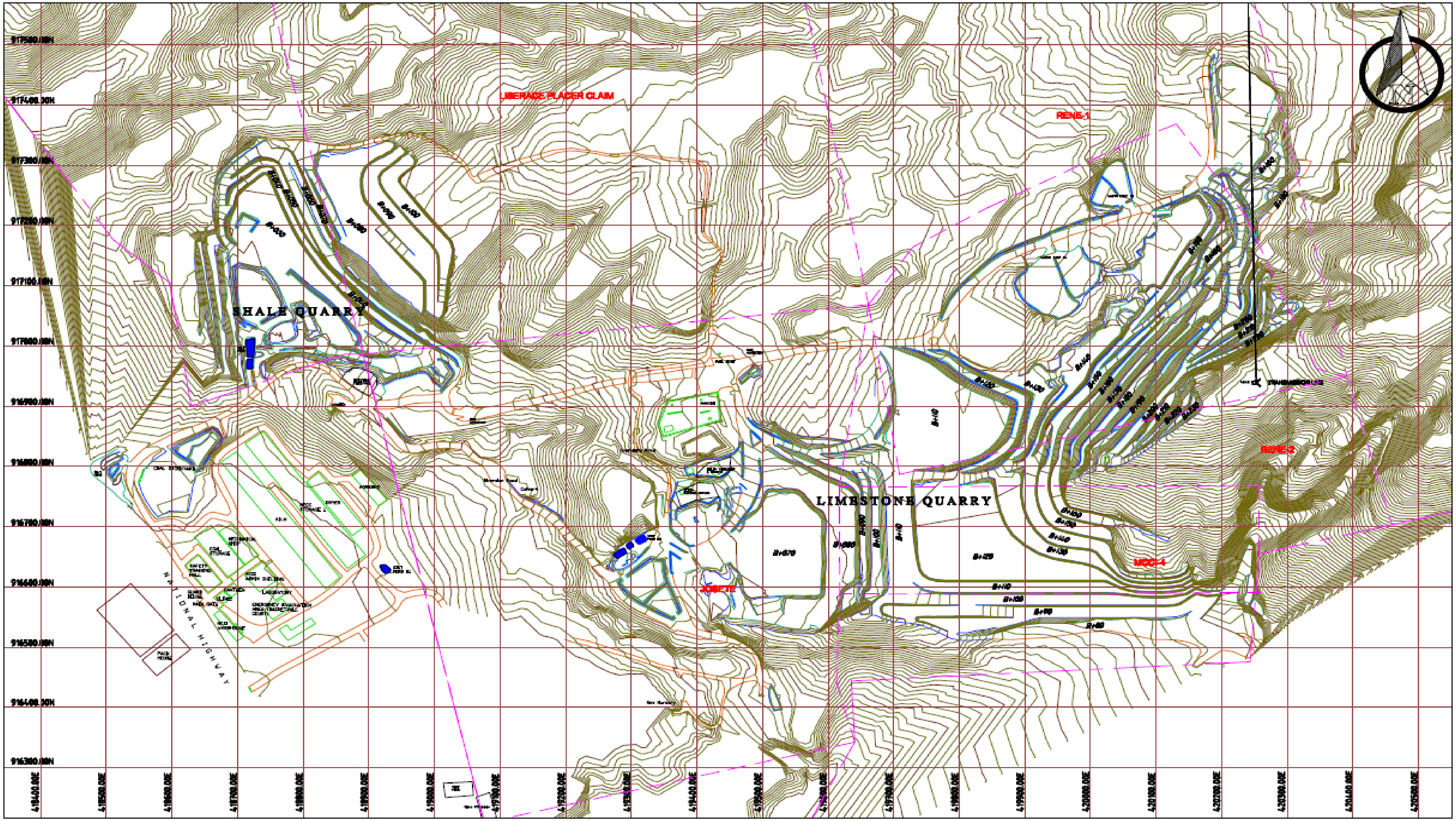
Source: Google Earth Image 2020

Figure 2.1-13. Active and Disturbed Quarry Areas (2020) on a Google Earth Map



Source: RCMI Actual Survey

Figure 2.1-14. Active and Disturbed Quarry Areas (2020) on a Topographic Map



Source: RCMI Actual Survey

Figure 2.1-15. Projected Changes in Topography by Year 2022 Showing Disturbed Quarry Areas

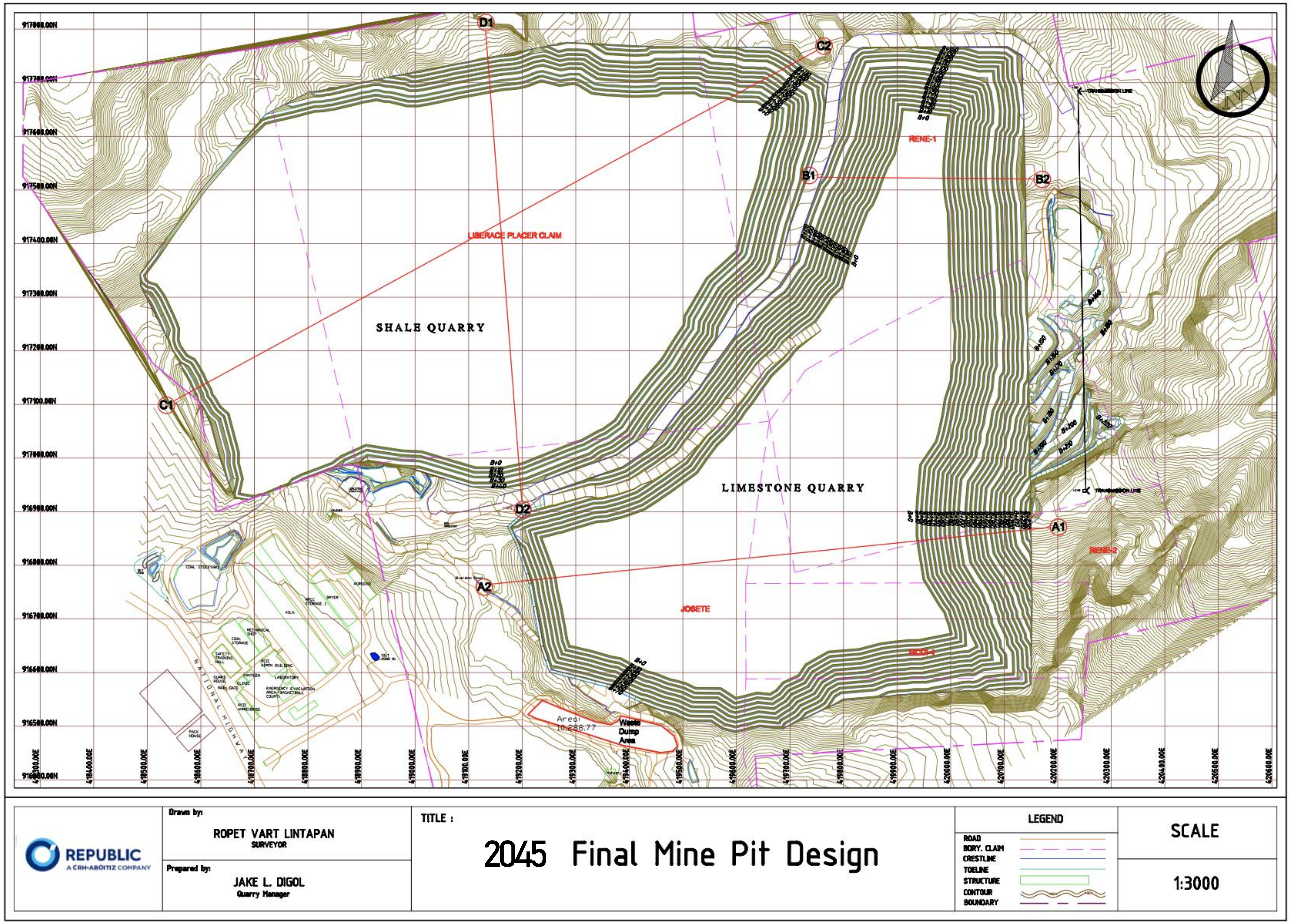


Figure 2.1-16. Final Pit Design by Year 2044

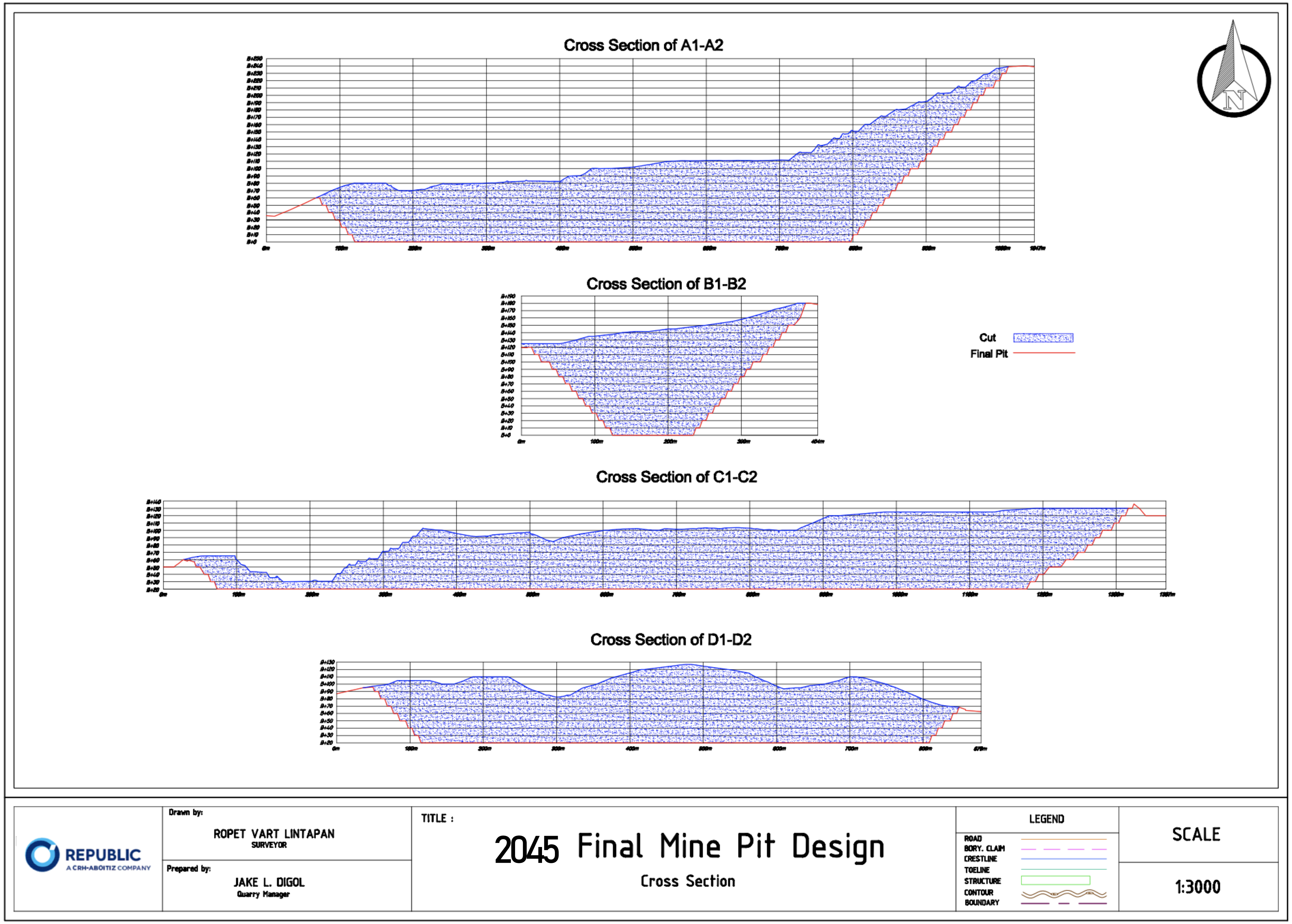


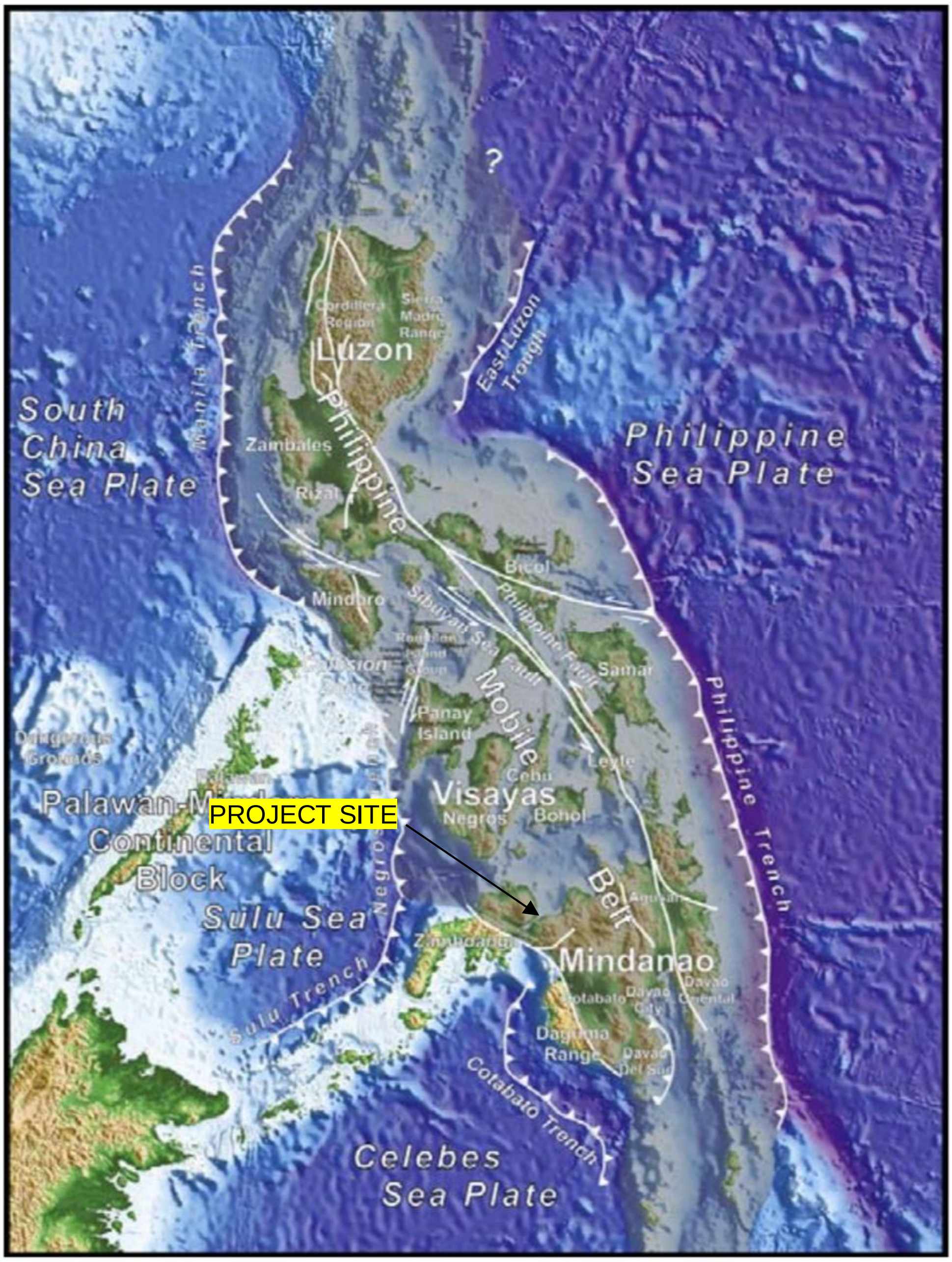
Figure 2.1-16a. Cross Sections for 2044 Final Mine Pit Design

2.1.2.2 Change in Subsurface Geology/Underground Conditions.

2.1.2.2.1 Regional Tectonic Setting

The Philippine Archipelago is bounded by two major subduction zones with opposing polarity (**Figure 2.1-17**). The west-dipping East Luzon Trough-Philippine Trench lies to the east while the east-dipping Manila-Negros-Cotabato Trench lies to the west.

The Celebes Sea Basin is currently subducting at the Cotabato Trench located southwest of Mindanao Island. This has resulted to the formation of the Cotabato Island Arc or West Mindanao Arc which is made up of Miocene volcanics and plutons. The Central Mindanao Volcanic Arc is believed to have been formed by a detached lithosphere that is currently underneath the Central Mindanao Volcanic Arc (Cardwell, 1980).



Source: MGB, 2010

Figure 2.1-17. Major Subduction Systems Bounding the Philippine Archipelago

2.1.2.2.2 Regional Stratigraphy

The province of Lanao Del Norte is part of the Central Mindanao Stratigraphic Group (MGB, 2010). This is composed of an ancient volcanic arc encompassing the areas of Misamis Oriental, Bukidnon, Lanao del Norte, and the Mindanao Central Cordillera with a superimposed Quaternary volcanic complex defined by a NNW belt from Camiguin Is. in the north to Mt. Parker in the south.

Figure 2.1-18 is the geologic map of parts of Dalipuga and Iligan City quadrangles generated by MGB-10. More detailed mapping, as discussed under Local Geology would show that the Opol Formation depicted in **Figure 2.1-18** in the vicinity of the project site is actually Iponan Formation as illustrated in **Figure 2.1-20**).

Figure 2.1-19 shows the stratigraphic column of the Central Mindanao Stratigraphic Group, which is further subdivided into Misamis Oriental-Bukidnon-Lanao, Mindanao Central Cordillera and Central Mindanao Volcanic Complex, representing volcanic deposits from eruptions of Quaternary volcanic centers. Iligan City, Lanao del Norte is part of the 1st subdivision.

The stratigraphic column indicates that the Early Cretaceous Tago Schist constitutes the basement unit in the area, composed of garnitiferous quartz- sericite-epidote-amphibolite, greenschists, phyllite and slate. This is in fault contact with younger serpentinized peridotites of the Late Cretaceous Awang Ultramafic Complex (AUC). The AUC made up largely of serpentinites, underthrusts Eocene interbeds of graywackes, metaconglomerate and metavolcanics of the Himalyan Formation. This consists of graywacke, metaconglomerate, mylonite, metavolcanics and metadiabase. Unconformably overlying these older rock units are the Late Oligocene to Early Miocene Balongkot Limestone and Tuod Formation, which consist of carbonaceous limestone, and a sedimentary sequence intercalated with volcanic flows and volcanic breccias, respectively. These formations were subsequently intruded by the varying types of the diorites of the Middle Miocene Maniki Quartz Diorite. Associated with the quartz diorite are diorite, graonodiorite and andesite.

The carbonate sequence (conglomerate, pebbly sandstone, pyroclastic breccia tuffaceous sandstone and tuff) of the Late Miocene Opol Formation, Pliocene limestone and calcareous sediments of the Indahag Limestone and Iponan Formation, and Pleistocene agglomerate, sandstone and conglomerate of the Bukidnon Formation subsequently overlie the older rocks units. Capping the stratigraphy are slightly consolidated gravels of the Pleistocene to Holocene Cagayan Gravel.

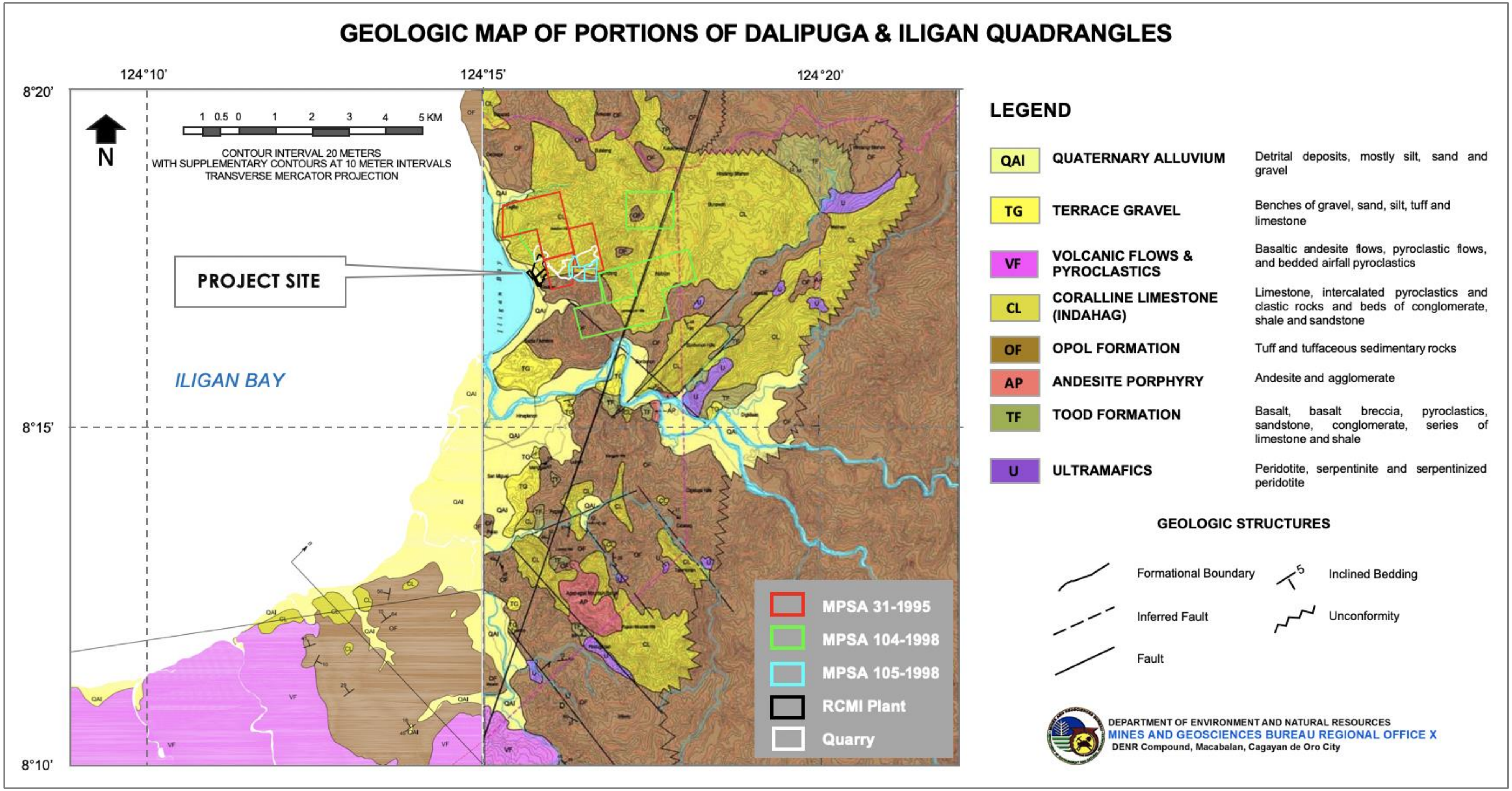
The thickness of these formations are as follows: Opol Formation – 100-150m; Indahag Limestone – 250-300m; Iponan Formation – 500m; and Quaternary Alluvium – nil to 60m (*Hydrogeologic Investigation on the Potential Water Resources of Iligan City, MGB, 2000*).

The Opol Formation was previously named Opol Sandstone by Capitrano (1946) for the sandstone units exposed at Opol, Misamis Oriental. Pacis, in 1966, used the name Opol Formation to include the conglomerate, pebbly sandstone, pyroclastic breccia, tuffaceous sandstone and tuff in the area. In Iligan City, exposures of this formation are found at the southern part of Mandulog River, from Upper Hinaplanon to Mandulog. It is also observed along Pugaan River underlying the Indahag Limestone and at Sitio Pindugangan in Tipanoy. (MGB, 2000) In the quarry areas, some clastic sediments represented by thin to medium beds of brown silty shale with some sandstone as intercalations occur as “erosional windows” over the limestone-dominated area.

The Pliocene deposits of the Indahag Limestone and Iponan Formation underlie the study area and the surrounding vicinity. The Indahag Limestone was named by Capistrano (1946) for exposures of the limestone at Brgy. Indahag, Cagayan de Oro City. This is composed of varying limestone deposits ranging from massive to well-bedded, and coralline with minor interbeds of clastic rocks of conglomerate, tuffaceous sandstone, and shale (MGB, 2010). Three distinct horizons have been observed in this formation and these are a lower section of coralline limestone, with interbeds of calcirudites, calcarenites, and calcisiltites, a middle section of limestone rubble and coral fingers, and an upper section of coralline limestone, calcarenite and limy tuff interbeds (Pacis, 1966 and MGB, 2010).

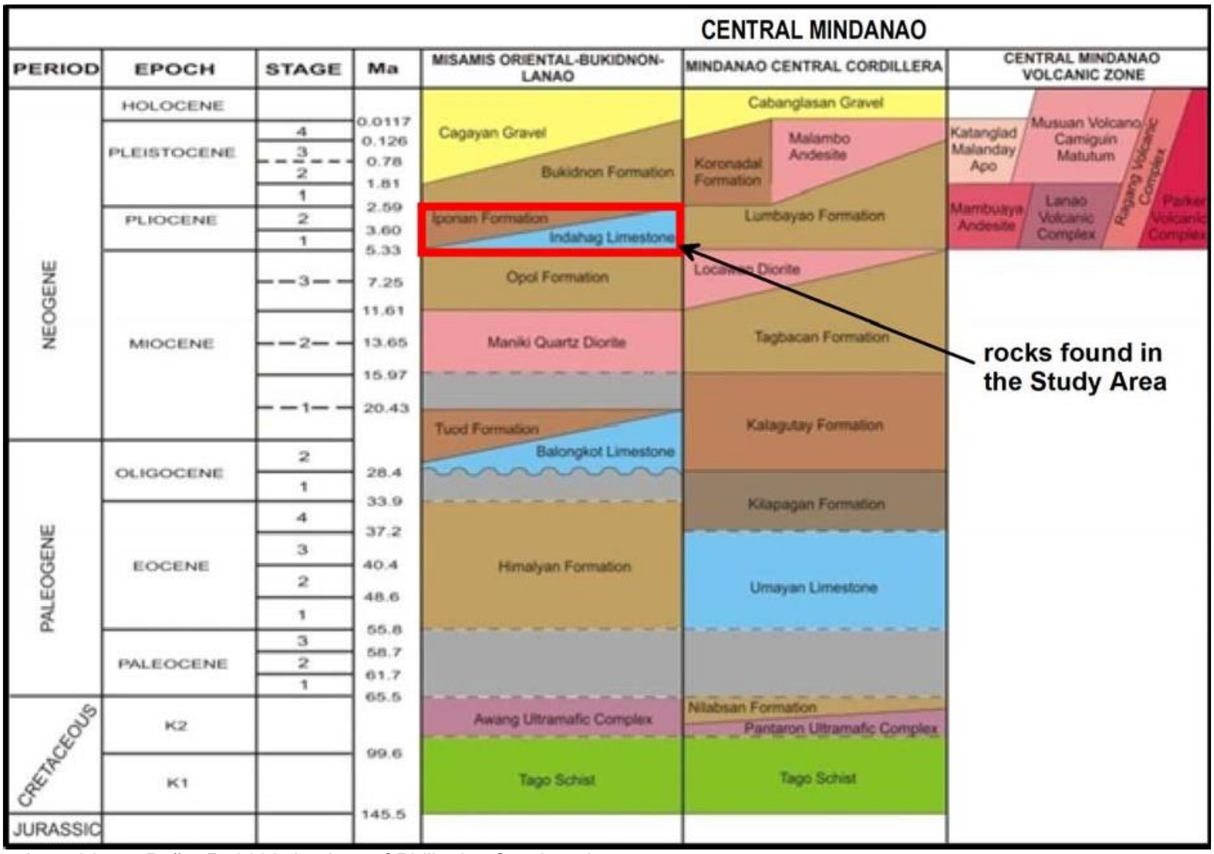
In Iligan City, Indahag Limestone is largely composed of coralline limestone with abundant coral fingers and megafossils. The limestone is exposed in Puga-an, Abuno, Bonbonon Hills, Kiwalan, and Dalipuga (MGB, 2000).

The Iponan Formation, previously called the Iponan Clastics, consists of well-bedded interbeds of conglomerate, sandstones, and shale (Pacis, 1966 and MGB, 2010). Subrounded to rounded pebbles to boulders of igneous and metamorphic origin comprise the conglomerate, while the sandstone layers vary from quartz arenite, arkosic arenite to lithic arenite (MGB, 2010). In Iligan City, this formation occurs mainly as interbeds of poorly-sorted conglomerate beds and sandstone. An exposure at Sta. Filomena, along the road going to San Roque near the National Highway, shows a sequence of conglomerate and sandstone beds reaching up to 1 meter in thickness. The conglomerates are poorly consolidated and composed subrounded to well-rounded pebble to boulder size clasts of schist, serpentinite, quartz diorite, dacite, porphyritic andesite and coralline limestone in sand and clay matrix (MGB 2000).



Source: MGB-10, 2010

Figure 2.1-18. Geologic Map of Iligan City and vicinities



Adapted from: Peña, R. 2008. Lexicon of Philippine Stratigraphy

Figure 2.1-19. Stratigraphic Column of Central Mindanao Stratigraphic Group

2.1.2.2.3 Regional Structural Geology

There are no major active faults traversing the study area based on the available data of the Philippine Institute of Volcanology and Seismology (PHIVOLCS).

The structural features inferred in the project area include a series of folds, the most prominent of which, is an anticline between the Pugaan and Mandulog rivers. North of the Pugaan River, the fold axis generally trend eastwest. To the south, it appears that the fold axes have a N-S trend.

2.1.2.2.4 Local Geologic Setting

The study area is underlain by limestone and clastic sedimentary rocks of the Indahag Limestone and Iponan Formation, respectively. The limestones are mostly exposed in the mountainous northern and eastern sections of Iligan City, while the Iponan clastics are generally observed at the lower hill and mountain slopes and the flatlands of Iligan City. **Figure 2.1-18** above displays the geologic map of Iligan City and vicinities.

2.1.2.2.5 Property Geology
Limestone Quarry

The limestone quarry is underlain by creamy buff to red, massive coralline limestone and bedded fossiliferous limestone. The limestone beds exhibit a general northeast strike and dip 35 to 60 degrees northwest. They are generally moderately to highly fractured. Most limestone exposures are moderately weathered and easily crumble.

Recrystallization occurs in both limestone types but more commonly in the bedded limestone. The recrystallized portions become relatively indurated resulting in the bedding structures being less noticeable. Recrystallized calcite crystals ranging from 3mm to 50mm in size fill pore and fracture spaces mostly in the calcirudites.

Oxidation manifested as red spots, occur in some exposures. These result from the percolation of oxygenated water through the iron-rich recrystallized limestones.

Figure 2.1-21 presents the geologic map of the project site and its immediate vicinity based on field mapping and analysis of available data particularly, the 2017 exploration drillhole data. **Figure 2.1-20** illustrates the geologic section across the quarry.

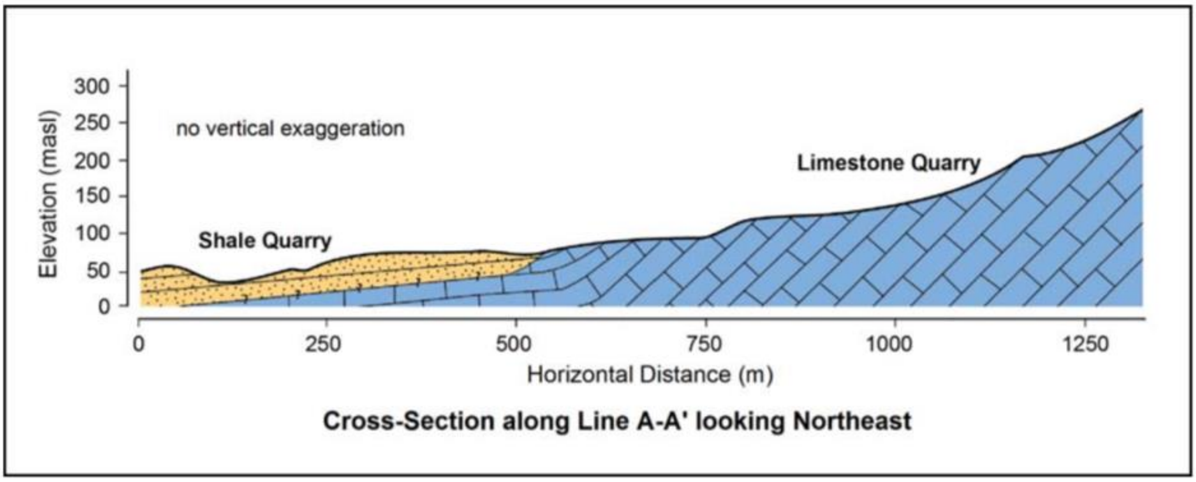


Figure 2.1-20. Geologic Section Across the Shale and Limestone Quarries of RCMI

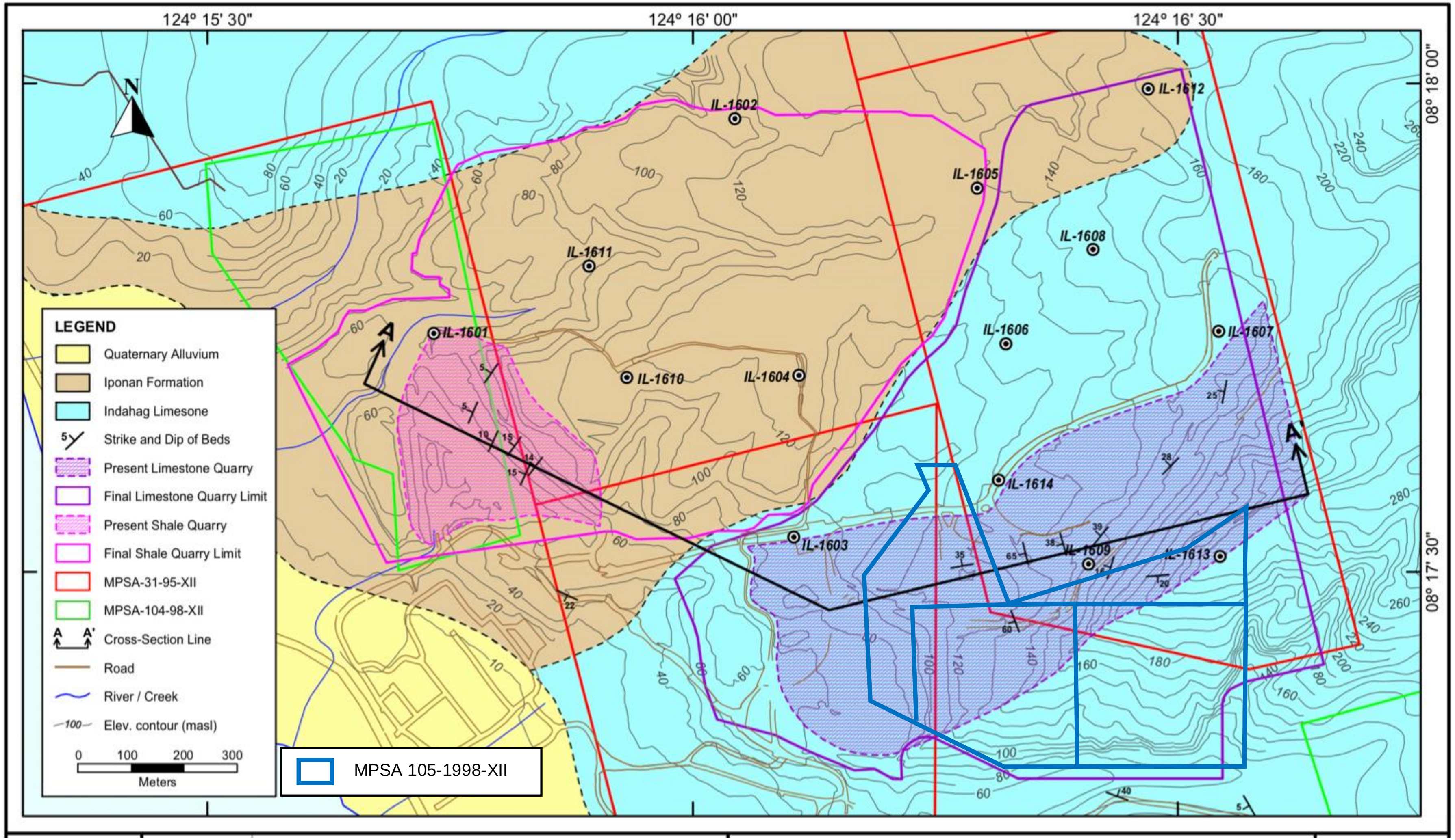


Figure 2.1-21. RCMI Plant and Quarry Sites Geologic Map

Shale Quarry

Interbedded calcareous sandstone, siltstone and mudstone with occasional intercalations of carbonaceous sandstone, and massive limy tuff underlie the shale quarry. These rocks strike northeast and dip 10 to 15 degrees northwest. **Figure 2.1-21** above also shows the geology in the vicinity of the shale quarry while **Figure 2.1-20** also depicts the section across the shale quarry. **Figure 2.1-22** below presents the stratigraphic column.

Beginning at Bench 30, the current lowest level of the quarry, the rocks may be classified in to 4 stratigraphic units, which are:

1. A lowermost unit consisting of massive gray limy tuff.
2. A middle lower unit made up of cross-bedded calcareous sandstone and siltstone with some intercalated carbonaceous mudstones, interbedded with mudstone. The sandstone and siltstone is composed of lithics, bioclasts, and mudstone clasts. This unit exhibited noticeable water seepage along bedding planes.
3. A middle upper unit comprised of interbedded black carbonaceous mudstone, siltstone and sandstone with visible fossils of leaf and stem, which is a diagnostic feature of the Iponan Clastics. These rocks easily crumble.
4. An uppermost unit composed of highly weathered interbedded mudstone, siltstone and sandstone. The mudstone and some sandstone and siltstone laminations are slightly indurated. The sandstone and siltstone easily crumble.

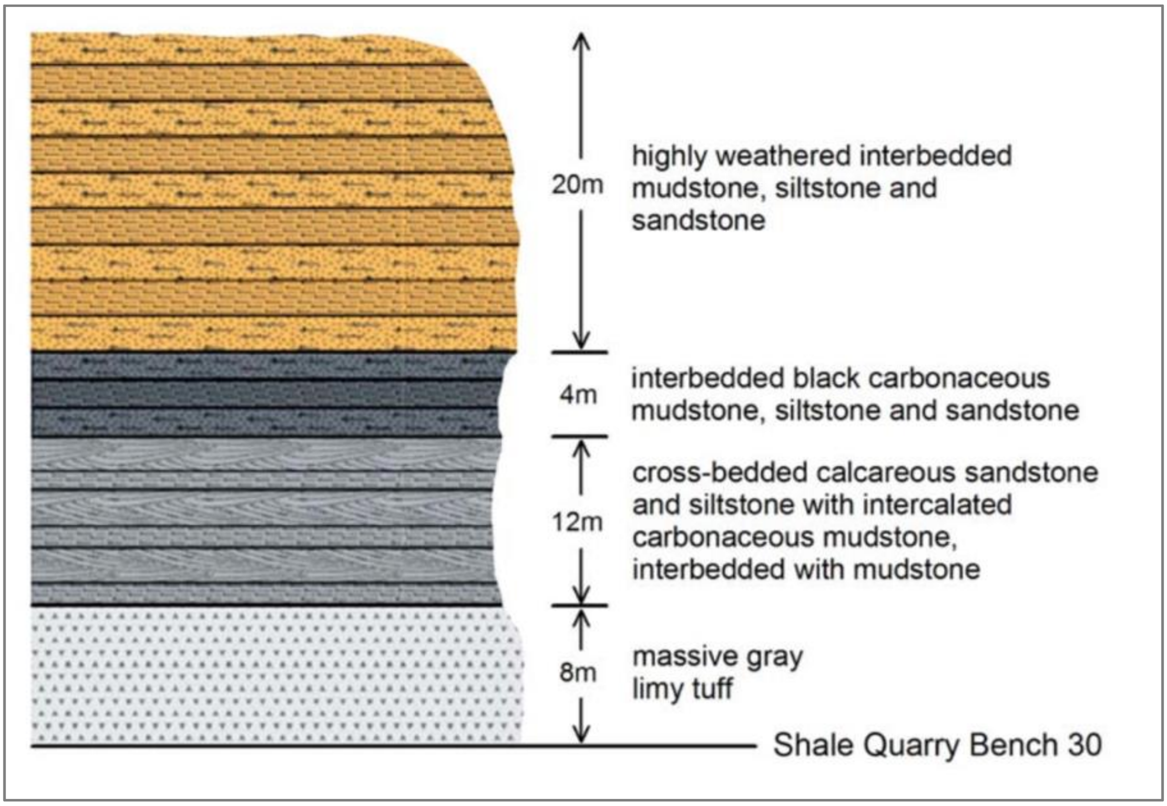


Figure 2.1-22. Stratigraphic Column from Bench 30 at the Shale Quarry

2.1.2.2.6 Mineral Resource Estimate

In 2002 and 2004, the volume of limestone in the area was re-estimated at 350,264,000 MT; while the volume of shale in the area was computed at 88,846,900 MT. This includes the limestone in parcels CHAMPACA 1, CHAMPACA 2, AND CHAMPACA 3 of MPSA 104, which have not been extracted, and hence, remain on the ground. (See **Table 2.1-5**)

A resource delineation drilling campaign was conducted in 2017 to augment the previous drilling data (10 drillholes), which was found to be insufficient for resource estimation purposes. Fourteen additional holes were drilled ranging in depth from 35m to 120m for a total of 1,183 meters. This was conducted inside MPSA 031 and parcel AQL-41 of MPSA 104 Amended.

The follow-up drilling campaign of 2017 produced more detailed information and more in-depth delineation and blocking of resources resulting to an increase in both limestone and shale resource/reserve estimates as compared to the earlier (2002/2004) estimates.

The 2018 estimateion results for limestone is a proven reserve of 248,891,497 MT and a probable resource of 64.4 MMT. The shale was placed at 76.59 MMT proven plus 19.9 MMT probable resources. This does not include the resource that may be found in other parcels of MPSA 104. (See **Table 2.1-3**)

Considering the proven reserves only and at the existing production rate of 1.72 MMTPY for limestone and 0.51 MMTPY for shale, the estimated life of mine (LOM) is 145 years and 150 years, respectively. With the proposed increase to 5.91 MMTPY (3.44%) for limestone and 2.29 MMTPY (4.49%) for shale, the LOM will decrease to 42 years and 33 years, respectively.

For the contract period of the MPSAs (2nd 25-year term), a total of 147.75 MMTPY limestone and 57.25 MMTPY shale shall have been extracted by the year 2045. These accounts for 59.36% and 74.74% of the reserves, respectively.

There lies a potential reserve for the shale materials in other parts of the MPSA areas. Reserves are expected to increase once the planned follow-up exploration is implemented and completed.

Table 2.1-3. Estimated Mineral Reserves

	2002/2004 (EXISTING ECCs)		2018	
Category	**Tonnage (MT)**	**Grade (%CaCO3)**	**Tonnage (MT)**	**Grade (%CaCO3)**
LIMESTONE				
Proven	285,864,000	Incomplete Data	248,891,497	90 – 95
Probable	64,400,000	Incomplete Data	64,400,000	90 – 95
Potential	-	-	132,800,000	90 – 95
TOTAL	**350,264,000**	Incomplete Data	**446,091,497**	90 – 95
SHALE				
Proven	88,827,000	46.62	76,595,979	42.27
Probable	19,900	NO DATA	19,900	NO DATA
Potential	NO DATA	NO DATA	NO DATA	NO DATA
TOTAL	**88,846,900**	**46.62**	**76,615,879**	42.27-

2.1.2.2.7 Impact Analysis

The geological setting of the area in the existing ECC and the proposed expansion project are basically the same. The subsurface condition is characterized by the occurrence of loosely consolidated clastics consisting of medium dense to very dense fat clay with sand and clayey sand in the upper layer underlain by poor quality volcanic and sedimentary rocks.

The proposed modification in the plant site will entail additional land clearing, earth moving and land development or expansion of the current project footprint. Hence, this is seen to have an effect on the current subsurface morphology of the area but the underlying bedrock or the geology will remain the same.

The disturbance of original soil and rock materials during land development and quarrying exposes these materials to the surface where subsurface processes like oxidation, solar radiation, hydrolysis could affect their original characteristics. Progressive and systematic excavation and filling would minimize exposure of the soil or rock to the elements.

In the construction of the additional plant facilities, buried materials different from the original substrate will be introduced to the ground. To minimize risk of contamination or chemical alteration of the soil or rock, appropriate materials will be used for these components. These materials will be carefully selected to make sure that these are able to withstand stress conditions on the ground so incidences like seepage of contaminants will be prevented.

In the quarrying operations, the original and existing geological setting (underlying bedrocks) of the area will technically be the same. What may be considered as “change” is the stripping or gradual depletion of shale and limestone deposits. Similar to the excavations in the plant site, the quarrying will expose more of the bedrocks. Proper stockpiling of overburden and other waste materials should be implemented.

The mineral resource estimates for the shale and limestone within the mining tenements of RCMI were presented in the last EIS of MPCC (2006). For this current EPRMP, another updated (2018) resource estimates is reported based on the follow-up drilling campaign in 2017. This is discussed under **subsection 2.1.2.2.6** above. Even with the continuous quarrying for the past 16 years, the resources barely decreased because more drilling campaign enabled the Proponent to block or delineate more of the mineral resources.

The total volume of shale and limestone extracted from 2007 to 2020 are: 2,374,990 MT and 8,784,236, respectively. Furthermore, the overburden and other mine wastes generated from 2015 to 1st semester 2020 is 46,685 MT, or 1.1% of extracted ore from the same period. Majority of the overburden comes from the shale quarry only. The silt and other sediments that were eroded and trapped at the various siltation ponds were periodically transferred to the dumpsite as well.

As discussed above, with the proposed increase in extraction rate, only 59.36 percent of the limestone and 74.74 percent of the shale reserves shall be extracted at the end of the life of the mining tenements (Year 2045).

Although there will be changes in the volume of reserves due to extraction, the general geology remains the same.

2.1.2.3 Inducement of Subsidence, Liquefaction, Landslides, Mud/ Debris Flow, etc.

2.1.2.3.1 Seismic Hazards

Seismic hazard is the perceptible trembling to violent shaking of ground caused by either tectonic movements or volcanic activity. Areas that are more susceptible to this hazard are those underlain by unconsolidated soils and sediments deposited on the low-lying areas.

Although Mindanao has been the most seismically active among the 3 major island groups in the past decades (Mangao et al., 1994), most of the earthquakes occurred in the eastern portion of the island, where the southern extension of the Philippine Fault Zone (PFZ) and the Philippine Trench pass through, and in the southwestern region in the vicinity of Cotabato Trench. In general, Iligan City, which is located far from the three aforementioned earthquake generators, is not subject to excessive seismic activities. Most of the seismicity near the City is to the west in the vicinity of Cotabato Trench (AusAID-PMRDP, 1999).

Historically, there have been two destructive earthquakes in nearby Lake Lanao. The first, with a magnitude of 7.7, occurred on August 21, 1902 while the second, with a magnitude of 7.5 and maximum intensity of VII-VIII, occurred on April 1, 1955. Earthquakes experienced in Iligan, however, are generally small in magnitude or are located far from the city (AusAID-PMRDP, 1999).

PHIVOLCS certified that the nearest active fault from the proposed project site in barangays Kiwalan and Dalipuga is a segment of the Lanao Fault System (LFS), which is approximately 17.8 km and 21.2 km to the southeast, respectively**.** Moreover, PHIVOLCS stated that the project site is safe from ground rupture and liquefaction but strong ground shaking may be experienced. The low-lying coastal areas are said to be prone to local tsunami due to offshore fault or submarine landslide. (**Plate 2.1-1**)

Figure 2.1-23 shows the distribution of active faults and trenches in the Philippines. **Figure 2.1-24** is the seismicity map from 1608-2016 while **Table 2.1-17** lists the earthquakes that were experienced in the region from 1907-2016.

Although several earthquakes are felt in the City, many of these are small magnitude events or distant events whose effects in the city are insignificant. The most significant event is the March 31, 1955 earthquake with **Ms 7.3**, which resulted in extensive damages in northern Mindanao, including the City of Iligan. The epicenter of this earthquake is to the southwest of Iligan, near the northwestern shore of Lake Lanao. (*Iligan City CLUP, 2013-2022*). This event is probably related to the Lake Lanao Fault. Also in this vicinity, epicenter of earthquake in Nov 15, 1957 was recorded at **Ms 6.3**.

The May 23, 1998 event has an epicenter in Iligan Bay and with magnitude **Ms 6.2**.

In the PHIVOLCS **Table 2.1-4** below, there was no intensity report in Iligan for the 1955 earthquake, but this does not automatically mean it was not felt in the City. The same is true for other events listed above.

Based on the intensity reports in the table, the strongest reported earthquakes in Iligan City are on: June 14, 2002 (Ms: 5.4, Intensity IV); May 31, 2010 (Ms: 5.8, Intensity II); and April 17, 2013 (Ms: 5.3, Intensity II).

Plate 2.1-1. PHIVOLCS Certification

DOST
PHIVOLCS

Republic of the Philippines
Department of Science and Technology
PHILIPPINE INSTITUTE OF VOLCANOLOGY AND SEISMOLOGY

TÜVRheinland CERTIFIED
Management System ISO 9001:2015
www.tuv.com ID 9108634644

HASS-EQ-04

HAS-May-19-552

DATE	30 May 2019
FOR	**TECHNOTRIX CONSULTANCY SERVICES, INC.**
REPRESENTED BY	**EDGARDO G. ALABASTRO**
PURPOSE	EIA requirement

EARTHQUAKE HAZARD ASSESSMENT

BARANGAY HAZARD ASSESSMENT:	GROUND RUPTURE	LIQUEFACTION	TSUNAMI	
Brgy. Bunawan, Iligan City, Lanao del Norte	**Safe; Approximately 17.7 kilometers north of a segment of the Lanao Fault System**	**Safe**	**Safe**	
Brgy. Kiwalan, Iligan City, Lanao del Norte	**Safe; Approximately 17.8 kilometers northwest of a segment of the Lanao Fault System**	**Safe**	**Low-lying coastal area is prone to local tsunami due to offshore fault or submarine landslide**	
Brgy. Dalipuga, Iligan City, Lanao del Norte	**Safe; Approximately 21.2 kilometers northwest of a segment of the Lanao Fault System**	**Safe**	**Low-lying coastal area is prone to local tsunami due to offshore fault or submarine landslide**	

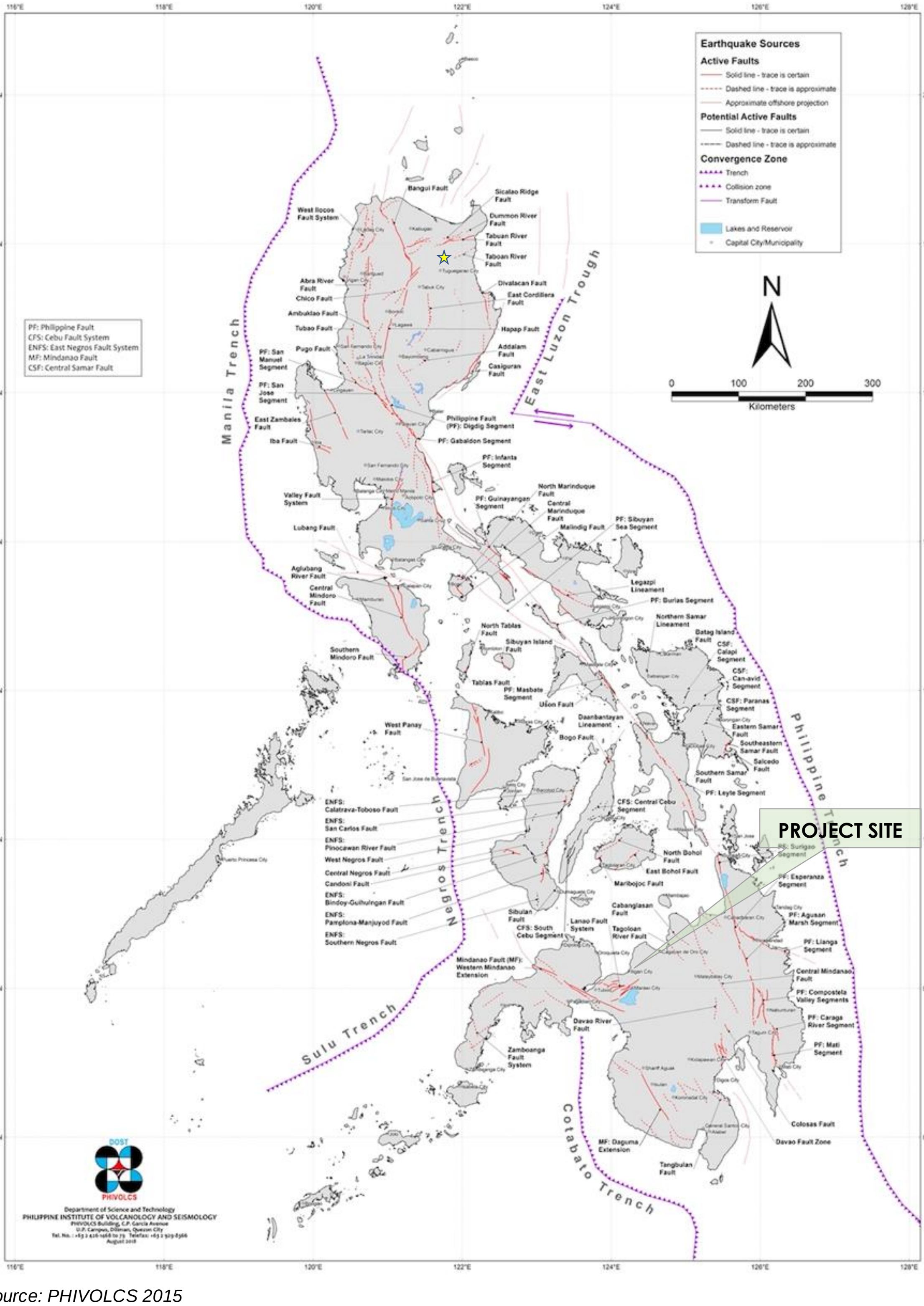
Brgy. Acmac, Iligan City, Lanao del Norte	Safe; Approximately 19.1 kilometers northwest of a segment of the Lanao Fault System	Safe	Low-lying coastal area is prone to local tsunami due to offshore fault or submarine landslide	
Brgy. Bonbon, Iligan City, Lanao del Norte	Safe; Approximately 16.1 kilometers northwest of a segment of the Lanao Fault System	Safe	Safe	

EXPLANATION AND RECOMMENDATION

- ✓ Barangay hazard assessment is made when appropriate vicinity map was not provided. Please note that barangays are located using the PhilGIS (2011). All hazard assessments are based on the latest available hazard maps.
- ✓ Ground rupture hazard assessment is the distance to the nearest known active fault. The recommended buffer zone, or Zone of Avoidance, against ground rupture hazard is at least 5 meters on both sides of the active fault or from its zone of deformation.
- ✓ All sites may be affected by strong ground shaking.
- ✓ Ground shaking hazard can be mitigated by following the provisions of the National Building Code and the Structural Code of the Philippines.
- ✓ Tsunami threat to people's lives can be addressed by community preparedness and tsunami evacuation plan. Advice for tsunami evacuation comes from public agencies and local governments. But more importantly, coastal communities must learn to evacuate themselves when they recognize the three natural signs of tsunami, namely 1) strong ground shaking, 2) unusual rise or fall of sea level, and 3) strong or unusual sound coming from the sea.
- ✓ This hazard assessment supersedes previous assessment made by this office regarding the site.

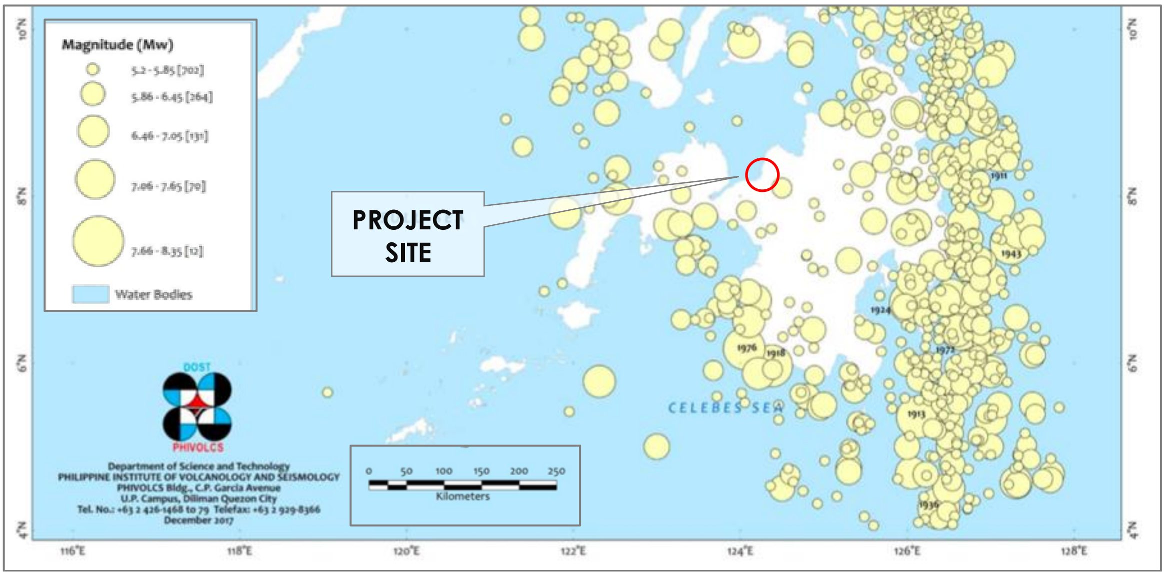
Assessed by	Ericson B. Bariso	Officer-of-the-Day
Verified by	Maria Isabel T. Abigania	Senior Science Research Specialist
Approved by	**RENATO U. SOLIDUM, JR.**	**Undersecretary for DRR and CC, DOST** *and* **Officer-in-Charge, PHIVOLCS**

V2-2017-05-19



Source: PHIVOLCS 2015

Figure 2.1-23. Distribution of Active Faults and Trenches in the Philippines



Source: PHIVOLCS, Dec 2017

Figure 2.1-24. Seismicity Map of Mindanao, with Moment Magnitude >5.1 (1608-2016)

Table 2.1-4. Earthquake Events in Mindanao with Magnitude of 5 and above (1907-2016)

Date	Hour (GMT)	North Latitude	East Longitude	Depth (km)	Ml	Mb	Ms	Intensity Reports in Iligan
20-Jul-07	13	07.100	125.600	1			6.8	
02-Mar-23	16	06.500	124.100	33			7.2	
05-May-25	10	09.500	123.100	33			6.8	
30-Oct-26	13	09.500	124.500	520			6.3	
19-Dec-28	11	06.100	124.500	33			7.3	
28-Dec-28	14	07.500	123.100	33			6.9	
08-Apr-29	10	07.800	124.600	610			6.7	
04-Jun-29	15	06.500	124.500	300			7.0	
16-Jan-34	18	06.100	124.700	33			6.3	
04-Oct-35	05	06.000	125.000	400			6.5	
05-Oct-36	06	09.100	122.700	33			5.7	
22-Sep-40	22	07.500	123.500	33			6.8	
20-Oct-42	23	07.900	122.400	33			7.3	
30-Apr-49	01	06.500	125.100	130			7.4	
02-Jul-51	05	06.100	124.500	100			6.1	
06-Mar-55	10	09.500	122.500	33			6.1	
06-Mar-55	13	09.500	122.500	33			6.3	
31-Mar-55	18	08.000	124.100	96			7.3	
31-Mar-55	20	08.100	124.500	96			6.5	
10-Apr-55	17	08.000	125.000	33			6.5	
15-Nov-57	07	08.100	124.500	100			6.3	
23-Dec-60	10	08.300	125.700	67		5.0		
30-Apr-62	20	06.460	124.140	117		5.3		
13-Jul-62	03	09.870	122.560	79		6.0		
16-Feb-63	08	09.000	123.000	33		5.0		
02-Aug-63	19	06.100	124.900	105		5.0		
29-Sep-63	19	06.060	125.430	103		5.3		

Date	Hour (GMT)	North Latitude	East Longitude	Depth (km)	MI	Mb	Ms	Intensity Reports in Iligan
17-Nov-63	07	07.000	125.000	33		5.6		
01-Mar-64	12	08.400	122.600	73		5.2		
26-Mar-64	06	08.200	122.200	59		5.3		
04-Nov-64	21	06.900	125.700	62		5.5		
23-Jan-65	23	07.430	123.860	628		5.2		
21-Mar-65	13	06.350	124.060	61		5.1		
22-Jun-65	23	07.210	123.530	58		5.8		
15-Jul-65	18	07.640	123.760	605		5.7		
22-Dec-65	00	06.670	124.110	552		5.2		
18-Feb-66	06	06.730	124.820	58		5.3		
16-Mar-66	20	09.480	122.180	38		5.2		
07-Oct-66	03	08.900	125.600	85		5.1		
07-Nov-66	08	07.260	125.530	84		5.0		
08-Jun-67	07	06.160	125.830	161		5.1		
03-Nov-67	10	06.190	125.780	87		5.0		
15-Nov-67	07	06.200	123.700	579		5.1		
06-Apr-68	21	07.470	124.140	41		5.2		
12-Nov-68	05	06.000	125.300	138		5.0		
12-Dec-68	05	09.690	125.780	122		5.6		
20-Dec-68	21	09.230	125.490	74		5.0		
17-Jan-69	20	08.390	124.310	45		5.1		
08-Aug-69	05	07.190	125.490	56		5.1		
14-Sep-69	10	06.270	125.560	54		5.1		
19-Sep-69	00	06.060	125.320	105		5.5		
05-Oct-69	16	07.300	123.700	51		5.4		
06-Oct-69	21	07.170	123.780	68		5.3		
07-Nov-69	02	06.950	124.620	412		4.9		
17-Nov-69	05	09.900	125.900	80		5.1		
07-Dec-69	21	09.670	125.630	35		5.2		
11-Jan-70	12	09.000	125.600	61		5.1		
17-Feb-70	05	09.800	125.900	83		5.8		
29-Apr-70	16	07.580	123.690	660		4.9		
19-Aug-70	05	09.460	122.450	51		5.0		
09-Oct-70	17	06.460	124.150	570		4.9		
14-Oct-70	07	06.950	123.770	50		5.3		
04-Nov-70	23	06.600	124.750	381		5.0		
28-Feb-71	18	09.620	125.890	90		5.1		
24-Mar-71	20	08.930	125.700	59		5.5		
31-Mar-71	09	09.010	125.710	49		5.1		
31-Mar-71	10	08.950	125.680	33		5.4		
02-Apr-71	04	08.940	125.680	31		5.0		
15-Apr-71	03	09.050	125.760	35		4.9		
03-May-71	06	08.840	124.140	68		5.6		
24-May-71	18	09.370	124.450	540		5.0		
06-Jun-71	12	07.480	124.430	54		5.1		
22-Jul-71	07	07.800	122.900	33		5.0		
31-Dec-71	22	06.900	123.260	6		5.5		

Date	Hour (GMT)	North Latitude	East Longitude	Depth (km)	MI	Mb	Ms	Intensity Reports in Iligan
24-Mar-72	17	07.150	123.750	33		5.5		
24-Mar-72	19	07.130	123.770	33		5.5		
04-Jul-72	10	09.410	122.520	58		5.5		
27-Aug-72	21	06.410	125.910	145		4.9		
01-Oct-72	23	07.470	123.750	613		6.0		
13-Dec-72	22	09.660	122.540	143		5.2		
21-Dec-72	09	09.200	123.950	565		5.2		
14-Apr-73	16	06.640	124.090	23		5.4		
14-Apr-73	16	06.640	124.030	57		5.4		
22-Jul-73	15	06.320	124.020	33		5.1		
02-Sep-73	00	07.410	123.740	6		5.3		
20-Sep-73	20	09.050	123.790	560		6.0		
22-Sep-73	01	06.320	124.600	528		5.1		
06-Oct-73	16	09.730	125.620	82		5.5		CDO RF3
28-Oct-73	14	09.120	123.930	554		5.1		
18-Jan-74	01	08.200	122.200	33		5.4		
18-Jan-74	01	08.200	122.300	54		5.1		
04-Feb-74	09	06.200	125.100	25		5.1		
21-May-74	00	08.160	122.980	77		5.0		
27-May-74	10	08.530	123.160	35		5.2		
23-Feb-75	02	08.000	124.000	623	5.6			
14-Apr-75	03	09.800	125.300	38	5.0			
14-Apr-75	03	09.800	125.500	44	5.0			
02-May-75	23	09.200	125.400	33	5.0			
31-May-75	07	08.200	123.000	33	5.5			
22-Nov-75	02	08.130	125.810	69	5.5			
09-Dec-75	01	06.100	123.600	600	6.2			
16-Aug-76	16	06.080	123.920	33	6.3		7.9	
16-Aug-76	17	06.740	123.020	33	5.0			
23-Aug-76	03	06.500	124.100	50	5.0			CDO RF4; COTABATO RF3
14-Jun-78	12	08.270	122.140	33	5.5			
12-Dec-78	11	07.430	123.330	96	5.7			INTENSITY III -CDO
11-Sep-79	11	08.090	125.290	33	5.4			
08-Jul-80	04	06.610	125.910	241	5.6			
08-Sep-80	15	09.280	125.810	49	5.6			
04-Jul-81	10	06.140	125.690	76	5.0			
19-Feb-83	20	08.720	124.010	630	5.9			
15-Jun-83	19	08.940	123.390	543	5.0			
22-Jun-84	12	08.750	123.920	633	5.7			
06-Aug-84	12	07.500	123.760	240	5.0			
18-Aug-84	09	06.300	125.920	33	5.0			
14-Dec-85	06	09.900	125.100	33	5.0			
17-Nov-86	22	06.000	123.500	33	5.0			
18-May-87	17	08.300	125.360	16	4.3	5.5	5.9	RF3-CDO
26-Aug-87	01	09.290	122.270	58	5.0			
05-Jul-88	08	06.540	125.080	178	5.0			
07-Feb-90	06	09.800	124.710	64			5.0	

Date	Hour (GMT)	North Latitude	East Longitude	Depth (km)	MI	Mb	Ms	Intensity Reports in Iligan
08-Feb-90	07	09.690	124.710	31		6.2	6.6	CDO - INT. V
08-Feb-90	07	09.660	124.540	33			5.1	
08-Feb-90	07	09.660	124.840	33			5.3	
08-Feb-90	07	09.730	124.640	34		6.0	6.5	
08-Feb-90	08	09.690	124.430	55			5.3	
10-Feb-90	20	09.530	124.880	33			5.2	
12-Feb-90	23	09.780	124.480	33			5.0	
03-Mar-90	19	09.300	124.800	97			5.5	
18-Mar-90	16	06.200	125.490	33			5.0	
26-Mar-90	22	09.250	125.610	39		5.6	5.5	
17-Apr-90	21	08.570	124.200	30			5.0	
16-Jul-90	10	09.220	125.520	33			5.3	
13-Oct-90	04	08.810	122.060	14			5.8	
24-Feb-91	11	09.210	125.210	58			5.2	
24-Apr-91	04	08.930	124.130	15			5.2	
05-May-91	16	09.000	125.780	67			5.0	
12-Jun-91	03	08.850	125.800	7			5.0	
19-Jun-91	05	06.520	123.290	55			6.1	
10-Jul-91	05	09.070	124.110	511			5.1	
19-Oct-91	19	08.170	122.390	14			5.4	
23-Oct-91	12	09.890	125.880	26			5.0	
02-Nov-91	14	08.830	123.390	56			5.1	
18-Nov-91	11	08.380	125.180	6			5.3	
21-Nov-91	12	07.050	125.720	12			6.2	
18-Dec-91	13	09.240	122.870	15			5.4	
06-Feb-92	13	07.100	124.990	14			5.3	
07-Feb-92	13	08.900	123.960	1			5.1	
17-Mar-92	05	08.520	124.280	27			5.0	
24-Mar-92	22	07.130	124.920	18			5.0	
01-Apr-92	11	08.860	125.270	3			5.1	
07-May-92	22	06.730	124.590	10			5.1	INTENSITY I - CDO
08-May-92	20	07.760	124.950	33			5.6	INTENSITY II - CDO
09-May-92	02	07.810	125.060	17			5.0	INTENSITY III - CDO
29-Oct-92	07	06.990	123.670	23			5.1	
29-Oct-92	07	06.990	123.670	23			5.1	
14-May-93	10	07.140	124.870	29			5.2	
16-Oct-93	10	07.530	123.400	33			5.6	
27-Oct-93	07	06.810	125.670	23			5.1	
23-Nov-93	15	06.380	125.720	14			5.1	
17-Feb-94	19	09.770	125.640	9			5.6	
13-May-94	20	07.880	123.300	5			5.7	
22-May-94	10	06.520	123.460	20			5.5	
06-Jul-94	09	06.500	125.900	110			5.6	
06-Nov-94	11	07.550	125.930	23			5.7	
20-Apr-95	05	06.290	125.750	4			5.0	
23-Apr-95	06	06.200	123.740	556			5.2	
06-Jun-95	13	07.410	123.740	6			5.0	

Date	Hour (GMT)	North Latitude	East Longitude	Depth (km)	Ml	Mb	Ms	Intensity Reports in Iligan
04-Nov-95	02	06.960	125.400	16			5.0	
27-May-96	05	09.980	124.100	3			5.6	
04-Aug-96	15	06.150	124.700	3			5.1	
28-Sep-96	14	09.950	125.410	224			6.2	
17-Oct-96	16	06.400	125.490	7			5.6	
03-Dec-96	20	09.710	125.550	7			5.1	
11-Jun-97	04	09.840	125.410	15			5.5	
05-Oct-97	19	06.180	125.460	190			5.3	
18-May-98	11	09.380	125.620	18			5.0	
23-May-98	17	08.370	124.000	623			6.2	
03-Sep-98	02	08.280	125.860	5			5.4	
23-Sep-98	19	09.710	125.500	15			5.4	
22-Dec-98	03	06.430	124.920	373			5.0	
05-Mar-99	22	06.330	122.150	25	5.5	6.0	5.5	
07-Jun-99	07	08.580	125.750	7			5.1	INTENSITY II - CDO
09-Jun-99	01	08.600	125.650	14			5.0	
08-Jul-99	00	07.500	123.840	10	5.1	6.8	5.6	
16-Aug-00	18	06.186	124.880	24	4.7	5.7	5.1	
08-Oct-00	03	09.746	125.545	12	4.9	5.9	5.4	
01-Jan-02	11	06.102	125.847	126	5.1	6.0	5.6	INTENSITY I- CDO
14-Jun-02	02	07.661	123.909	3	5.0	5.9	5.4	INTENSITY IV - ILIGAN CITY, INTENSITY III - CDO
30-Dec-02	04	07.372	123.322	1	5.5	6.4	6.1	INTENSITY II- CCDO
26-May-03	23	06.805	123.646	562	5.9	6.8	6.8	
26-Feb-04	15	08.060	123.131	18	4.6	5.6	5.0	
26-Feb-04	17	08.177	123.294	20	4.6	5.6	5.0	
19-Dec-04	15	07.387	123.840	593	4.7	5.7	5.2	
19-May-05	14	06.278	125.771	124	4.8	5.7	5.2	
04-Oct-05	09	09.469	125.337	4	4.6	5.6	5.0	
19-Nov-05	17	06.252	125.926	71	5.0	5.9	5.4	
23-Jan-06	14	07.048	125.833	73	4.7	5.7	5.1	
16-Apr-06	17	05.994	125.060	213	5.0	5.9	5.5	
14-Nov-06	10	06.326	123.644	21	4.8	5.8	5.2	
15-Nov-06	04	06.540	123.631	5	4.9	5.9	5.5	
24-Nov-06	17	07.407	124.819	4	4.6	5.6	5.0	
06-Dec-06	03	09.640	122.185	25	4.6	5.6	5.0	
12-Dec-06	09	06.584	125.927	56	4.8	5.7	5.2	
25-Apr-07	11	07.161	125.585	61	5.2	4.3	5.2	
09-May-07	09	06.633	124.013	584	4.8	5.7	5.2	
13-Jul-07	00	09.275	123.079	1	4.3	5.3	5.0	
21-Aug-07	19	07.084	123.546	24	4.6	5.6	5.0	
16-May-08	12	06.509	125.429	33	4.9	5.9	5.3	
17-May-08	14	06.010	125.142	111	4.8	5.8	5.2	
10-Jul-08	17	06.312	124.509	1	4.7	5.7	5.2	
21-Jul-09	07	06.012	125.926	89	4.6	5.5	5.0	
26-Aug-09	22	09.528	123.863	572	4.9	5.8	5.3	
18-Sep-09	11	06.496	124.700	74	5.1	6.1	5.7	

Date	Hour (GMT)	North Latitude	East Longitude	Depth (km)	MI	Mb	Ms	Intensity Reports in Iligan
19-Sep-09	01	06.449	124.728	16	4.9	5.8	5.3	
04-Oct-09	10	06.793	123.658	627	5.9	6.8	6.6	
27-Oct-09	00	06.388	124.637	23			5.3	
11-Nov-09	13	09.367	125.584	16	5.2	6.1	5.8	INTENSITY III - CAGAYAN DE ORO CITY; TAGOLOAN
13-Jan-10	12	06.584	124.307	7	4.7	5.7	5.1	
31-May-10	10	06.929	123.884	6	5.2	6.1	5.8	INTENSITY III - CDO; OZAMIS CITY; INTENSITY II - ILIGAN
23-Jul-10	22	06.837	123.543	598	5.9	6.8	6.9	INTENSITY II - CDO
23-Jul-10	22	06.749	123.597	595	4.9	5.9	5.5	
23-Jul-10	22	06.684	123.584	568			7.1	INTENSITY II - CDO
23-Jul-10	23	06.574	123.340	638			7.1	INTENSITY II - CDO
24-Jul-10	05	06.214	123.672	563	5.2	6.1	6.0	
26-Jul-10	16	06.859	123.669	595	4.2	5.2	5.0	
26-Jul-10	23	06.696	123.137	648	4.6	5.6	5.4	
29-Jul-10	07	06.396	123.400	616			6.6	
29-Jul-10	08	06.584	123.379	601	3.9	4.9	5.5	
24-Aug-10	20	06.638	123.588	629	4.6	5.6	5.0	
05-Oct-10	08	06.757	123.762	602			5.0	
06-Oct-10	21	06.671	124.800	8	4.8	5.7	5.2	
24-Jan-11	06	06.346	123.595	596	4.7	5.7	5.0	
03-Mar-11	15	09.510	125.900	3	5.1	6.0	5.7	INTENSITY I - CDO
24-Jun-11	17	06.743	123.745	593	4.5	5.5	5.0	
07-Jul-11	07	06.228	124.245	576	4.8	5.8	5.2	
10-Jul-11	16	09.490	122.136	31	4.8	5.7	5.2	
11-Jul-11	20	09.506	122.023	4	5.5	6.4	6.2	INTENSITY II - CDO
11-Jul-11	21	09.693	122.566	101	5.1	6.0	5.7	
01-Oct-11	04	07.446	123.926	621	4.8	5.8	5.2	
05-Nov-11	23	06.706	123.870	573	4.6	5.6	5.0	
07-Nov-11	09	07.993	125.013	1	4.7	5.7	5.2	INTENSITY II - CDO
12-Jan-12	00	08.394	125.867	1	4.6	5.6	5.0	
17-Jan-12	10	06.518	125.877	90	4.7	5.7	5.1	
06-Feb-12	03	09.968	123.165	5	6.0	6.9	6.9	INTENSITY III - CDO
06-Feb-12	10	09.915	123.172	1	5.6	6.5	6.3	
06-Feb-12	11	09.917	123.111	6	5.0	6.0	5.5	
06-Feb-12	11	09.929	123.075	8	4.8	5.8	5.2	
16-Mar-12	07	09.977	125.599	17	5.3	6.2	5.9	INTENSITY III - CDO
03-Jun-12	13	06.575	124.020	631	4.9	5.9	5.3	
11-Jun-12	13	06.650	123.853	604	4.7	5.7	5.1	
03-Sep-12	06	06.539	123.580	1	5.3	6.2	5.9	
03-Sep-12	19	07.914	124.883	5	5.1	6.1	5.7	INTENSITY III - CDO
02-Oct-12	06	08.192	123.081	24	4.8	5.8	5.2	INTENSITY III - OROQUIETE CITY; INTENSITY II - LUGAIT; INTENSITY I - CDO
24-Nov-12	20	06.516	123.625	630	4.7	5.7	5.0	

Date	Hour (GMT)	North Latitude	East Longitude	Depth (km)	Ml	Mb	Ms	Intensity Reports in Iligan
17-Apr-13	09	07.296	124.795	6			5.3	INTENSITY III - CDO; INTENSITY II - ILIGAN CITY
01-Jun-13	14	07.285	124.793	1			5.7	INTENSITY III- MARAWI; OZAMIS CITY; CDO
02-Jun-13	20	07.360	124.794	12			5.7	INTENSITY III - CDO
15-Jul-13	01	07.338	124.814	3	4.8	5.8	5.2	INTENSITY III- CDO
18-Aug-13	22	06.327	124.698	385	5.1	6.0	5.6	
15-Oct-13	00	09.848	124.044	12	6.2	7.0	7.2	INTENSITY V - OZAMIS CITY; CDO
15-Oct-13	02	09.873	124.009	9	4.7	5.7	5.1	
15-Oct-13	08	09.825	123.688	3	5.0	5.9	5.5	
15-Oct-13	08	09.909	124.009	5	4.7	5.7	5.1	
15-Oct-13	13	09.769	123.664	7	4.7	5.7	5.1	
16-Oct-13	01	09.745	123.615	1	5.8	4.8	5.2	
16-Oct-13	09	09.908	124.070	7	5.7	4.7	5.0	
20-Oct-13	23	09.891	124.028	7			5.4	
29-Oct-13	15	07.517	125.207	123	4.6	5.6	5.0	
01-Nov-13	13	09.849	124.123	5	4.8	5.8	5.2	
17-Mar-14	05	09.458	125.281	10	4.9	5.9	5.4	
11-Jun-14	09	09.706	125.786	20	4.6	5.6	5.0	
19-Sep-14	23	06.875	125.104	1	4.7	5.7	5.0	
20-Sep-14	04	06.747	124.979	15	5.5	6.4	6.2	
20-Oct-14	18	06.801	125.056	3	4.6	5.6	5.0	
22-Oct-14	02	06.730	125.006	4	4.7	5.7	5.0	
25-Oct-14	10	08.424	125.882	14	4.7	5.7	5.0	
20-Jan-15	20	06.238	123.890	623			5.2	
26-Jan-15	07	09.817	122.262	16			5.1	
13-Apr-16	18	07.834	121.965	27	5.4	6.3	6.0	INTENSITY II - DIPOLOG CITY; OROQUIETA CITY
26-Jul-16	14	09.672	125.466	12	4.9	5.9	5.3	
06-Aug-16	09	06.202	125.313	74	4.9	5.9	5.4	
02-Sep-16	08	06.352	123.772	1	4.6	5.6	5.0	
04-Sep-16	02	08.389	125.805	6	5.3	6.3	6.0	INTENSITY II - CDO
14-Oct-16	18	09.096	125.469	34	4.9	5.8	5.3	INTENSITY II - CDO

Source: PHIVOLCS 2019
Notes:
Green highlights – with Intensity Report for Iligan
Orange highlight – epicenter is near Iligan

Although several earthquakes are felt in the City, many of these are small magnitude events or distant events whose effects in the city are insignificant. The most significant event is the March 31, 1955 earthquake with **Ms 7.3**, which resulted in extensive damages in northern Mindanao, including the City of Iligan. The epicenter of this earthquake is to the southwest of Iligan, near the northwestern shore of Lake Lanao. (*Iligan City CLUP, 2013-2022*). This event is probably related to the Lake Lanao Fault. Also in this vicinity, epicenter of earthquake in Nov 15, 1957 was recorded at **Ms 6.3**. The May 23, 1998 event has an epicenter in Iligan Bay and with magnitude **Ms 6.2**.

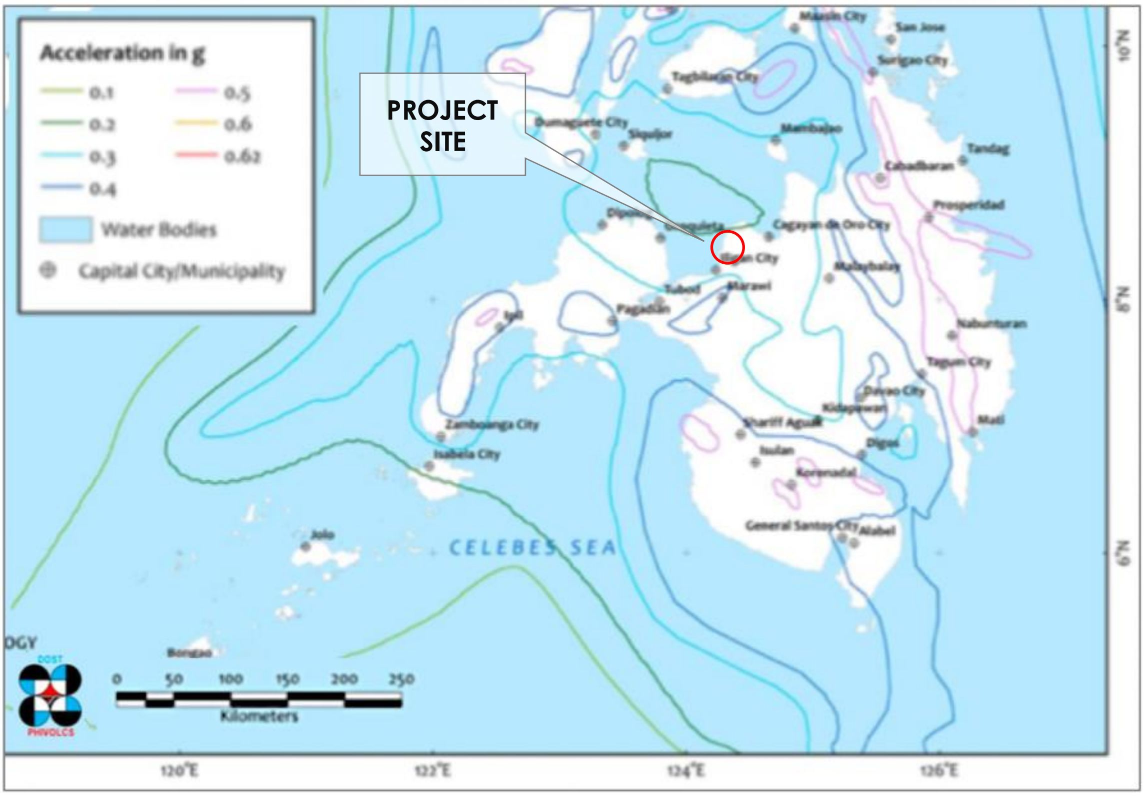
In the PHIVOLCS table above, there was no intensity report in Iligan for the 1955 earthquake, but this does not necessarily mean it was not felt in the City. The same is true for other events listed above. Based on the intensity reports in the table, the strongest reported earthquakes in Iligan

City are on: June 14, 2002 (Ms: 5.4, Intensity IV); May 31, 2010 (Ms: 5.8, Intensity II); and April 17, 2013 (Ms: 5.3, Intensity II). Those without

2.1.2.3.1.1 Ground Shaking/Acceleration

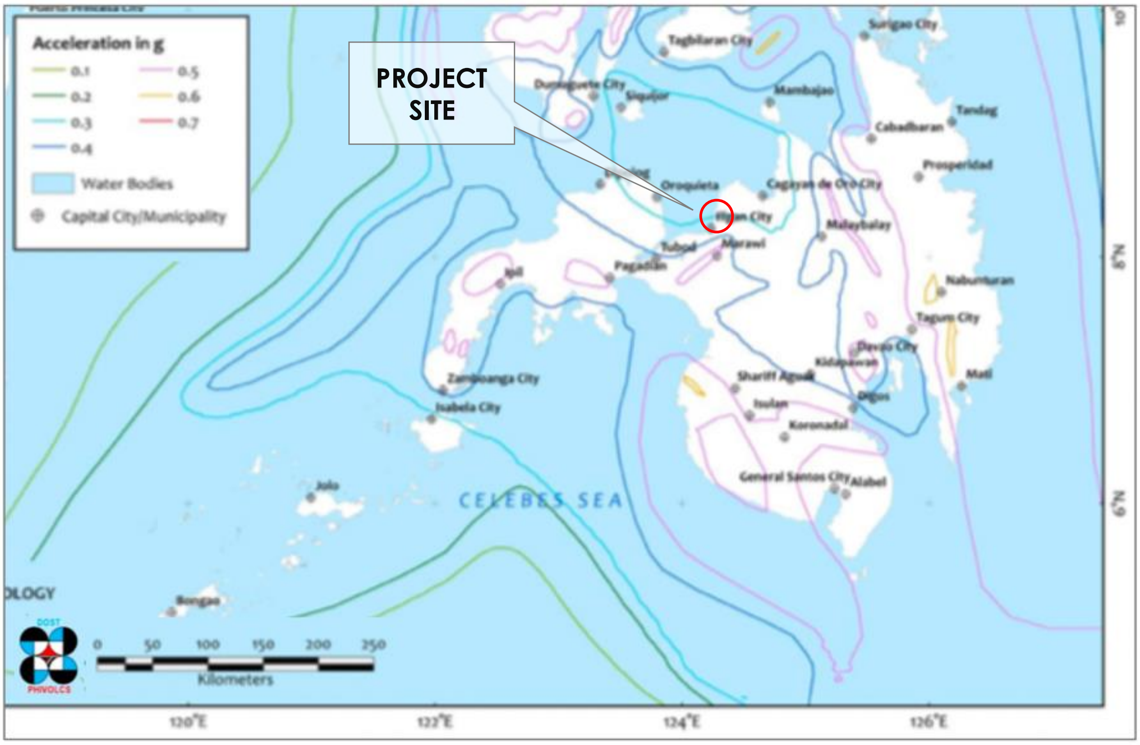
Ground acceleration caused by earthquakes may result to great damage and destruction to property and infrastructure accompanied by loss of life. Factors that influence the intensity of ground shaking include the magnitude of the earthquake, distance of the site in relation to the earthquake generator, characteristics of the underlying rocks, and the soundness of the building. The Philippines is located near or along the so called “earthquake belt” and is prone to seismic hazards. The reason why the Philippine Institute of Volcanology and Seismology (PHIVOLCS) and the United States Geological Survey (USGS) conduct ground motion hazard mapping in terms useful to engineering design using modern probabilistic methodology. In the study, the peak horizontal ground accelerations that have a 10 % probability of being exceeded in 50 years have been uniformly estimated for rock, medium soil, and soft soil site condition. Result of the study shows an estimate on rock ranging from a low of 0.11g in Visayas to a high of 0.30g in the vicinity of Casiguran fault zone in eastern Luzon. Estimates for soft soil conditions are considerably higher and range between 0.27g for Visayas and 0.80g along the Casiguran fault zone.

The project site which, is underlain mainly by limestone and clastic rocks fall under “rock site”. **Figures 2.1-25** to **2.1-27** are the latest (2017) Peak Ground Acceleration Maps released by PHIVOLCS with “g” on rock site at 0.2 to 0.3 for 500-year return period; 0.3 for 1,000-year return period; and 0.4 for 2,500-year return period.



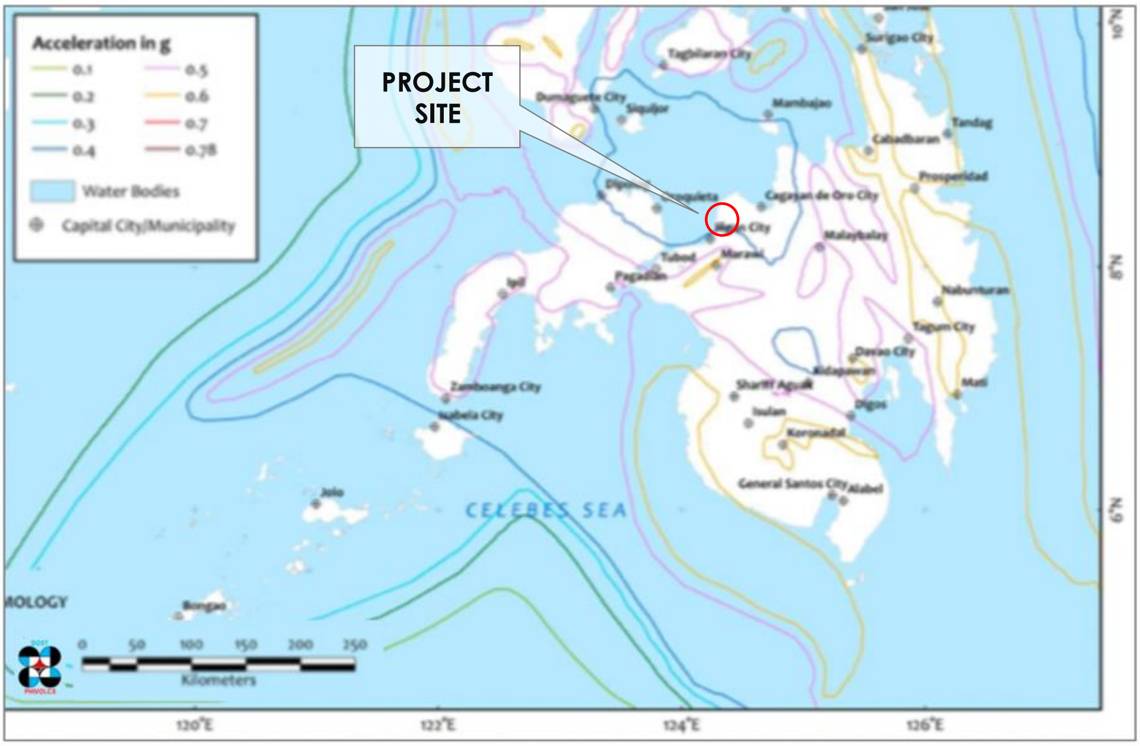
Source: PHIVOLCS, 2017

Figure 2.1-25. Peak Ground Acceleration Map, 500-Y Return Period on Rock Site



Source: PHIVOLCS, 2017

Figure 2.1-26. Peak Ground Acceleration Map, 1,000-Y Return Period on Rock Site



Source: PHIVOLCS, 2017

Figure 2.1-27. Peak Ground Acceleration Map, 1,000-Y Return Period on Rock Site

Applying the deterministic method of Fukushima and Tanaka (1990) in determining the probable peak ground acceleration values for the project site using the following attenuation relation:

Log10A = 0.41M-log10 (R + 0. 032 x 10 0.41M) – 0.0034R + 1.30

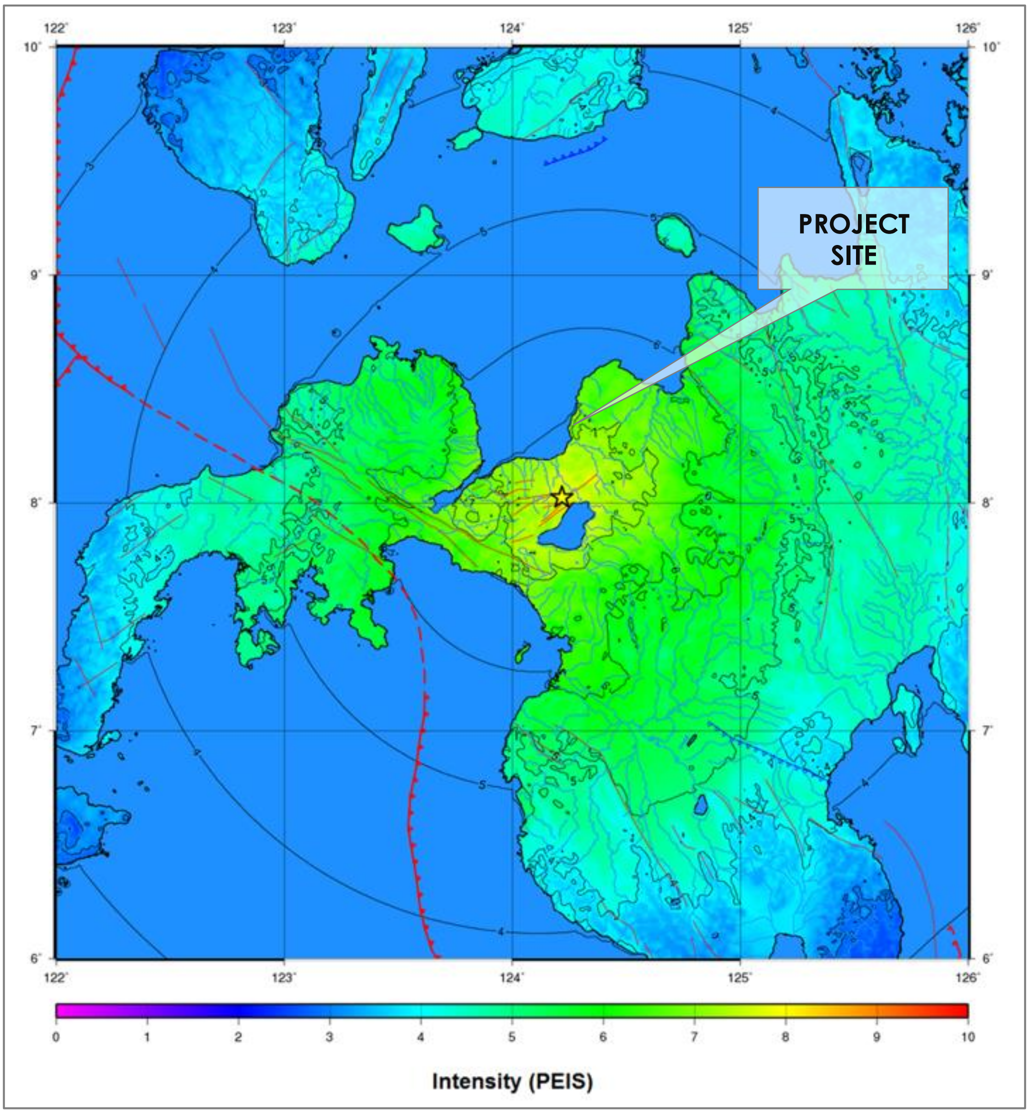
where : A= mean of the peak acceleration from two horizontal components at each site (cm/sec^2)
R= shortest distance between site and fault rupture (km)
M= surface-wave magnitude

and considering an earthquake magnitude of 6.9 from the nearest possible earthquake generator to the project site, a segment of the Lanao Fault System about 17.8km away, the following "**g**" values are obtained: bedrock = 0.182, medium soil=0.303 and soft soil=0.425. The plant site falls under the soft soil, hence should consider the g value of **0.425**. For the quarry area which is on rock site, the g value to be considered is **0.182**.

Table 2.1-5. Computed PGA Values

Earthquake Generator	Magnitude	Distance	Calculated PGA (g) Values		
			Bedrock	Medium Soil	Soft Soil
Lanao Fault System	6.9	17.8	0.182	0.303	0.425
Western Mindanao Fault	7.3	70	0.068	0.114	0.160
Central Mindanao Fault	7.6	114	0.042	0.070	0.098
Davao River Fault	7.1	198	0.009	0.016	0.022

Figure 2.1-28 shows that the project site is highly prone to ground shaking hazard with Intensity VI and above for a M6.9 scenario earthquake from Lanao Fault.



Source: PHIVOLCS, n.d.

Figure 2.1-28. Ground Shaking Scenario Map – Lanao Fault System M6.9 Earthquake

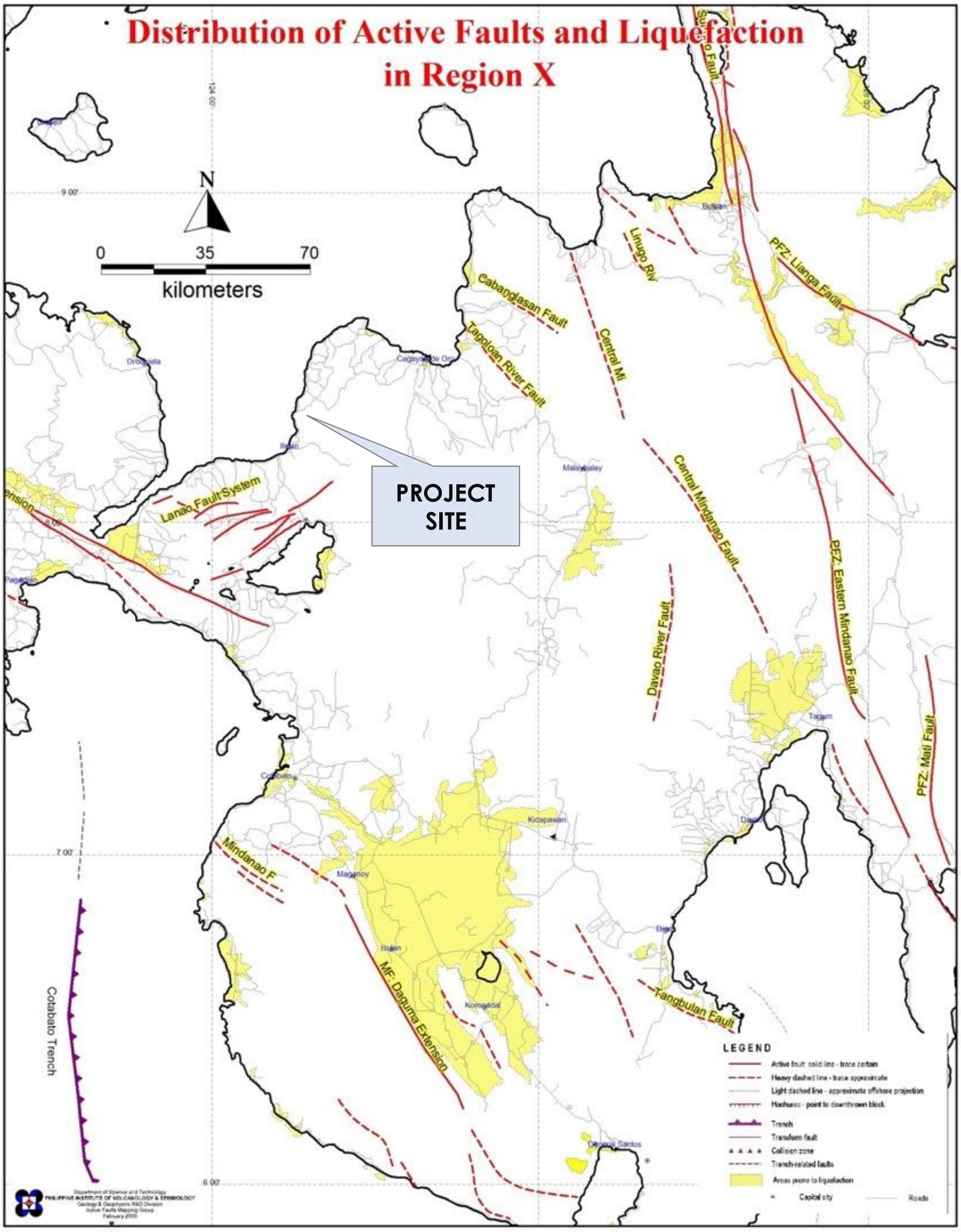
2.1.2.3.1.2 Ground Rupture

This hazard is seemingly absent in the project area since the nearest active fault, the Lano Fault, is about 17.8km SW from the project. PHIVOLCS's recommended buffer zone for ground rupture hazard is 5 meters on both sides of the fault.

2.1.2.3.1.3 Liquefaction

Liquefaction is the process that transforms the behavior of cohesionless water-saturated unconsolidated sediments from a solid to a liquid state usually caused by seismic stresses (Torres et al, 1994) that create ground shaking. Water saturated soils loose strength and liquefy and thus the material tends to flow causing buildings to sink and rotate or lean into the soil (Keller, 1985).

Based on the Liquefaction Hazard Map prepared by PHIVOLCS, the project area is not susceptible to liquefaction hazard (**Figure 2.1-29)**.

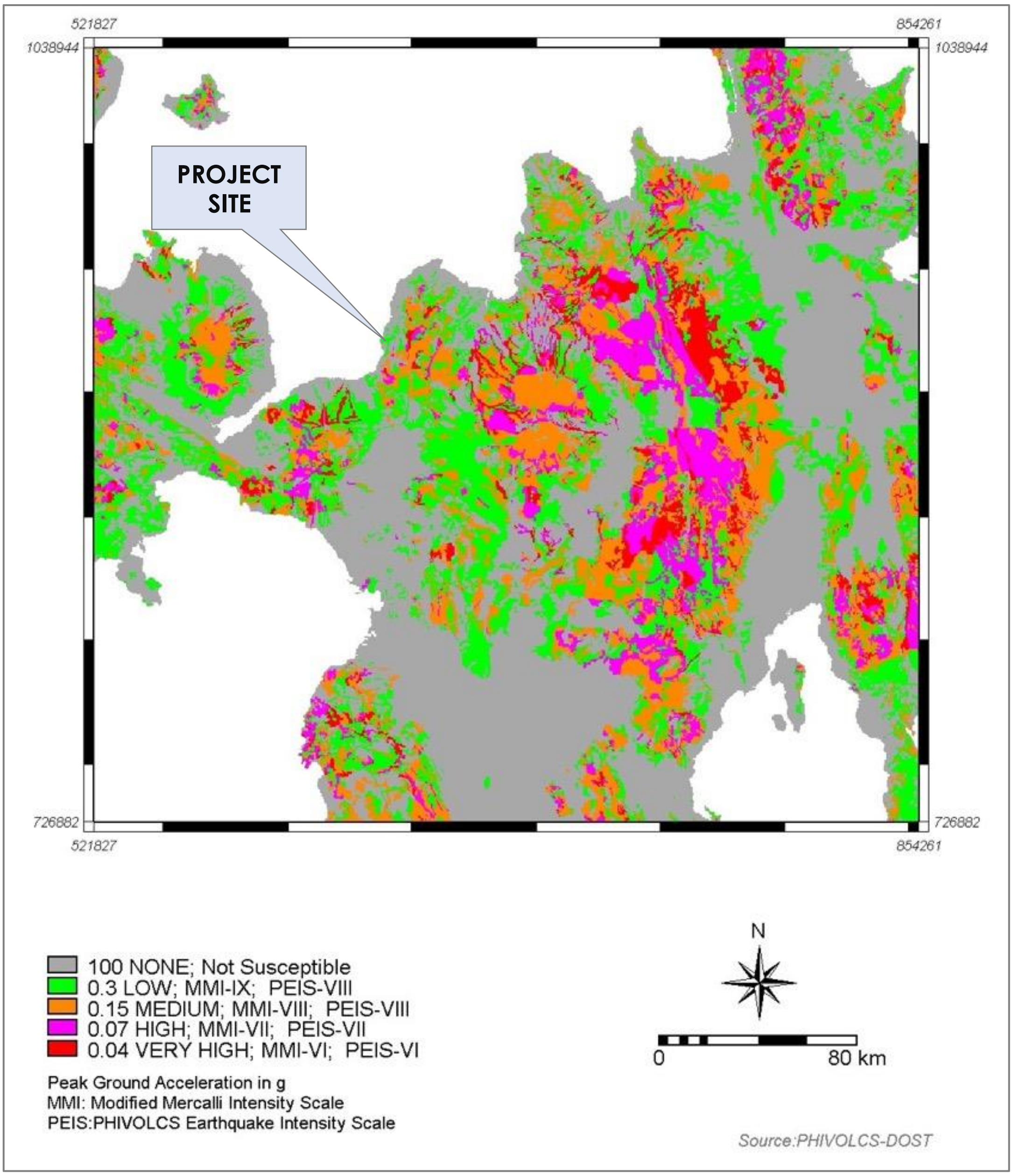


Source: PHIVOLCS, 2010

Figure 2.1-29. Liquefaction Hazard Map in Region X

2.1.2.3.1.4 Landslide

The project site's susceptibility to earthquake-induced landslides, as shown in the figure below, is none to low.



Source: PHIVOLCS, n.d.

Figure 2.1-30. Earthquake Induced Landslide Hazard Map of Region X

Impact Analysis and Mitigation

The quarrying mining method will be creating benches. The adoption of industry best practices will ensure the slope stability of these benches and hence, will not be prone to landslides. The average working bench height is 10m for limestone and 5m for shale, while the average bench width is 30m. The working face angle is at 70° while final pit slope is 60°. The overall slope is maintained at 45° to maintain bench stability. Final bench width is 7m.

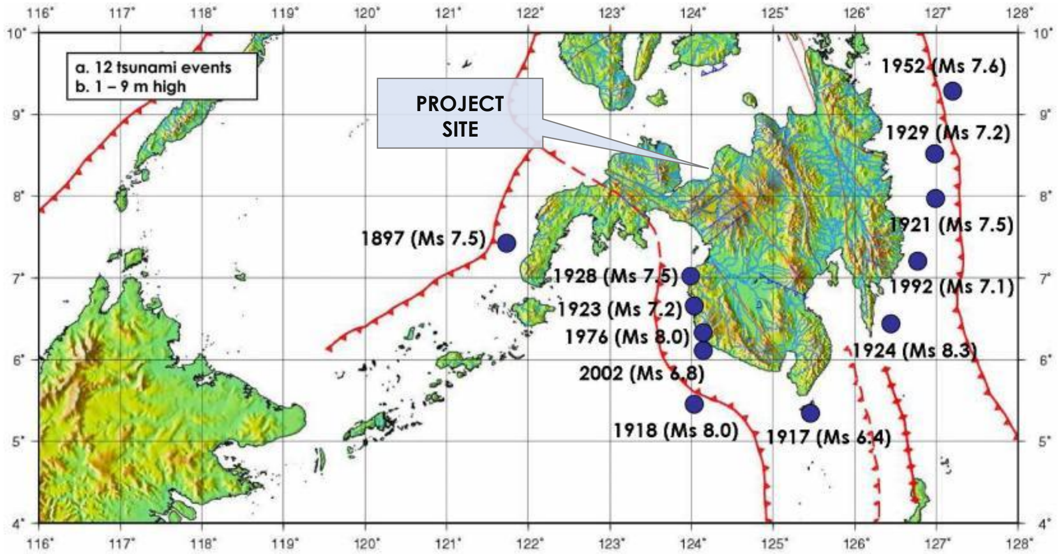
Considered in the slope design is the potential risk for the slope stability in the existence of sedimentary layers that may be water saturated. Such layers when cut by the mining progress may discharge their water together with the sand into the pit and over a period of weeks and months possibly causing destabilization of the strata above. Due to the inclination of the strata, this risk is not significant for the final slope.

For the sake of a secure dump that does not destroy any facilities and endanger men through slope failure, the maximum slope inclination for the waste dump is set for 16°. At least every 10m in elevation a bench will be foreseen. This allows accessing the slope and supporting re-vegetation.

2.1.2.3.1.5 <u>Tsunami</u>

In the Tsunami Hazard Map of Lanao del Norte (PHIVOLCS 2007), the area is said to be not susceptible to tsunami hazard. Based on PHIVOLC's site hazard assessment (2019), however, the project site is prone to tsunami due to offshore earthquakes or submarine landslides. In such event, only the plant site is at the coastal/low-lying area. The quarry is further inland and sits on higher elevation.

Figure 2.1-31 below shows the tsunamigenic earthquakes that occurred in Mindanao. It is noted that none of these have affected the project site and its vicinities.



Source: MLP Bautista, et al., 2014. PHIVOLCS

Figure 2.1-31. Tsunamigenic Earthquakes that Affected Mindanao

2.1.2.3.2 Mass Movement

2.1.2.3.2.1 <u>Landslide (Rain-induced)</u>

Based on **Figure 2.1-32** or the Landslide Susceptibility Map of Iligan City (MGB-10, 2012), the plant site, which sits on a flat-lying area, has low susceptibility to landslide hazard (yellow) while the quarry areas located east of the plant, which has a rolling to hilly topography, has moderate susceptibility.

Impact Analysis and Mitigation

There is a possibility of collapse of the mining benches at the shale quarry and the nearby limestone quarry that may be brought by poor engineering/mining methods in benching/quarrying. The same goes for the waste dumpsite as it is composed of loose, inconsolidated overburden and mine spoils, hence the slopes may not be stable.

During the abandonment phase, the plan calls for 10m-high benches, with slope of 55deg to 60deg, at the final pit limit. The resulting post-quarrying landforms will be visually inconsistent with the surrounding landscape and relatively less stable. Further, abandoned quarry areas may be used in ways that may conflict with its proper land use designation. Houses may be built within the abandoned quarry areas and because of slope instability, risk of landslide is higher primarily in case of natural calamities.

The stability of the bench slopes is crucial to avoid landslides or mass movement. These are addressesd through the implementation of the following:

- Proper planning of quarry operations;
- Proper engineering measures including sound earthworks;
- Reduction of cut slopes by terracing/benching (10m height and 70 degree slope);
- Prevention of increase in internal water pressure by vegetation cover;
- Adequate drainage control through provision of drainage canals at the toe line of the benches leading to siltation ponds; and
- Progressive rehabilitation (area will be recontoured during rehabilitation).

To reduce the occurrence of erosion and landslides, runoff will be diverted from bare areas to areas with cover. Sufficient surface drains shall be provided in the quarry areas to divert water away from erosive areas, such as newly-opened areas, waste dump and stockyard. Such drains shall also be built in backfilled areas.

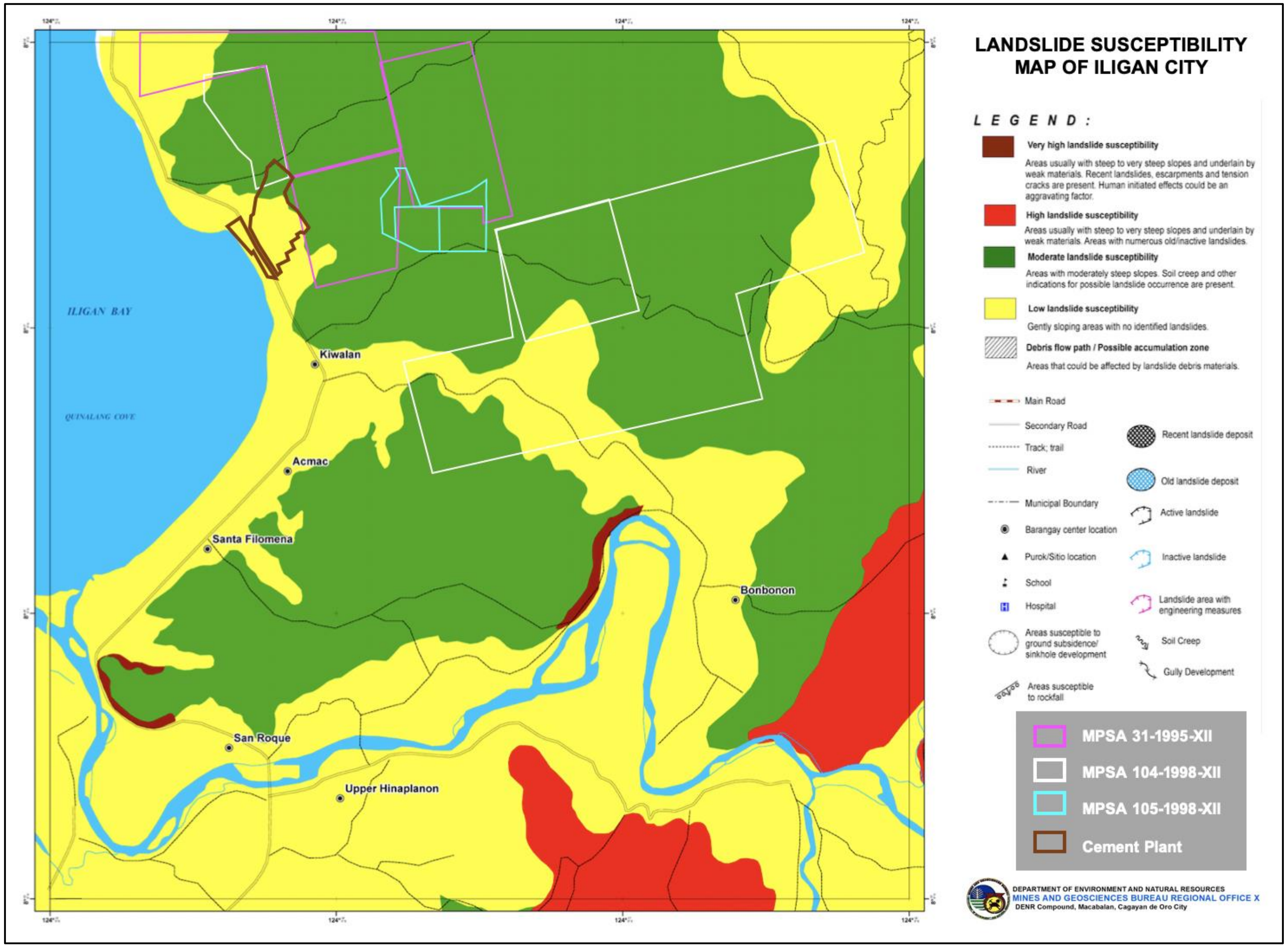
In the development of benches, overcutting of geologic structures such as faults and bedding planes shall be avoided so as to avoid planar or wedge slope failure. As much as possible, excavation shall be made perpendicular or nearly perpendicular to the strike of steeply dipping structures. In case a sliding plane daylights on the slopes, unstable materials above it shall be removed. To avoid circular slope failure or slumping, excavation of steep slopes in areas underlain by thick saturated sandy layers shall be avoided.

The waste dump, which temporarily hosts materials to be used for rehabilitation, will be maintained at the angle of repose of the waste materials as much as possible. Should there be a need to store wastes at slopes steeper than the angle of repose in order to optimize space, the toe will be stabilized with boulders. Sufficient surface and subsurface drains shall be regularly checked and maintained to ensure optimum capacity.

The dumpsite shall be properly maintained through:

- Pushing of waste materials;
- Desilting of side silt trap;
- Bamboo trees around the dump for buffer; and
- Temporary vegetation (cover crops and/or vines) on side slope;

When the dumpsite is filled up, this will be fully stabilized, rehabilitated and planted with forest trees.



Source: MGB-10, 2012

Figure 2.1-32. Landslide Susceptibility Map of Iligan City

2.1.2.3.2.2 Subsidence

The tendency of the limestone rocks to develop karstic topography is evident at the ground surface in the form of sinkholes and vugs. It is formed as a result of the dissolution of carbonate ($CaCO_3$) in the limestone by the action of meteoric and groundwater. Types of karst features in limestone include sinkholes, caverns, pipes, shafts and other solutional features. A small cavity can develop into large caverns or horizontal caves that can extend for a few kilometers in depth. Its potential to cause failures is depending on its size and depth. Collapse, subsidence, pipe-out and foundation settlement are among the types of ground failures that can be related to the occurrence of solutional cavities. If not mitigated, its effect can cause severe damage to property and worst loss to human lives.

No caves nor sinkholes were found inside the quarry areas and plant site. A cave was mapped in the Champaca 1,2,3 Parcels of MPSA 104 but there are no active quarries nor operations in the area at present. This information is based from the various drilling campaigns conducted and other geological information available on the surface and should be treated as preliminary in nature. The presence of sinkholes has to be further evaluated. Small underground cavities at depth will have some adverse impact particularly to heavy structures. The occurrence of larger underground caverns may cause foundation problems resulting to potential risks to life, safety and property.

Subsidence may take place due to collapse of underground caverns forming sinkholes. This can be triggered by earthquakes. Collapsed sinkholes may form when the backfilled materials in the surface collapses into underground cavities. This is caused by subsurface soil erosion of soil piping that will occur on top of a buried sinkholes or cavities.

Majority of the households in the area source their domestic water from groundwater pumping. Overpumping can likewise cause the lowering of the water table, which could also result to subsidence.

2.1.2.3.3 Hydrologic Hazards
2.1.2.3.3.1 Flood Hazard

Floods usually occur during or after heavy rainfall wherein the river channels are saturated with water resulting to river swelling and overflowing of floodplains. The low-lying areas with poor drainage system are susceptible to flood hazard.

The susceptibility of the project site to flooding is from low to high, depending on which data source to consider. The project site elevation ranges from 0m-10 at the plant to a maximum of 400masl at the quarry.

According to the Flood Hazard Map of MGB-10 (**Figure 2.1-33**), the plant site is highly susceptible to flooding but the quarry site is not. Based on UP NOAH's 100-Year hazard map, the whole project site is safe from flooding (**Figure 2.1-34**).

Mandulog River is roughly 50 km-long river originating from the mountains of Lanao del Sur. The river has a roughly 700 square kilometer watershed. Iligan City sits at the mouth of the Mandulog River. This was greatly flooded during Ty. Sendong in December 2011.

Extreme rainfall, combined with topography and communities living on a major river's floodplain, formed a deadly mix that devastated Iligan City at the height of tropical storm Sendong (UP NIGS team, 2011). The UP NIGS team who responded in this incident, said most rainfall fell over northwest Mindanao, particularly over the Iligan area.

Based on data from the Tropical Rainfall Measurement Mission (TRMM) of the US National Aeronautics and Space Administration (NASA), rainfall totals in the area were between 300-400 mm from Dec 13 to 19, 2011, compared to 200-250 mm in other areas along the storm's path. Most of the rain fell between 11:30 pm and 1:30 am on Dec. 16 and 17.

During the storm, water from the mountains, along with logs, trees, mud, sand and other debris from the mountains, cascaded down the river "like a tsunami. The surge of water and debris from the mountains took not just the course of the river, but spilled over and took over the flood plain, where the city was situated.

Mandulog River is about 3.8km away from the RCMI Cement Plant. The project site was not flooded although there were 10 households in Brgy. Kiwalan and 228 households in Brgy. Dalipuga that were affected (Iligan CSWD as cited in the CLUP 2013-2022).

Other notable flooding events in the City occurred in: 1972;1983 - Iligan River overflowed entering West Mahayahay through Lagnasan creek; 1986; 2007 and 2009.

In 1986, flood happened because of cloudburst. It caused the flood water to rise to 0.5 meter in Purok 5, and washed-out two houses in Purok 12 both in Barangay Abuno. On the other hand, 2007 and 2009 floods have damaged crops, swamped and washed out some houses proximate to Iligan River, and destroyed bridges in the upstream barangay (Panul-iran in Brgy Abuno). Also, flashflood caused by cloudburst happened along Linamon River affecting Purok 1A of Barangay Buru-un. On the same event in 2009, a number of houses along Mandulog River were inundated. The flood affected industrial sand and gravel quarries as well as eroded the Bonbonon Creek. It also damaged a bridge across Digkilaan River, Riverine erosion was also observed along Mandulog River in Sitio Dodiongan of Barangay Bonbonon.

Impact Analysis

The operation of settling ponds for the quarries generates deposits of silt and other loose sediments. Moreover, there is always the risk of overflowing or breaching of the containment structures.

Another possible impact of quarrying is increased runoff. Ground surfaces without vegetation and structures to trap or slow down the flow are conducive to runoff.

The increased runoff, in turn, may cause flooding downstream. Although the steep slopes in the area and its proximity to Iligan Bay preclude the occurrence of a major flood downstream, overflowing of siltation ponds or drainage canals in the event of intense rainfall may cause short-duration flooding.

Mitigating Measures

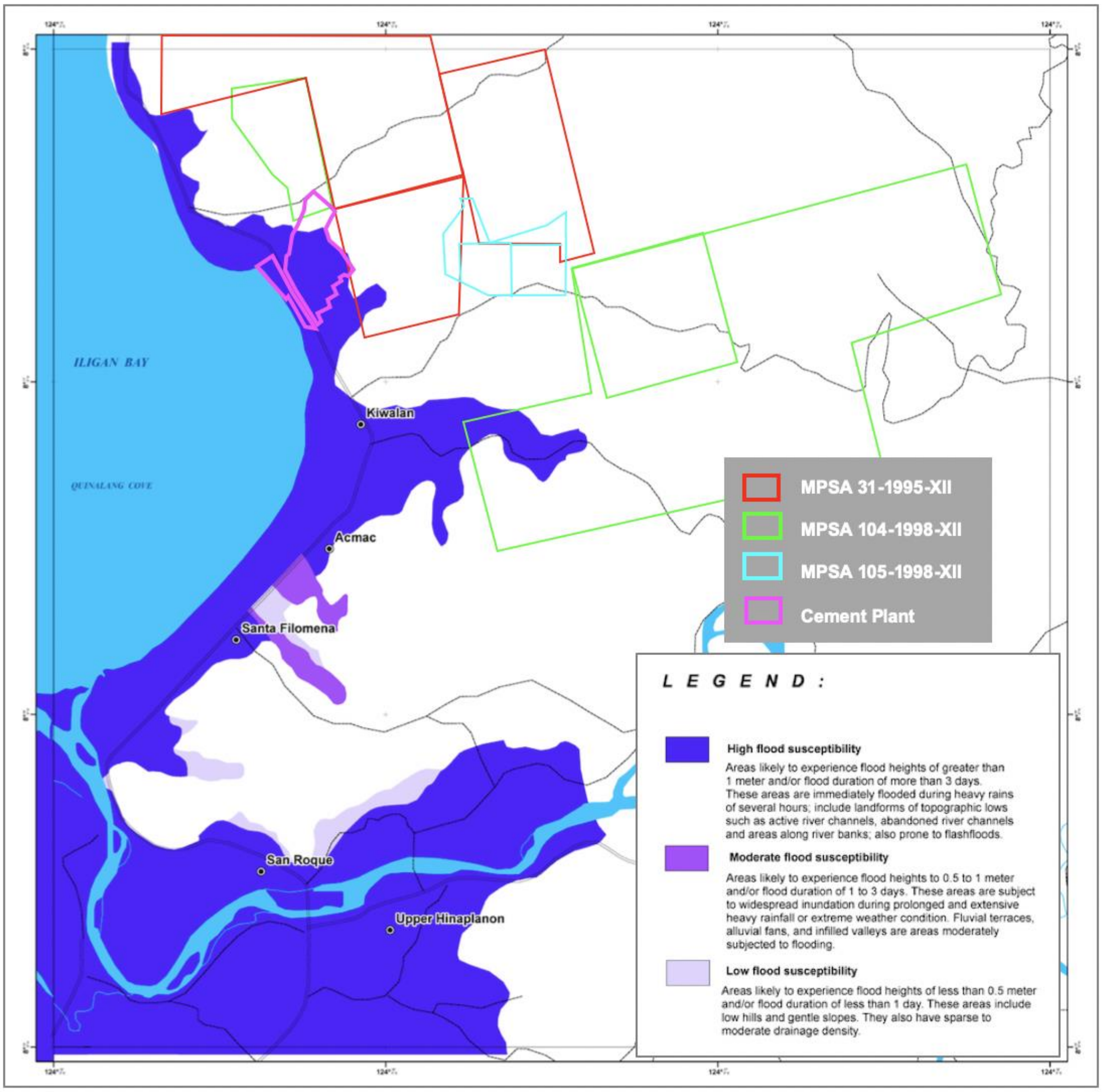
To lessen the risk of flooding downstream by overflow or accidental release of silt-laden water, the settling ponds shall be regularly desilted. As much as possible, the level of silt deposit in the ponds shall not be allowed to reach halfway of the original depth. Freeboard markers or depth markers are installed in each of the silt pond to alert the staff when it reaches the 50% mark wherein desilting should be done. The cleaning of the settling ponds is usually done quarterly, but during rainy season, desilting is done as often as needed. The level of silt is monitored every month by the quarry department.

Drainage channels shall also be regularly cleaned of sediments and obstruction (such as plants) that may get in the way of water flow.

RCMI's Work Instruction Manual is being implemented at the quarry sites, which involves the following:

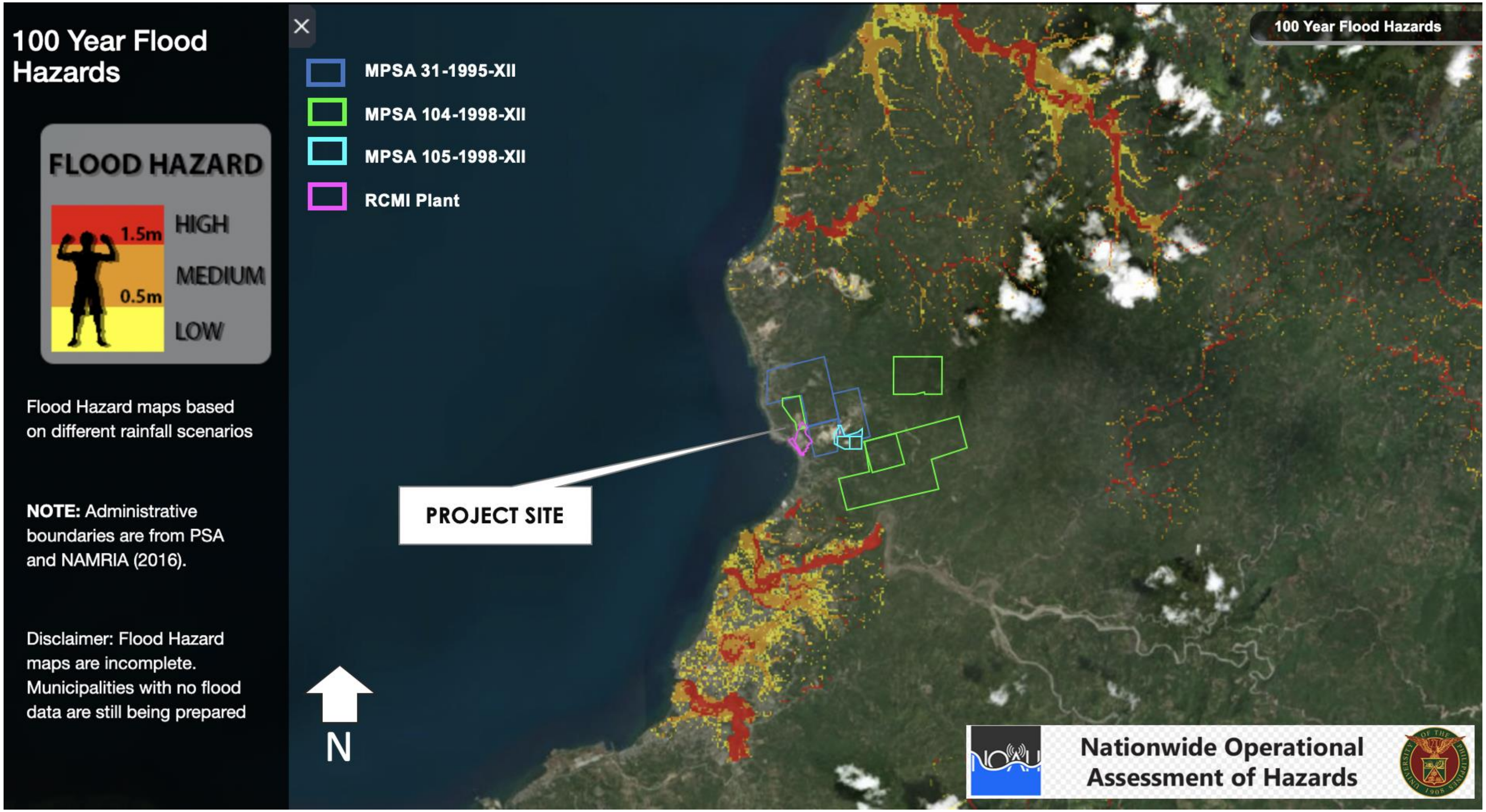
- Identify areas at quarry site for potential flashflood to occur during heavy rains;
- Effect the construction of working bench spillways and waterways at loading area;
- Implement regular schedule for declogging and cleaning of quarry drainage once or twice a month;
- Prohibit fishing and swimming activities in the area;

- Post/install safety warning signs in two or three corners of the siltation pond as reminder to all employees and nearby residents;
- Ensure that the volume of build-up of silt would not exceed 50% of its containment to prevent silt discharging through the spillway;
- Extracted silt materials shall be transported to the designated waste dump site;
- Prohibit the throwing of wastes to siltation ponds; and
- Installation and maintenance of perimeter fence.



Source: MGB-10, 2012

Figure 2.1-33. Flooding Susceptibility Map of Iligan City



Source: UP NOAH, screen-captured June 2019

Figure 2.1-34. 100 Year Flood Hazard Map of Iligan City

2.1.2.3.3.2 Storm Surges / Storm Waves

Storm surge is an abnormal rapid rise of sea level resulting from strong winds pushing water towards the shore (NOAA, 2013). This can cause severe destruction and damage in its surrounding areas. High winds push the ocean's surface that causes water pile up higher than the ordinary sea level. Storm surges have known to damage nearby coastal structures, resulting from the wave impacts and debris carried by the surge. Other effects include flooding of low-lying coastal areas and intense wave erosion of beaches, dunes and other structures.

The Maximum Storm Surge Height Map of the Philippines was presented in the report, "Identification of storm surge vulnerable areas in the Philippines through the simulation of Typhoon Haiyan-induced storm surge levels over historical storm tracks" (Lapidez, JP, et al., 2014). It "calculates the maximum probable storm surge height for every coastal locality by running simulations of Haiyan-type conditions but with tracks of tropical cyclones that entered PAR from 1948–2013" (Lapidez, JP, et al., 2014). Hypothetical typhoons were created using the tracks of the selected typhoons and the central pressure, maximum sustained wind speed values, and radii to the 50 and 30 knot winds of Haiyan. A total of 861 hypothetical typhoons were generated for this study. Storm surge simulations for these typhoons were generated using the JMA Storm Surge Model. (Lapidez, JP, et al., 2014). This model is a numerical code that is used to simulate and predict storm surges generated by tropical cyclones (Higaki, 2006). The numerical scheme of the model is based on 2D shallow water equations. Other governing equations include the equation of motion and the continuity equation with air pressure and wind fields used as external forcings.

Based on this study, the project site in Iligan City is within the zone of 1-2m maximum height. This indicates that the conservative storm surge advisory level to be adapted in the area is Advisory 1 (SSA 1). **Figure 2.1-35** shows the storm surge hazard in the vicinity of the project site. Inundation height will be low to medium (high for piers and jetties) and will affect only a very limited area a few meters from the shore.

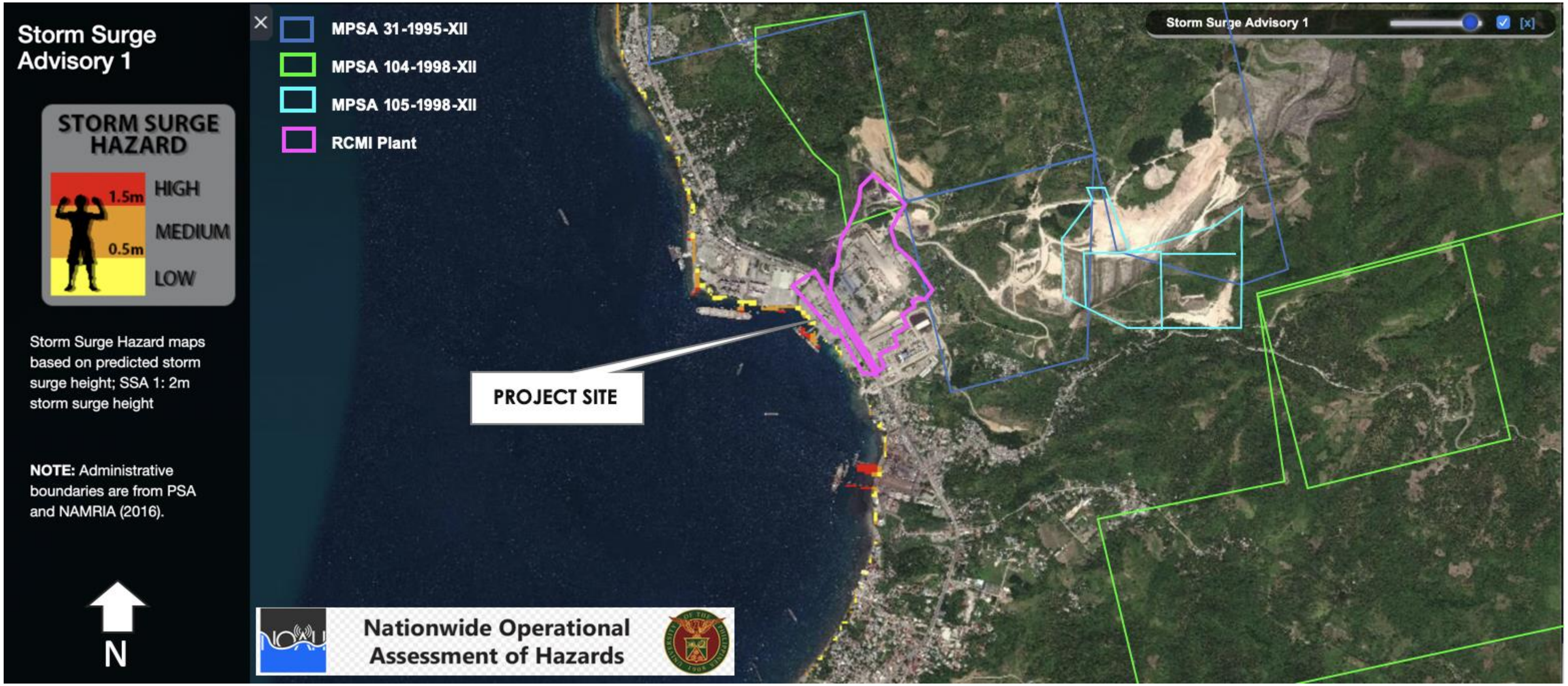
The site of RCMI's existing pier facility is exposed to this hazard. Precautionary measures must be put in place.

Project NOAH's Compilation of Storm Surge Occurrences in the Philippines (2014), lists 57 events. Of these, there is only one event during Ty. Sening/Kate on October 14-15, 1970, which indicates that 12 provinces on north islands of Mindanao were affected. Iligan City is located in Northern Mindanao, however, the affected areas were not specified in the list.

Climate change (global warming) has potential impacts on the frequency and strength of typhoons, and hence, on storm surge and storm waves. Rise in sea levels, spurred by climate change, will increase water depths and, by extension, wave heights in stormy weather. Even if the rise in sea level during storms does not flood the coastal areas, the resulting waves probably will. Storm surges can also be enhanced by tidal fluctuations and can be difficult to prepare for unless one has an hour-by-hour estimation of the weather situation.

As sea levels rise due to climate change, low-lying coastal areas are permanently flooded by the sea. The likelihood and severity of storm surges also rises since weaker winds will also be able to increase the sea level enough to flood coastal areas. In addition, as the sea level rises, the water depth increases and the wave base becomes deeper; waves reaching the coast have more energy and therefore can erode and transport greater quantities of sediment.

The project will not cause storm surge but this hazard will have impact on the plant site, especially the pier and other plant structures nearest the coast.

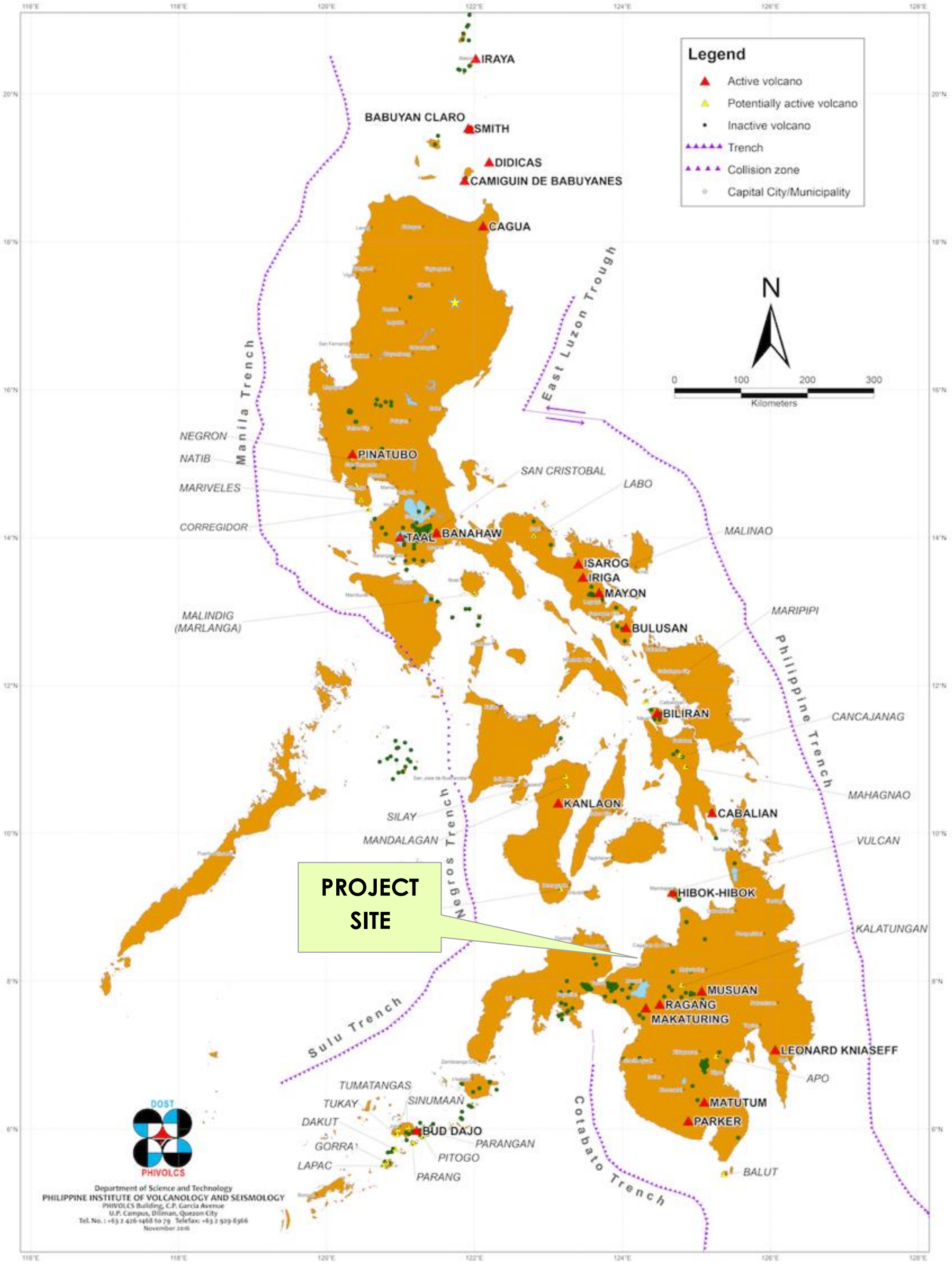


Source: UP-NOAH, screen-captured June 2019

Figure 2.1-35. Storm Surge Map of the Project Site and vicinities (SSA 1)

2.1.2.3.4 Volcanic Hazards

There are no active volcanoes near Iligan City, and hence, volcanic hazards are absent at the project site. The nearest active volcano is Mt. Hibok-hibok in the province of Camiguin, about 105km northeast from the project site. See **Figure 2.1-36** below.



Source: PHIVOLCS 2015

Figure 2.1-36. Distribution of Active Volcanoes in the Philippines

2.1.3 Pedology
2.1.3.1 Soil Erosion / Loss of Topsoil/Overburden.
2.1.3.1.1 Soil Investigation/Baselining

Pedology is deemed to be insignificant in relation to the Clinker/Cement Production for the following reasons:

- There will be no alteration in land use such as in cases which may involve agricultural plantation or forestation, thus soil properties are not considerations.

- Erosion/erodability potential/bank stability which may be influenced by soil characteristics/properties are also deemed insignificant for this project.

For the quarrying operations:

In 2002, assessment of the soil and land conditions was conducted. Soil sampling was done in each block of MPSA 104 located in Brgy. Kiwalan, namely: Champaca 1, Champaca 2, Champaca 3, ICC 12, and ICC 13. Soil sampling was done on sites roughly representing the different blocks of the expansion site.

The soils in the MPSA blocks have thin soil surface with thickness ranging from 10cm to 45cm. These are characterized in the table below.

Table 2.1-6. Soil Sampling Sites Description

Site	Soil Depth (cm)	Soil Texture	Description of the Area
Champaca 1	0-45	Clay loam	Inhabited by local community with a large portion already quarried by the locals. Portion of the land are old kaingin planted mostly with coconut, banana, fruit trees like star apple, jackfruit, avocado and santol.
Champaca 2	<45	Loamy clay	Area where sample was taken is located along the valley and is an old kaingin with long-term crops planted such as coffee, coconut, banana, and some short-term crops like gabi, corn, eggplant, etc. The upper part of the elevated portions are covered with grass and shrubs.
Champaca 3	0-25	Clay loam	Long term crops noted, mostly old kaingin, with elevation of not more than 300masl. Vegetated with coconut, banana, weeds, and shrubs
ICC 12	0-15	Loamy sand	A number of quarrying activities by locals were observed. The elevated portions are mostly old kaingin planted with coconut, banana, star apple, vegetable, corn, and other crops. No agricultural crops in thin soil areas.
ICC 13	0-45	Loam	Whole area planted with coconut, star apple, banana, and some fruit trees. A number of quarrying sites noted.

Source: ICC EIS, 2002

Based on the Soil Map of the Philippines, the soil types in the area are as follows:

The soil in the flat land near the national highway are classified only as built-up area. This is were the Cement Plant is located.

The Alimodian soil series from shale and sandstone parent rock are underlying the High Shale / Sandstone. These are steep hills to very steep hills 30 to 50 percent slopes or greater that 50% with an elevation of 100 – 300 masl. The vegetation cover are coconut, banana, corn, fruit trees, vegetable crops, root crops, cut flowers, shrubs and grasses. (Iligan CLUP 2013-2022). This series is made up of sandy loam, silt loam, loam, sandy clay loam, clay loam, and sandy clay. The external drainage is good to excessive while internal drainage is fair.

The Bolinao and Faraon series are underlying warm, cool, High Limestone Hills**.** These occur on the most western part of the City boundary covering Barangays Dalipuga and Bunawan. These are moderately sloping to rolling and steep to very steep hills (greater than 50% slope) with an elevation of 100 – 300masl. Parent materials are limestone and other calcareous materials. (Iligan CLUP 2013-2022). The Faraon soil is made up of clay and is usually black to dark brown in color, which may be attributed to organic matter.

The soil in the quarry areas have thin surface with thickness ranging from 10cm to 45cm and are relatively high in alkalis with pH ranging from 7.8 to 8.1. Heavy metal concentration for soils has been analyzed and was found to exceed the Dutch Intervention Values for total chromium for all stations and mercury in Station 1.

The quarry areas are largely agricultural in nature with patches of grasslands. These are dominated by coconut trees (*Cocos nucifera*), banana (*Musa sapientum*), and corn (*Zea mays*). These are planted in vast tracks of land and are the primary source of income of farmers in the area. The agricultural areas embrace approximately more than 284 hectares and represent about 88% of the MPSA area. The industrial lands cover approximately 39 hectares or about 12% of the MPSA area, which are the active quarry sites for the limestone and shale raw materials, the quarry access roads, stockpile pads, equipment yards, explosive magazines, siltation ponds, waste dumpsites and water reservoir/s.

The soil map is shown in **Figure 2.1-37** below.

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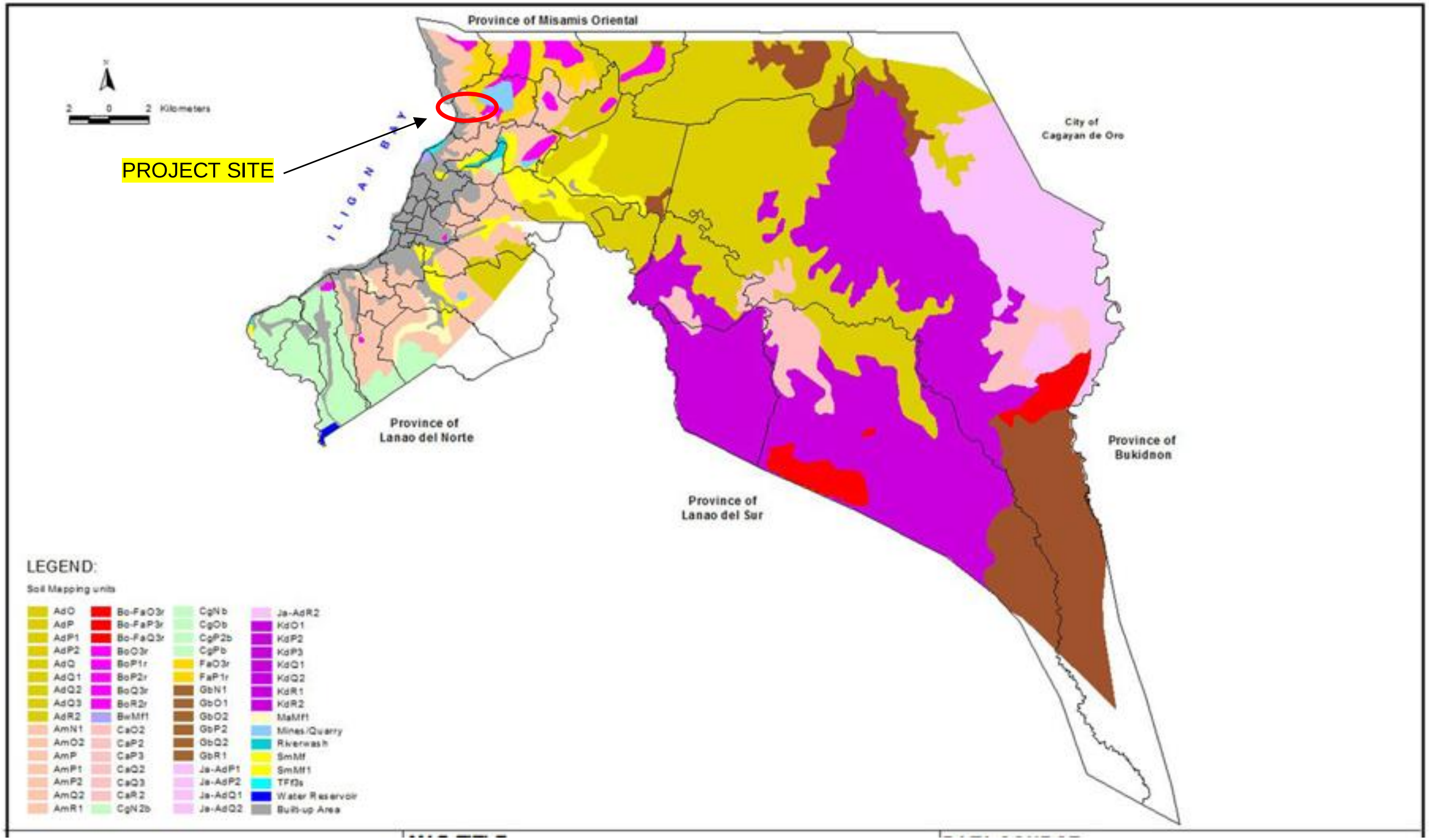


Source: Iligan City CLUP, 2013-2022

Figure 2.1-37. Soil Map of Iligan City

2.1.3.1.2 Impact Analysis on Siltation due to Soil Erosion

The quarrying activity will expose and loosen soil making the area susceptible to erosion and mass wasting. Transport and stockpiling in temporary areas will likewise increase erosion susceptibility. Erosion of quarrying soils and spoils into the nearby the body of water is expected to occur when there is heavy rainfall. As the disturbed area gets larger, large-scale erosion will be observed if this is not properly mitigated. This impact will be long-term, permanent and irreversible.

The stripping of overburden material, which normally includes the entire portion of the topsoil, and the removal of vegetative cover will lead to the removal/ loss of top soils resulting from excavation activities. This may lead to movement of soil to lower elevation, thus erosion and siltation will occur due to occasional rains and during movement of heavy equipment passing over unpaved roads and soil stockpile area. Similarly, alteration of land topography may result in heavy influx of surface runoff waters resulting in erosion in the uncovered surfaces and siltation downstream of the sloping condition of the project site. Moreover, areas affected by access ramp construction and bench development will be rendered susceptible to erosion, slope instability and mass wasting.

Nevertheless, the quarrying activities conducted by the Company in recent years (>10 years) has been on existing quarry areas only. It was only very recently (2019) when RCMI started opening new areas in its shale quarry, wherein which, stripping of topsoil and overburden occurred. In the limestone area, no overburden is generated at present because the active faces are on pre-existing areas wherein the overburden was already long gone.

In the proposed expansion, an additional area of 19.71 ha for limestone and 61.722 ha for shale quarries shall be cleared. A total of 157.87 hectares shall have been disturbed by the end of project. There will be more siltation in the shale quarry than in the limestone area due to the inherent character of the shale (less compacted) compared to the limestone.

In the backfilling of topsoil for the final rehabilitation, the total area is only 131.3837 hectares since RCMI only considered to backfill the benches (bench widths) and excluded other areas for backfilling such as slopes and drainage canals per bench. Topsoil to be backfilled is 0.5 meters thick X 1,313,837.27 m^2 = 656,919 m^3.

Construction of access road may likewise cause soil erosion during cut and fill of slopes. Nevertheless, the shale quarry already has access/haul roads, hence, more impact is not expected.

Moreover, temporary stockpiles will be produced during stripping in the quarries. These will be eroded to drainage and siltation ponds. Silt will build up along the drainage causing water to spread and the tendency to cause water to overflow to lower elevations. The result is that the silt will be carried into the seabed. Current quarrying operation protocols calls for hauling of stockpiles within hours of extraction, and hence, maintenance is more manageable.

Monitoring of soil erosion caused by present quarry operation provide basis for detailed soil erosion management. As a measure of the rate of soil erosion, the amount, timing and frequency of desilting of the catchment ponds are monitored and recorded by RCMI. Below is a tabulation of the desilting activities done over the years. Since the 2nd semester of 2018 to the 3rd quarter of 2020, a total volume of 11,165.20 m^3 of silt/sediments were recovered from the 7 settling ponds of RCMI. This is equivalent to an average of 425.7 m^3/month of silt. Note that there is no data from the 2 ponds (SP 6 and SP 7) in MPSA 105 as these were then held by MCCI.

Table 2.1-7. Record of Desilting of Settling Ponds (2018-2020)

Settling Pond	Volume of Silt (m^3)					
	2018 Sem 2	2019 Sem 1	2019 Sem 2	2020 Sem 1	2020 3rd Q	TOTAL
SP 1	225.29	324.86	616.98	399.36	274.56	1,841.05
SP 2	112.86	0.00	342.53	0.00	0.00	455.39

Settling Pond	Volume of Silt (m^3)					
	2018 Sem 2	2019 Sem 1	2019 Sem 2	2020 Sem 1	2020 3rd Q	TOTAL
SP 3	282.15	39.94	54.91	239.62	34.94	651.56
SP 4	996.93	359.42	794.11	204.67	74.88	2,430.01
SP 5	282.15	209.66	284.93	79.87	74.88	931.49
SP 8	771.21	587.13	814.99	324.48	289.54	2,787.35
SP 9	922.69	564.10	174.72	207.16	199.68	2,068.35
TOTAL	**3,593.28**	**2,085.11**	**3,083.17**	**1,455.16**	**948.48**	**11,165.20**

2.1.3.1.3 Mitigating Measures

The Proponent will practice 100% compliance on silt-sediment discharge to streams and 100% compliance on RA 9275.

Proper phasing and/or scheduling of earthmoving activities and proper stockpiling of scrapped soils are observed well or stockpiling of spoils is done on flat areas away from water bodies. Installation of barrier nets, silt traps or sedimentation basin leading to water bodies is implemented to minimize siltation.

Source erosion controls were installed and constructed to minimize soil transport and sedimentation within the local streams and to nearby water bodies such as the Tag-ibo Creek and Iligan Bay. Additional control measures include:

1. Sound quarry development planning to minimize the need for clearing.

2. Quarry benches development will be timed during the dry season to mitigate soil erosion potential.

3. Provision of adequate drainage system to accommodate peak runoff that could contaminate the nearby water bodies and degrade the area.
    - Drainage canals will be constructed at the toe of the benches and stockpiles/dumpsite to intercept and divert the surface water runoff from disturbed/cleared areas during rainfall events. These canals will convey the runoff to a series of constructed ponds for treatment (settling) prior to their discharge to Iligan Bay via a spillway.
    - Maintenance of haul roads in good condition at all times. The transport of silt and sediment from the haul roads to the creeks and waterways during rainfall events will be controlled by the construction of road berms and interceptor canals that lead to the siltation ponds as well.
    - Runoff will be diverted from bare areas to areas with cover. Sufficient surface drains shall be provided in the quarry areas to divert water away from erosive areas, such as newly-opened areas, waste dump and stockyard. Such drains shall also be built in backfilled areas.

4. A series of settling ponds are currently in use to pump out runoff caused by heavy rainfall and for settling of suspended sediments before release of water into the receiving Iligan Bay. There are 2 active settling ponds for the shale quarry and 7 ponds for the limestone quarry that are strategically distributed. The design parameters is shown in **Table 1-17** under **Section 1.4.5.2: Drainage System and Settling Ponds.** One additional pond is proposed for construction to provide for the increase in production rate. Silt traps, silt fences, soil nets, and other source controls using eco-friendly geo-textile materials will also be installed. (**Figure 2.1-38**)

    The use of geotextiles/coconets shall be considered in the proposed expansion. These are permeable fabrics, typically made of polypropylene or polyester,which, when used in association with soil, have the ability to separate, filter, reinforce, protect, or drain. By placing these materials over soil layers movement of soil particles, i.e. erosion is effectively prevented or minimized. The materials of construction of geotextiles are inert and therefore will not contaminate the soil. These erosion protection materials are equally effective against rain-induced erosion since these prevent the soil from being washed away and likewise during dry periods wherein the soil particles could naturally erode. Geomembranes render strength to the soil.

In the construction of additional settling ponds, a low-lying area with natural depression shall be selected. This will minimize the volume of excavation as well as the visual impact.

5. Slope stabilization by maintaining safe angles/gradients and heights of stockpiles/. The installation of soil nets along slopes, such as coco-fiber mats shall be looked into.
   - Raw material stockpile areas are lined with concrete barriers at the perimeter to prevent spilling to the drain canal during rain and also to minimize the increase in moisture content of the materials.
   - Maintenance of stockpiles of materials is regularly conducted wherein height is limited to 3m to 5m depending on the volume delivered.

6. Overburden and other mines spoils are hauled to the mine waste dumpsite. This is properly stockpiled and the dumpsite is maintained in terms of height, slope, terracing, temporary planting of non-persistent cover crops, and surrounding the area with bamboo for buffer purposes.
   - Minimize accumulation of dumped wastes by re-utilization of overburden in road works, berms, and for progressive recontouring/rehabilitation efforts.

7. Progressive rehabilitation.
   Progressive rehabilitation shall be implemented on the mined-out areas. Ideally, the rate of rehabilitation is similar to the rate of quarrying. This is implemented in consonance with the approved EPEP.

   Involves the immediate rehabilitation of affected areas that are no longer relevant to the operations (mined-out). Activities include re-soiling of abandoned areas or previous excavations and pit openings, provided it does not block the flow of drainage. The process involves the filling up of void spaces with mine waste until it reaches or approaches the original surface level, then resurfaceing it with a foot of topsoil for tree planting purposes. This also includes cutting down of high wall and overhangs (if any) to conform with the safety standards and general grade or topography of the area. The planted trees shall be under periodic maintenance and monitoring.

   Nevertheless, it should be noted that at this juncture, **no areas** in the whole quarry sites are declared mined-out in view of the mine development plan wherein advance of active quarry sites is done in consideration of safe benching parameters as well as the mixing/blending of different grades of ore to be fed to the mill. As such, quarrying operations shall continue for several years without depleting the ore from any particular site in the immediate future.

   As such, present rehabilitation efforts are done within the buffer zones and utilized as green belts. The rehabilitation accomplishments of the Proponent are discussed under the subsection on Terrestrial Ecology.

8. Bunking, proper cut and filling along slopes and temporary damming is recommended during access road construction to ensure minimal occurrence of soil erosion.
9. The topsoil from areas that will be stripped shall be retained for future rehabilitation. As much as possible, the topsoil shall be stored separately from other wastes in order to avoid destroying seeds (and other plant propagules), soil-microorganisms, and plant nutrients.
10. Continuous monitoring and maintenance of these water and soil management management control features.

2.1.3.1.4 Monitoring

Parameters monitored are:

1. Water quality
2. Rate of soil erosion: The silts/sediments go into the siltation ponds which is regularly desilted. The volume of silt removed and the date it was taken are recorded and reported.
3. Slope stability: a topographic survey is conducted monthly to monitor the changes in topography, configuration of benches, and identify any presence of unstable slopes.
4. Visual observation of surface runoff, quarry drainage and siltation ponds during periods of heavy rains. A height meter is installed in all ponds which alerts the personnel if it is already 50% filled and therefore needs desilting.

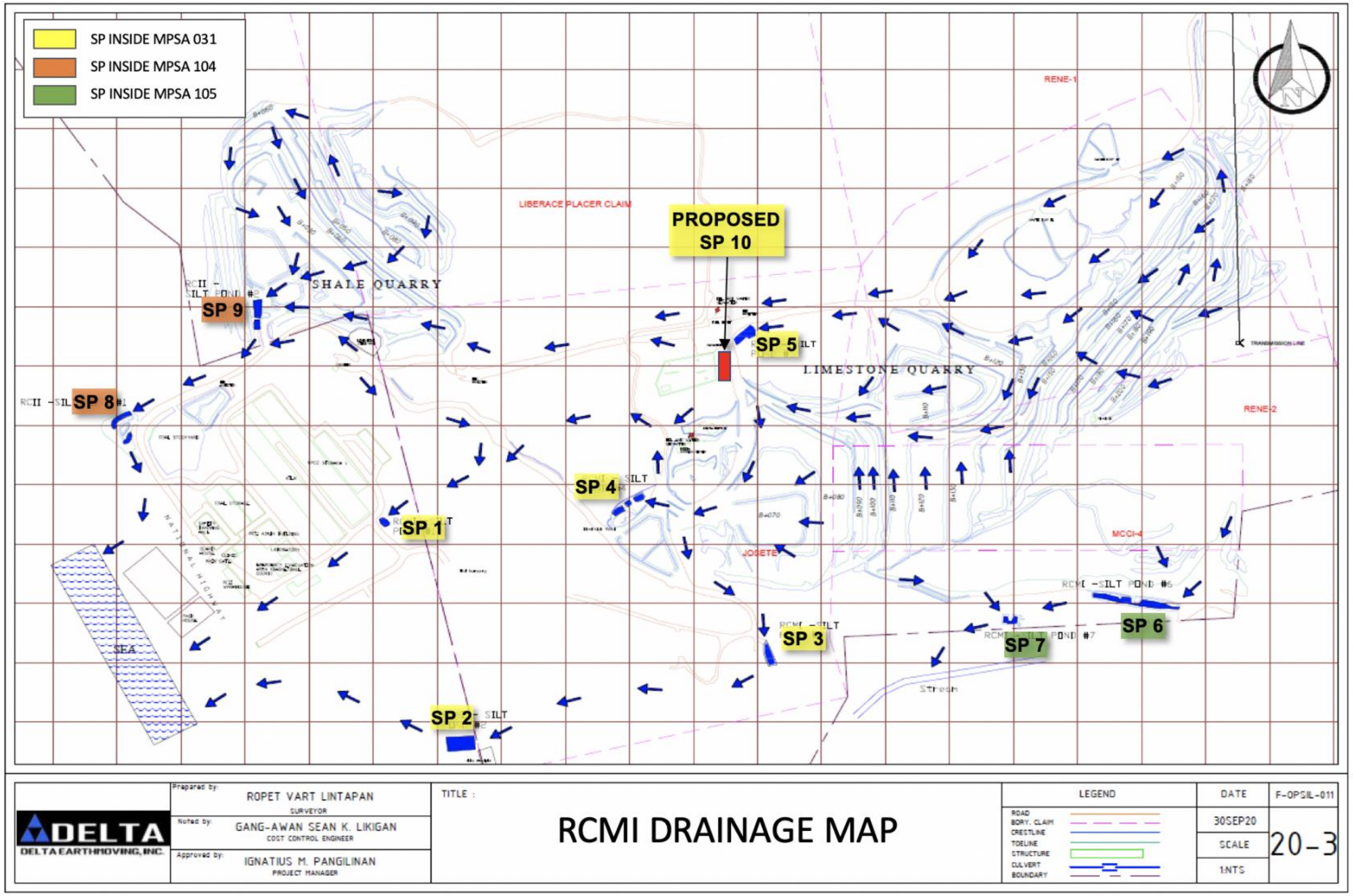


Figure 2.1-38. Drainage Map and Location of Settling Ponds

Note: The additional drainage in consideration of the expansion project is mentioned in Section 1, Figure 1.28-a.

2.1.3.2 Change in Soil Quality/Fertility

The Company conducted soil survey in 2002 inside its tenements. The soil in the tenement.014Orga
areas was found to be relatively high in alkalis with pH ranging from 7.8-8.1 as presented in the following table. Organic matter and other nutrient contents are also high in the other 4 sample sites with percent organic matter ranging from 3.89 to 7.12, phosphorous content of 9-18 ppm, and potassium content ranging from 0.27 to 0.89 mol. The high exchangeable P and K and high N percent in Champaca 2 and ICC 12 indicates high fertility in these areas as likewise indicated by the luscious growth of agricultural crops.

Table 2.1-8. Laboratory Results of Soil Samples

Site	pH	OM	N (%)	P (Olsen) ppm	K cmol(+)/kg soil
Champaca 3	7.8	4.4	0.2	9	0.27
ICC 12, upper portion	8.1	3.89	0.16	18	0.29
ICC 12	8.0	7.12	0.33	13	0.38
Champaca 2	7.9	7.02	0.32	16	0.84

Source: ICC EIS, 2002

Soil sampling and soil quality tests were again conducted on March 2020. Below is the table showing the test results conducted on the area together with the sampling site Map and Coordinates:

Table 2.1-9. Geographic Coordinates of the Soil Sampling Stations

Sampling Station	Location	Coordinates	
		Latitude	Longitude
SS1-1	RCMI Plant	8°17'21.00"N	124°15'56.00"E
SS2-1	RCMI Plant	8°17'17.00"N	124°15'57.00"E
SS3-1	Access Road	8°17'28.00"N	124°16'0.00"E
SS4-1	Access Road	8°17'30.00"N	124°16'24.00"E
SS5-1	Access Road	8°17'40.00"N	124°15'49.00"E
SS6-1	Access Road	8°17'15.00"N	124°16'11.00"E
SS7-1	Quarry	8°17'34.00"N	124°15'56.00"E
SS8-1	Quarry	8°17'18.00"N	124°16'14.00"E
SS9-1	Quarry	8°17'26.00"N	124°16'26.00"E
SS10-1	Quarry	8°17'40.00"N	124°16'38.00"E

Figure 2.1-39. Location Map of the Soil Sampling Stations

Table 2.1-10. Soil Test Results

Parameters	Test Method	SS1-1	SS2-1	SS3-1	SS4-1	SS5-1	SS6-1	SS7-1	SS8-1	SS9-1	SS10-1
pH @ 1:1 Mixture	Electromagnetic Method	7.66 @ 18.7˚C	8.14 @ 19.6˚ C	7.14 @ 19.6˚C	8.32 @ 20.2 ˚C	8.38 @ 20.2 ˚C	7.9 @ 19.6 ˚C	8.54 @ 18.4 ˚C	8.74 @ 17.6 ˚C	8.38 @ 20.2 ˚C	8.83 @ 18.0 ˚C
Nitrogen,%	Kjeldahl	0.05	0.027	0.027	0.014	0.123	0.068	0.027	0.014	0.014	To follow
Phosphorus, mg/kg	Colorimetry	211	14.3	34.7	12.6	337	13.4	334	< 2	28.7	10.9
Organic Matter, %	Titrimetry	0.691	0.077	0.308	0.65	0.192	0.994	0.077	0.077	1.38	0.115
Arsenic	Silver Diethyldithiocarbamate-Colorimetric (Modified)	Less than 0.025	Less than 0.025	Less than 0.025	Less than 0.025	Less than 0.025	Less than 0.025	Less than 0.025	Less than 0.025	Less than 0.025	Less than 0.025
Potassium, mg/kg	Atomic Emmision Spectrophotometry (AES)	1,440	471	790	538	1,672	436	1,492	657	1,434	107
Cadmium, mg/kg	AES	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Lead, mg/kg	AES	7.2	6.5	7.2	7.2	8.2	4.8	7.8	5.4	7.4	5.5
Mercury, mg/kg	Cold Vapor AAS	0.003	< 0.002	0.017	0.008	0.012	< 0.002	0.004	0.005	0.007	< 0.002
Boron	Colorimetry	0.32	0.70	1.5	0.66	1.0	0.61	0.34	0.74	0.26	0.24
Manganese, mg/kg	AAS	443	149	286	319	432	182	413	129	177	100
Iron	AAS	4.52	0.603	1.43	1.28	6.16	0.511	6.14	0.600	2.83	0.269
Copper, mg/kg	AAS	42.1	8.8	18.9	12.4	84.3	6.4	89.4	6.6	24	2.9
Zinc, mg/kg	AAS	59.1	18.9	20.9	15.1	62.8	8.6	66.9	7.4	35.5	4.3
Nickel, mg/kg	AAS	36.7	7.6	19.5	14.7	74.9	7	68.7	10.1	31.1	4.1
Cobalt, mg/kg	AAS	8.1	0.86	3.1	1.8	13.8	< 0.8	15.1	< 0.8	2.2	< 0.8

Reference: EPA Method 3050 B. Acid Digestion of Sediments, Sludges and Soils
EPA Method 7471 B. Mercury in Solid or Sediments Wastes (Manual Cold Vapor Technique).
Standard Method of Analysis for Soil, Plant Tissue, Water and Fertilizer, 1980

Table 2.1-11. Dutch Intervension Values for Soil Quality

Parameters	Results		Standards	Remarks
	Mean	Maximum		
Metallics and Toxic & Hazardous elements *Note 1*				
Arsenic			55	
Cadmiun, mg/kg	< 2	< 2	12	Within guidelines
Lead,, mg/kg	6.72	8.2	530	
Mercury, mg/kg	0.062	0.017	10	
Manganese mg/kg				
Iron				
Copper, mg/kg	29.58	89.4	190	
Zinc, mg/kg	29.95	66.9	720	
Nickel, mg/kg	27.44	74.9	210	
Cobalt, mg/kg	4.74	15.1	240	
Parameters for Agricultural Purposes and Floral Growth *Note 2*				
pH	8.2			
Nitrogen %	0.035	0.123		0.1 (low)
Phosphorus	98.7	337		7-10
Organic Matter	0.46	0.994		
Potassium	903.7b	1 672		>798
Boron				

Note 1 : In the absence of DENR standards, the Dutch Intervention Values (www.esdat.net Esdat Environmental Database Management Software) are used. When the DIVs are exceed intervention such as remediation is recommended.

Note 2. General Guidelines for Crops. Variable depends on several factors e.g. type of crops, climate, etc.

It is deemed that the present quality of soil does not pose any problem or constraints regarding soil quality.

2.1.3.2.1 Decrease in Agricultural Productivity

Most part of the claim areas where quarrying is done have very thin topsoil and with few vegetation of economic value, but there are also parts with thick soil and vegetated with agricultural crops. Quarrying will permanently destroy these farms. The impact is highly significant.

In addition, the generation of excessive dust will affect nearby farms. Dust is known to be detrimental to sensitive crops within and around the quarry area. It should be noted that different crops have different degree of sensitivity to dust. For example, mango is apparently sensitive to dust particles while coconut appears to be tolerant. Dust particles, for instance, causes abortion in the development of flowers to mango fruits. However, the degree of sensitivity of fruit trees is normally attributed to the architecture of the tree. Fruit trees such as mango and rambutan have exposed flowers, which are normally located on the outer portion of the tree crown. Coconut trees and banana, on the other hand, bears fruits under the canopy level, thus, protecting flowers and immature fruits from the damaging effects of dust.

Since coconut generally dominates the area, the effect of dust from quarrying may be expected to be lower. The broad crown of coconut trees will also lessen the impact of dust to crops underneath it. While there are no studies yet on the effect of dust to corn and tomato, the architecture of these crops alone shows their vulnerability. The impact of dust on agricultural productivity will be long term and highly significant but will be reversible.

2.1.3.2.2 Soil Contamination

This could be contributed by activities in the following facilities:

- Fuel and Grease Station
- Workshops
- Infrastructure

The above-cited activities will not result in soil contamination in view of prevention measures implemented. The potential concerns involve accidental spills from uses of petroleum products, e.g. diesel oil, grease and gasoline for the vehicles and plant equipment, especially during refueling, maintenance, or operation. There are in place (a) maintenance programs to prevent such as the containment of spills, collection and disposal through third party accredited entities. Moreover, the Proponent is in 100% compliance on RA 6969.

Another potential cause of soil contamination is improper waste and/or garbage disposal. Nevertheless, this will not be a concern because the Proponent strictly adheres to its Waste Management System that is in place and is in 100% compliance to RA 9003 and other laws regarding wastes. The Waste Management System is discussed in detail under **Section 1.5.2.1**.

2.1.4 Terrestrial Ecology

Terrestrial Flora

Conservation Status under International Union for the Conservation of Nature (IUCN 2015) and DENR 2007-01 "Establishing the National List of Threatened Philippine Plants and Their Categories, and the List of Other Wildlife Species

The Philippines is considered as one of the mega diverse country in the world. The 7,100 islands comprising the Philippines possesses high level of endemicity of marine/aquatic and terrestrial flora and fauna species, Regarded as one of the biodiversity hotspots in the world, Philippines is one of the world's biologically richest nation and has the most threatened and fragile ecosystems. Many endemic species are confined to forest fragments that cover 7% of the original extent of the hotspots. The 93% of the original forest have been cleared due to logging and extractive activities for agricultural/farming expansions and other developments to accommodate the needs of the growing population. And with this, the Philippines have been placed as one of the most endangered areas at the same time remains as one of the most diverse area on the planet. At the very least, one-third of more than 9,250 vascular plant species are endemic to the Philippines (Source: Conservation International, 2007 Biodiversity Hotspots – Philippines. Accessed from www.biodiversityhotspots.org).

The floral inventory and assessment recorded a total of 145 morpho-species of which 24 species or 16.55% of the total number of species recorded are either classified as threatened species by the International Union for the Conservation of Nature (IUCN) and DENR AO 2007-01. Among the critically endangered species cited by the IUCN are *Anisopthera thurifera* (Blanco) Blume*, Shorea guiso* (Blanco) Blume, and *Shorea polysperma* (Blanco) Blume, all belongs to family Dipterocarpaceae. The species of *Shorea guiso* (Blanco) Blume, on the other hand, was not included in the DENR list. Meanwhile, the endangered species under the IUCN category includes *Pterocarpus indicus* Willd. (Fabaceae) but listed as critically endangered category A under the DENR list. On vulnerable species, the IUCN classified the species of *Vitex parviflora* Juss. (Lamiaceae), *Securinega flexuosa* Muell.-Arg., *Macaranga grandilofia* Muell.-Arg., and *Macaranga bicolor* Muell.-Arg., (Euphorbiaceae), and *Adenathera intermedia* Merr. (Mimosaceae), however, the *M. bicolor* and *M. grandifolia* were not included in the DENR list while *A. intermedia* were listed as other threatened species (category D). The species of *Calamus merrillii* Becc. (Arecaceae) is classified as near-threatened by the IUCN but not listed in the DENR. The other species recorded in the study area are not cited/listed either in IUCN or DENR.

Their classification in the IUCN and DENR AO 2007-01 status was attributed to the decline in population or subpopulation due to rates of habitat due to overexploitation (particularly logging) and shifting cultivation (slash-and-burn; charcoal making) have led to considerable declines in population. In most cases, forest lands, including mangrove areas are being converted into other purposes, to include industrial, commercial, and agricultural expansion which threatened the existence and/or population of a particular species. Meanwhile, *Mangifera indica* L. (Anacardiaceae) was classified as Data Defficient (DD) by the IUCN. *M. indica* L. have been cultivated for thousands of years and become pantropic in distribution. IUCN cited that wild populations can be found in Assam, India and Myanmar (Assam-Chittagong Hills). However, appropriate data on abundance and/or distribution is lacking, hence more information/ data on the species in the wild is required to approximate its status whether it is threatened or not. The species is said to be restricted (native) to India and an introduced species in Bangladesh, China, Indonesia, Malaysia, Myanmar, Philippines, Sri Lanka, Thailand, and Vietnam. However, seven (7) species have been identified as invasive in the IUCN-Global Invasive Species Database (www.issg.org/database) and these are; *Litsea glutinosa* Lour. Rob. (Lauraceae), *Leucaena leucocephala* Lam. (Mimosaceae), *Syzygium cumini* (L.) Skeels (Myrtaceae), *Astronia cumingiana* Vidal (Melastomataceae), *Lantana camara* L. (Asteraceae), and *Chromolaena odorata* Blanco (Asteraceae). Species in this category have no major threats at present and the population is believed to be stable. However, conservation measures and adherence to the principles good environmental practices must be intensified to avert the continuing forest land degradation.

Endemicity/ Geographical Distribution

Of the 145 species, 65.52% are considered native/ endemic/ resident species found in the lowland and upland forests while 34.48% (within the locality) are considered introduced/ exotic species which have been cultivated and/or naturalized throughout the Philippines. Some of the introduced/ exotic species have been regarded as invasive species by the ASEAN Centre for Biodiversity (ACB) such as *Lantana camara, Samanea saman, Leucaena leucocephala, Mimosa pudica, Paspalum conjugatum, Psidium guajava, Gliricidia sepium,* and *Syzygium cumini* (Source: Biodiversity Information Sharing Service, ASEAN Biodiversity Clearing House Mechanism). Their pathways to new location have been through nursery trade for ornamentals and local dispersal methods by consumption and excretion as flowers and seed are dispersed by birds or other animals (zoophily) or by wind (anemophily) or by water (hydrophily). Long distance dispersal is by man, who has planted species widely in agroforestry, particularly for food production, shelter/ shade, medicine, etc. For instance, *Gliricidia sepium* (Jacq.) Kunth. Walp (Fabaceae) introduced during Spanish colonization from Mexico, *Leucaena leucocephala* Lam. (Mimosaceae) which happened to be a reforestation species in the 1960’s to 1970’s for the operationalization of denrothermal, is a native of Mexico and Central America, *Cocos nucifera* L. (Arecaceae) considered by many as the “Tree of Life” is native of Polynesia and now pantropic in distribution and widely cultivated in the Philippines for economic purposes. Distribution of species widely occurs in Asian Region to Australia, Africa, Americas, and the Pacific Regions. Among the notable species that are restricted to the Philippines includes *Macaranga grandifolia* and *Ficus* ulmifolia. The species of *Pterocarpus indicus, Shorea guiso, Shorea polysperma, and Thurifera anisopthera,* a native to Southeast Asia, PNG, Sulawesi, Sabah, China, and Solomon Islands, is considered as regionally extinct in Vietnam.

Biodiversity Studies

A Biodiversity study has been conducted by a Team composed of Dr. Olga M. Nuneza, Dr. Jose Angelo A. Responte, Muhmin Michael Manting, MSc and Karyl Marie F. Dagoc, MSc the draft Report presented in **Annex 2.1-1**.

The location of observed important, endangered and keystone species is embedded in various parts of the Terrestrial Ecology Report. Noting the nature of the project and the sites involved, i.e. quarrying and cement processing there are no ecologically sensitive areas.

Figure 2.1-40 provides the transect map for the terrestrial (floral) ecology assessment.

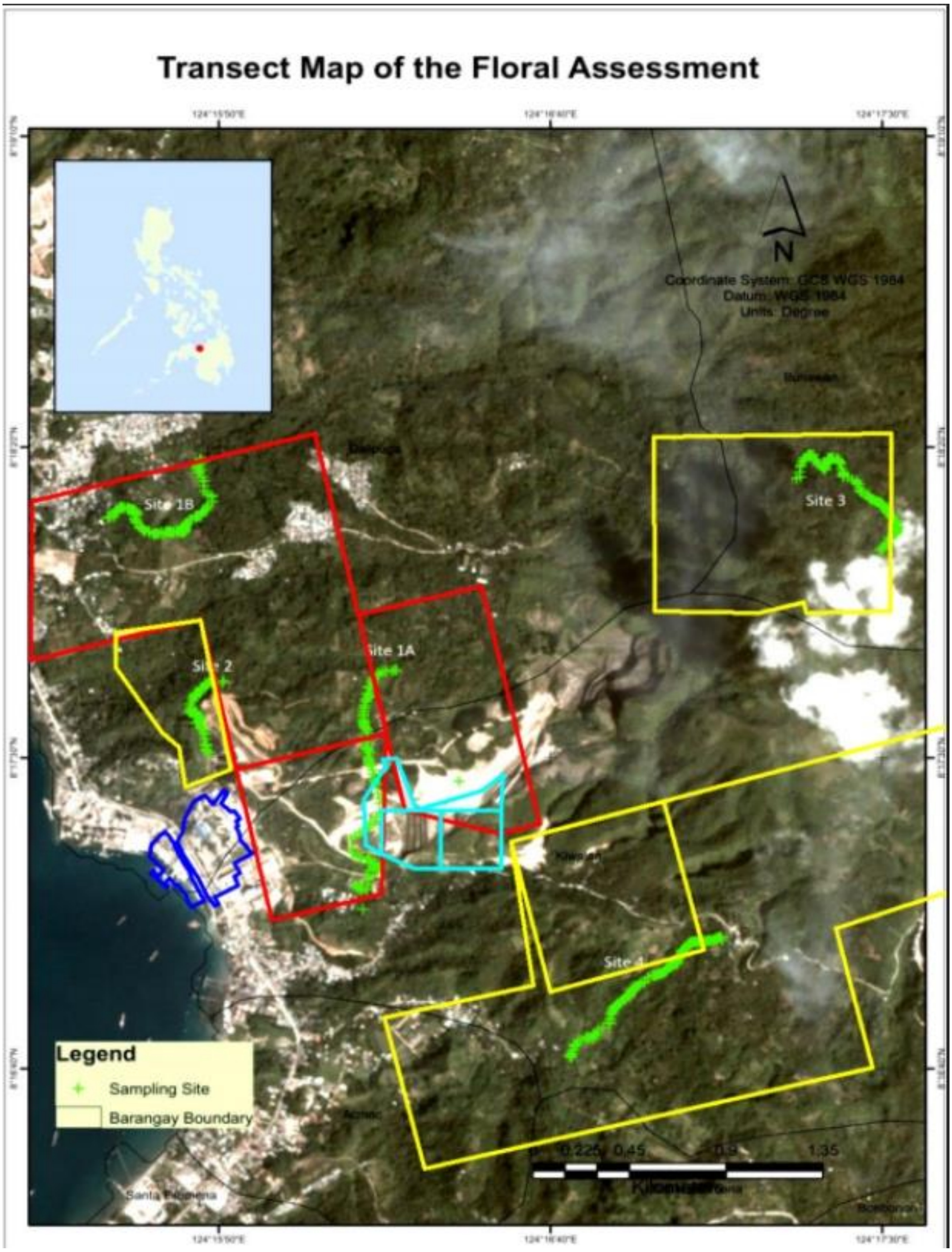


Figure 2.1-40. Transect Map for the Floral Assessment

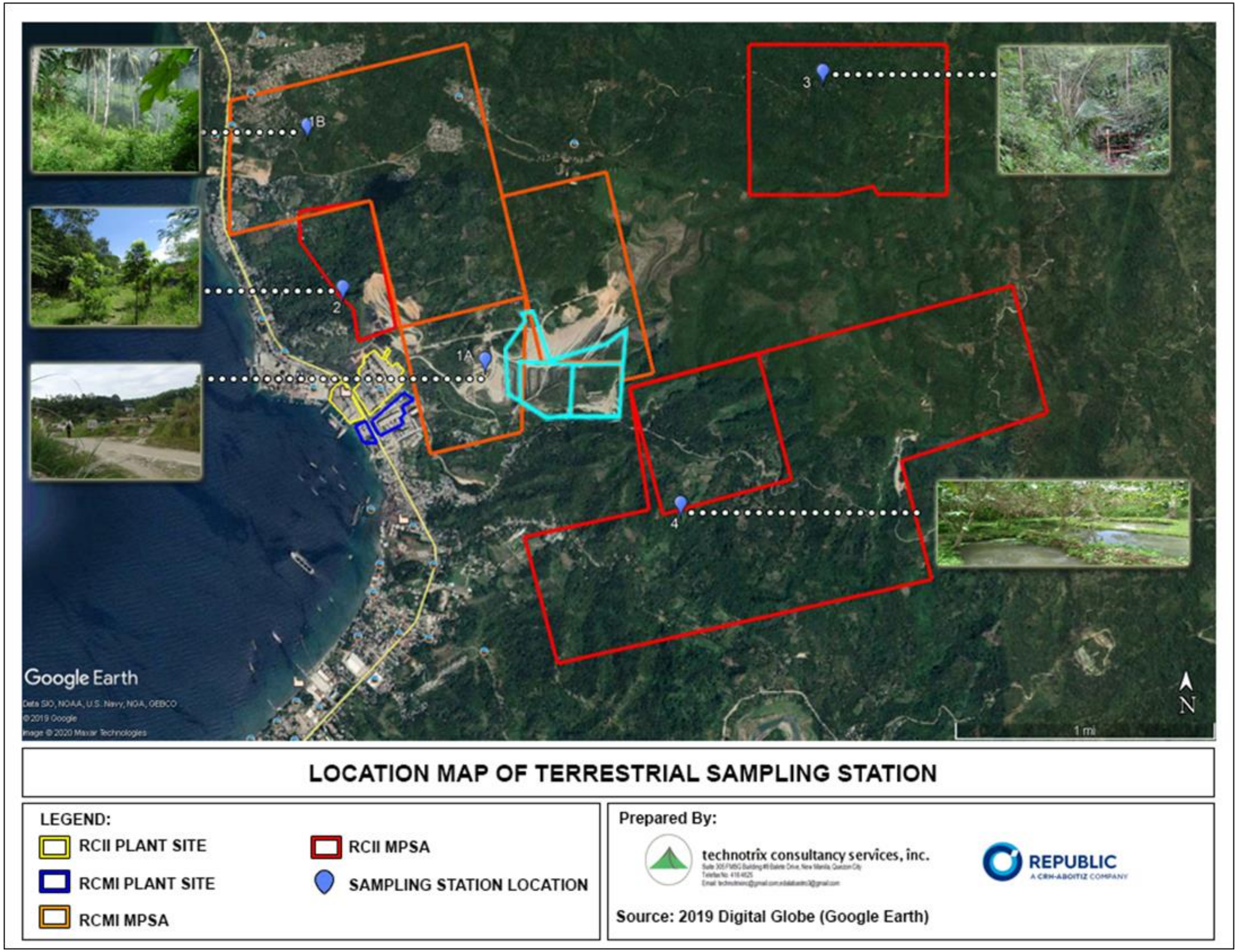


Figure 2.1-41. Sampling Station Map of Terrestrial Survey for the 2018 biodiversity study

Methodology

Table 2.1-12 summarizes the methodology adopted.

Table 2.1-12. Summary Table of the Methodology

Objectives	Data to be generated	Methodology
1. Identify species composition and distribution status of fauna and aquatic biota	• Species richness	• Transect walk (birds) • Trapping (rodents) • Mistnetting (bats) • Cruising technique (amphibians and reptiles) • Sweep netting (odonata) • Key Informant Interviews • Direct observations • Fish Visual Census and Coral Assessment
2. Identify endemic and threatened species and gathering of background information on the listed threatened species	• Presence/absence of endemic and threatened fauna • Conservation status • Species taxonomy and ecology	• Literature review (secondary data) • Conservation status based on IUCN 2016 and FishBase 2017 • Key Informant Interviews • Direct observations
3. Assessment of habitats and habitat profiling	• Floral Species Listing • Habitat description • Determinants of habitat structure • Habitat/ecosystem type	• General and detailed habitat assessment • Line Plot Survey • Conservation status of floral species based on DENR DAO 2015 List of Threatened Species • GPS tagging of plots and lines • Vegetation maps
4. Mapping of vegetation and Land-use	• Training and validation points (geographic coordinates) of vegetation and land-use patterns	• GIS-based maps of vegetation and land-use
5. Biodiversity Management Plan on the potential impacts of the plant project to threatened species and other threats to species of flora and fauna	• Critical habitats • Potential hazards and impacts • Threats to species	• Environmental Impact Assessment • Focused Group Discussion • Data Analysis
6. Recommend multi-stakeholder monitoring and evaluation activities	• Analysis of outputs	• Impact assessment • Literature review (secondary data) • Focused Group Discussion

Summary of Results and Discussions

FLORAL COMMUNITY

Table 2.1-13. Species Richness and Distribution of Floral Species

Taxonomic Group	FAMILY	NUMBER OF GENERA	NUMBER OF SPECIES
Tracheophytes (Angiosperms)	Acanthaceae	1	1
	Anacardiaceae	1	1
	Annonaceae	1	1
	Araliaceae	1	1
	Arecaceae	2	2
	Asteraceae	6	6
	Bignoniaceae	1	1
	Byttneriaceae	1	1
	Campanulaceae	1	1
	Combretaceae	1	1
	Convulvaceae	1	1
	Cyperaceae	1	2
	Elaeocarpaceae	1	1
	Euphorbiaceae	4	5
	Fabaceae	7	7
	Lauraceae	1	1
	Malvaceae	3	3
	Melastomataceae	1	1
	Meliaceae	2	2
	Moraceae	2	7
	Musaceae	1	1
	Myrtaceae	2	2
	Nyctaginaceae	1	1
	Oxalidaceae	1	1
	Piperaceae	1	1
	Poaceae	9	9
	Rutaceae	1	1
	Sapotaceae	1	1
	Solaceae	1	1
	Urticaceae	1	2
	Verbenaceae	5	5
TOTAL:	**(31)**	**(63)**	**(71)**
Pteridophytes			
(Ferns)	Adiantaceae	1	2
	Lygodiaceae	1	2
	Nephrolepidaceae	1	3
	Pteridaceae	2	3
(Fern-Allies)	Selaginellaceae	1	1
TOTAL:	**(5)**	**(6)**	**(11)**
OVER-ALL TOTAL:	**36**	**(69)**	**(83)**

Table 2.1-14. Species Distribution of Flora According to Habit of Growth

Group		HABIT	
Tracheophytes (Angiosperms)			
Herb	Shrub	Vine	Tree
25	11	1	34
Total:		71	

Table 2.1-15. Number of Genera and Species of the Documented Trees within the Different Sampling Areas

Family	Number of Genera	Number of Species
Anacardiaceae	1	1
Annonaceae	1	1
Araliaceae	1	1
Arecaceae (Palmae)	2	2
Bignoniaceae	1	1
Byytneriaceae	1	1
Combretaceae	1	1
Elaeocarpaceae	1	1
Euphorbiaceae	2	2
Fabaceae (Leguminosae)	5	5
Lauraceae	1	1
Malvaceae	2	2
Meliaceae	2	2
Moraceae	2	5
Myrtaceae	2	2
Oxalidaceae	1	1
Rutaceae	1	1
Sapotaceae	1	1
Urticaceae	1	1
Verbernaceae	1	2
Total: 20	**30**	**34**

Table 2.1-16. Tree Species Richness and Distribution in the Five Sampled Sites

FAMILY	SPECIES	SITE 1A	SITE 1B	SITE 2	SITE 3	SITE 4	TOTAL
Anacardiaceae	*Mangifera indica* L.	0	0	1	0	3	4
Annonaceae	*Annona muricata* L.	1	3	0	1	15	20
Araliaceae	*Polyscias nodosa* (Blume); Seemann	0	0	0	3	1	4
Areaceae	*Caryota rumphiana* Mart.	0	0	0	0	2	4
	Cocos nucifera L.	0	42	7	31	56	136
Bignoniaceae	*Spathodea campanulate;* P.Beauv	0	0	0	1	0	0
Byttneriaceae	*Kleinhovia hospita* Linn.	0	0	0	0	1	1
Combretaceae	*Terminalia catappa* L.	0	1	0	0	0	1
Elaeocarpaceae	*Muntingia calabura* L.	8	1	10	0	1	20
Euphorbiaceae	*Endospermum peltatum;* Merr.	0	2	0	0		2
	Melanolepis multiglandulosa (Reinw. Ex Blume) Rchb.f. &Zoll.	0	2	1	0	6	9

FAMILY	SPECIES	SITE 1A	SITE 1B	SITE 2	SITE 3	SITE 4	TOTAL
Fabaceae/ Leguminosae	*Gliricidia sepium* (Jacq.) Kunth ex Walp.	1	5	0	8	3	17
	Leucaena leucocephala (Lam.) de Wit	1	6	5	2	9	26
	Pterocarpus indicus Willd.	0	0	3	0	0	3
	Samanea saman (Jacq.) Merr,	1	0	0	0	0	1
	Tamarindus indica Linn.	2	0	0	0	0	2
Lauraceae	*Persea americana* Mill.	0	5	0	2	0	7
Malvaceae	*Ceiba pentandra* (L.); Gaertn.	5	0	0	0	0	5
	Theobroma cacao L.	0	0	0	2	0	2
Meliaceae	*Sandoricum koetjape* (Burm.f.) Merr.	0	1	3	0	0	4
	Swietenia mahogany; Jacq.	10	0	23	0	0	33
Moraceae	*Artocarpus altilis* (Parkinson ex F.A. Zorn) Fosberg	2	0	0	1	0	3
	Artocarpus camansi; Blanco	4	1	0	2	0	7
	Artocarpus heterophyllus; Lam.	3	6	3	0	2	14
	Ficus elastica Roxb. ex Hornem.	1	0	0	0	0	1
	Ficus minahassae; Tesym. De Vr.	1	0	0	1	2	4
Myrtaceae	*Psidium guajava* Linn.	1	0	1	0	7	9
	Syzygium cumini (L.); Skeels	0	0	0	0	1	1
Oxalidaceae	*Averrhoa carambola* L.	0	1	0	0	0	
Rutaceae	*Citrus maxima* (Burm.); Merr.	3	0	0	5	0	8
Sapotaceae	*Chrysophyllum cainito* L.	0	4	0	1	3	8
Urticaceae	*Leucosyke capitellata* (Poir.) Wedd	0	0	0	2	0	2
Verbenaceae	*Gmelina arborea* Roxb.	15	0	5	12	2	34
	Vitex parviflora Juss	2	0	1	2	0	5
TOTAL:		**61**	**75**	**63**	**80**	**114**	
Over-all TOTAL:		**391**					

Table 2.1-17. Threatened Trees and their Conservation Status

SPECIES	CONSEVATION STATUS	
	IUCN	DAO
Pterocarpus indicus Willd.	VU	VU
Vitex parviflora L.	VU	EN

The distribution of the number of species vis-à-vis the location in lowland, upland is cited for reference purposes. The more relevant description is with respect to the impact areas. The monitoring reports the SMRs, CMVRs, MMT reports have not included this type of observation.

Although it may be noted that the endemicity is quite high relating this observation to the "performance" of the project vis-à-vis an EPRMP is not readily made because of the absence of monitoring over an observation period. Mitigating measures particularly under the potential disturbance of the flora and faunal species are discussed in other parts of this Section 2.1.

FAUNAL COMMUNITY

Table 2.1-18. Species Richness, Distribution Status, and Conservation Status of Vertebrate Fauna

Vertebrates	SPECIES RICHNESS	DISTRIBUTION STATUS		CONSERVATION STATUS	
Amphibians	7	2	Philippine-endemic	1	Near threatened
		1	Mindanao faunal	6	Least concern
			region endemic		
		4	Non-endemic		
Reptiles	14	5	Philippine-endemic	12	Least concern
		1	Mindanao faunal	1	Near threatened
			region endemic	1	Not assessed
		8	Non-endemic		
Bats (volant	7	1	Philippine-endemic	7	Least concern
mammals)		6	Non-endemic		
Non-Volant Mammals	1	1	Philippine-endemic	1	Least concern
Birds	40	10	Philippine-endemic	40	Least concern
		29	Resident		
		1	Migrant		
Total	69	19	Philippine endemic	66	Least concern
		2	Mindanao faunal	2	Near threatened
			region endemic	1	Not assessed
		47	Non-endemic/		
			Resident		
		1	Migrant		
Percent endemism: 30					

Table 2.1-19. Species Composition, Abundance, Distribution and Conservation Status of Amphibians in the Project Site

Family	Species Name	Distribution	Conservation Status	S 1 - A	S 1 - B	S 2	S 3	S 4	Total
Bufonidae	Cane Toad (*Rhinella marina)*	Non-endemic	Least concern	22	40	5	1	21	**89**
Dicroglossidae	Common Pond Frog *(Fejervarya vittigera)*	Phil. Endemic	Least concern	0	1	0	0	0	**1**
	Giant Philippine Frog (*Limnonectes magnus)*	Non-endemic	Near-threatened	28	14	0	23	26	**91**
Eleutherodactylidae	Greenhouse Frog (*Eleutherodactylus planirostris)*	Non-endemic	Least concern	8	9	0	0	3	**20**
Microhylidae	Slender-digit Chorus Frog (*Kaloula picta)*	Phil. endemic	Least concern	0	2	0	0	0	**2**
Rhacophoridae	Common Tree Frog (*Polypedates leucomystax)*	Non-endemic	Least concern	11	0	4	9	27	**51**
Ranidae	Variable Backed Frog (*Pulchrana grandocula)*	MFR endemic	Least concern	0	0	0	10	0	**10**
	Total number of species = 7 Endemic species = 3		**Total no. of species per site**	**4**	**5**	**2**	**4**	**4**	

Table 2.1-20. Species Composition, Abundance, Distribution and Conservation Status of Reptiles in the Project Site

Family	Species Name	Distribution	Conservation Status	S 1 – A	S 1 - B	S 2	S 3	S 4	Total
Agamidae	Two-spotted Flying Lizard (*Draco bimaculatus*)	Phil. Endemic	Least concern	1	1	0	0	7	**9**
	Draco cyanopterus	Phil. Endemic	Least concern	0	0	0	0	1	**1**
Elapidae	Samar Cobra (*Naja samarensis)*	Phil. Endemic	Least concern	1	0	0	1	0	**2**
Colubridae	Asian Vine Snake (*Ahaetulla prasina preocularis)*	Non-endemic	Least concern	0	0	0	1	0	**1**
	Reddish Rat Snake (*Coelognathus erythrurus)*	Non-endemic	Not assessed	1	0	0	0	0	**1**
	Maren's Bronzeback *(Dendrelaphis marenae)*	Phil. Endemic	Least concern	0	0	0	0	1	**1**
	Paradise Tree Snake (*Chrysopelea paradisi)*	Non-endemic	Least concern	0	0	0	1	0	**1**
Gekkonidae	Tokay Gecko *(Gekko gecko)*	Non-endemic	Least concern	6	11	0	3	15	**35**
	Common House Gecko (*Hemidactylus frenatus)*	Non-endemic	Least concern	15	16	6	0	4	**41**

Family	Species Name	Distribution	Conservation Status	S 1 – A	S 1 - B	S 2	S 3	S 4	Total
Scincidae	Two-striped Mabuya (*Eutropis multicarinata)*	Non-endemic	Least concern	0	0	0	5	1	**6**
	Common Mabuya (*Eutropis multifasciata)*	Non-endemic	Least concern	1	1	0	0	0	**2**
	Emerald Skink (*Lamprolepis smaragdina philippinica)*	Non-endemic	Least concern	7	1	0	0	7	**15**
	Parvoscincus mindanensis	MFR Endemic	Near-threatened	0	0	0	0	1	**1**
Typhlopidae	Brahminy Blindsnake (*Ramphotyphlops braminus)*	Phil. Endemic	Least concern	0	1	0	0	6	**7**
Total number of species = 14 Endemics = 6			**Total number of species/site**	**7**	**5**	**1**	**5**	**9**	

Table 2.1-21. Species Composition, Abundance, Distribution and Conservation Status of Birds in the Project Site

Family Name	Species Name	Distribution	S 1 – A	S 1 - B	S 2	S 3	S 4	Total
Apodidae	Glossy Swiftlet (*Collocalia esculenta)* LC	Non-endemic	32	6	21	3	4	66
	Island Swiftlet (*Collocalia vanikorensis)* LC	Non-endemic	13	0	2	7	8	30
	Pygmy Swiftlet (*Collocalia troglodytes)* LC	Endemic	4	0	5	7	14	30
Alcedinidae	White-collared Kingfisher (*Todiramphus chloris)* LC	Non-endemic	22	31	21	31	21	126
Artamidae	White-breasted Wood Swallow *(Artamus leucorynchus)* LC	Non-endemic	2	0	0	4	4	8
Capitonidae	Coppersmith Barbet *(Megalaima haemacephala)* LC	Non-endemic	0	0	9	9	4	22
Columbidae	White-eared Brown-Dove *(Phapitreron leucotis)* LC	Endemic	34	18	9	23	42	126
	Zebra Dove (*Geopelia striata)* LC	Non-endemic	47	29	24	2	16	118
	Spotted Dove (*Streptopelia chinensis)* LC	Non-endemic	3	2	1	0	3	9
	Pink-necked Green Pigeon (*Treron vernans)* LC	Non-endemic	0	0	5	0	0	5
	Common Emerald-Dove (*Chalcophaps indica)* LC	Non-endemic	3	0	2	4	5	14

Family Name	Species Name	Distribution	S 1 – A	S 1 - B	S 2	S 3	S 4	Total
Corvidae	Large-billed Crow (*Corvus macrorhynchos*) LC	Non-endemic	3	4	0	8	7	22
Cuculidae	Plaintive Cuckoo (*Cacomantis merulinus*)	Non-endemic	2	0	1	2	3	8
	Philippine Coucal (*Centropus viridis*) LC	Endemic	11	5	6	6	14	42
Dicaeidae	Red-kelled Flowerpecker *(Dicaeum australe)* LC	Endemic	41	59	14	33	42	189
	Pygmy Flowerpecker (*Dicaeum pygmaeum*) LC	Endemic	26	14	2	5	16	63
Estrildidae	Chestnut Munia *(Lonchura atricapilla)* LC	Non-endemic	29	19	3	4	12	67
	White-bellied Munia *(Lonchura leucogastra)* LC	Non-endemic	1	0	0	0	0	1
Laniidae	Long-tailed Shrike *(Lanius schach)* LC	Non-endemic	1	0	0	0	0	1
	Brown Shrike *(Lanius cristatus)* LC	Migrant	3	0	0	0	4	7
Muscicapidae	Pied Fantail *(Rhipidura javanica)* LC	Non-endemic	31	67	7	19	27	151
	Yellow-Bellied Whistler *(Pachycephala philippinensis)* LC	Endemic	0	0	0	2	0	2
	Mangrove Blue Flycatcher *(Cyornis rufigastra)* LC	Non-endemic	0	0	0	4	0	4
	Black-naped Monarch *(Hypothymis azurea)* LC	Non-endemic	0	0	0	6	0	6
Nectariniidae	Olive-backed Sunbird *(Nectarinia jugularis)* LC	Non-endemic	47	135	33	86	109	410
	Purple-troated Sunbird *(Nectarinia sperata)* LC	Non-endemic	0	0	0	2	0	2
Oriolidae	Black-naped Oriole *(Oriolus chinensis)*LC	Non-endemic	0	4	0	5	2	11
Ploceidae	Eurasian Tree Sparrow *(Passer montanus)* LC	Non-endemic	33	98	24	17	28	200
Psittacidae	Colasisi *(Loriculus philippensis)* LC	Endemic	5	1	1	2	5	14
	Guaiabero *(Bolbopsittacus lunulatus)* LC	Endemic	9	3	2	5	9	28
Pycnonotidae	Yellow-vented Bulbul *(Pycnonotus goiavier)* LC	Non-endemic	177	318	55	145	159	854

Family Name	Species Name	Distribution	S 1 – A	S 1 - B	S 2	S 3	S 4	Total
	Philippine Bulbul (*Hypsipetes philippinus)* LC	Endemic	0	0	2	8	0	10
Rallidae	Barred Rail *(Gallirallus torquatus)* LC	Non-endemic	3	3	4	2	3	15
Sturnidae	Asian Glossy Starling *(Aplonis panayensis)* LC	Non-endemic	24	14	27	32	16	113
Sylviidae	Tawny Grassbird (*Megalurus timoriensis)* LC	Non-endemic	1	0	1	0	1	3
	Striated Grassbird *(Megalurus palustris)* LC	Non-endemic	2	0	0	2	4	8
Timaliidae	Brown Tit-Babbler *(Macronous striaticeps)* LC	Endemic	0	0	0	3	0	3
Turdidae	Pied Bushchat (*Saxicola caprata)* LC	Non-endemic	21	0	2	2	4	29
	Oriental Magpie Robin *(Copsychus saularis)* LC	Non-endemic	2	0	1	16	5	24
Zosteropidae	Mountain White-eye *(Zosterops montanus)* LC	Non-endemic	1	0	0	0	0	1
Total number of species: 40	**Resident: 29**	Total no. of species per site	31	19	27	33	30	
Least concern	**Endemic: 10**							
	Migrant: 1							

Legend: LC (Least concern); Site 1-A (Quarry Area); Site 1-B (Coconut field area); Site 2 (Coal stockpile area); Site 3 (Lacub environ); Site 4 (Matood environ

Table 2.1-22. Species Composition, Richness, Distribution, and Conservation Status of Lepidoptera Species in RCMI Plant Environ in Kiwalan, Iligan City.

Species Name	Common Name	DS	CS	Sampling Sites					Total
				Site 1-A	Site 1-B	Site 2	Site 3	Site 4	
BUTTERFLIES									
Family Hesperiidae									
Taractrocera luzonensis (Staudinger, 1889)	Luzon Grass Dart	R	LC	1	3	2	0	1	7
Family Lycaenidae									
Ionolyce sp.	Pointed Line-Blue	R	NE	**0**	0	1	0	1	2
Jamides cleodus C.& R.Felder, [1865]	White cerulean	R	LC	0	0	0	1	1	2
Jamides espada (Fruhstorfer, 1916)	Cerulean	R	NE	0	0	0	1	0	1
Prosotas dubiosa Semper, 1879	Tailless Lineblue	R	NE	3	0	1	0	0	4
Zizina otis oriens (Butler, 1883)	Lesser Grass Blue	R	LC	11	10	6	0	1	28
Family Nymphalidae									
Cupha arias arias (C.& R. Felder, 1867)	Rustic	R	NE	1	0	0	0	0	1
Danaus melanippus edmondii Lesson 1837	White Tiger	R	NE	0	1	0	2	0	3
Hypolimnas anomala anomala (Wallace, 1869)	Malayan Eggfly	R	LC	0	0	0	1	0	1
Hypolimnas bolina philippensis Butler, 1874	Great Eggfly	R	NE	0	2	0	0	0	2
Ideopsis juventa manillana Moore 1883	Grey Glassy Tiger	R	NE	0	0	0	5	2	7
Junonia almana almana Linnaeus 1758	Peacock Pansy	R	LC	9	1	3	0	0	13
Junonia hedonia ida Cramer 1775	Chocolate Pansy	R	LC	4	8	1	7	6	26
Junonia orithya leucasia Fruhstorfer 1912	Blue Pansy	R	LC	3	0	0	0	0	3
Mycalesis igoleta C.& R.Felder 1863	Bushbrown	PE	LC	1	3	2	1	1	8
Neptis mindorana C. & R. Felder, 1863	Sailer butterflies	PE	LC	0	2	0	0	0	2
Orsotriaena medus (Fabricius, 1775)	Medus brown	R	LC	2	0	0	0	0	2
Phalantha phalanta Drury, 1773	Common Leopard	R	LC	0	0	0	0	1	1
Ragadia melindena Felder & Felder 1863	Striped Ringlets	PE	LC	0	0	0	6	0	6
Ypthima sempera C.& R.Felder, 1863	Common Three-ring	PE	LC	4	11	3	0	0	18
Ypthima stellera stellera Eschscholtz 1821	Common Five-Ring	PE	LC	0	1	0	8	8	17
Family Papilionidae									
Achillides palinurus daedalus (C. & R. Felder, 1861)	Banded Peacock	R	LC	0	0	0	1	0	1
Menelaides polytes ledebouria (Eschscholtz, 1821)	Common Mormon	R	LC	0	0	0	1	0	1
Family Pieridae									
Eurema alitha (C. & R. Felder, 1862)	Scalloped grass yellow	R	LC	0	3	0	3	1	7
Eurema hecabe tamiathis Linnaeus, 1758	Common Grass Yellow	R	LC	2	5	5	4	3	19
Leptosia nina Fabricius, 1793	Wandering Psyche	R	LC	0	6	0	0	0	6

Species Name	Common Name	DS	CS	Sampling Sites					Total
				Site 1-A	Site 1-B	Site 2	Site 3	Site 4	
MOTHS									
Family Callidulidae									
Callidula sumatrensis (Pagenstecher, 1887)	Butterfly Moth	R	LC	0	0	0	1	0	1
Family Crambidae									
Pleuroptya ruralis (Scopoli, 1763)	Pearl moth	R	NE	1	0	0	0	)	1
Family Erebidae									
Amata sp.	Wasp Tiger Moth	R	NE	1	0	0	0	0	1
Argina astrea (Drury, 1773)	Crotalaria pod borer	R	NE	3	0	0	0	0	3
Asota heliconia philippina Rothschild, 1897	Snouted Tiger Moth	PE	LC	0	1	0	0	0	1
Family Geometridae									
Hyposidra leucomela (Walker, 1866)		PE	LC	0	0	0	1	0	1
Total Number of Individuals				48	57	23	43	25	194
Total Number of Species				14	14	8	15	10	**32**
Total Number of Philippine Endemic				2	5	2	4	2	7
Total Number of Threatened Species				0	0	0	0	0	0

Legend: DS (Distribution Status); CS (Conservation Status); PE (Philippine Endemic); R (Resident); LE (Least Concern); NE (Not Evaluated means no assessment of extinction risk has been made). Legend: Site 1-A (Quarry Area); Site 1-B (Coconut field area); Site 2 (Coal stockpile area); Site 3 (Lacub environ); Site 4 (Matood environ)

Table 2.1-23. Biodiversity Indices of the Sampling Sites

Study Site	*Sp.Richness*	Diversity Index	H-max	Evenness
Industrial Cement Port	37 species	2.41	3.61	1.22

2.1.4.1 Vegetation Removal and Loss of Habitat

Impact Analysis on the Floral Ecology

The concerns on disturbance/loss of floral species and vegetation are indeed integrated in the progressive rehabilitation program. The number of tress that could be disturbed or cut will need permit from the CENRO after an official inventory shall have been made. Movement of wildlife species may not necessarily be an adverse impact if the destination is to an area with better habitat and/or food. Injury to important faunal species shall be a primary concern of the quarry personnel.

Technical Bulletin 2016-04 of 02 December 2016 is duly noted. This refers to the conduct of Protected Area Suitability Assessment (PASA) and therefore apparently not relevant to the Project since it is not sited in an E-NIPAS protected area.

By and large, the proposed project will entail only minor earthmoving at the plant site during construction of the additional structures/buildings. The impacts are deemed to be more confined to the quarry and coal stockpile areas. Quarrying activities involve excavation works, change in landform but generally in the vertical directions, which could result in the removal of vegetation. Coal stockpiling involve basically the placement of coal materials on ground.

Continuous mining will remove the existing vegetation consisting of shrubs and grasses in the quarrying sites and some secondary forest and agriculture crops. The opening of large areas and the increase in earthmoving activities will also result in the increased generation of dust. This impact will be long-term, permanent, highly significant and irreversible.

Overburden will be removed to expose the desired materials, which will result to displacement of vegetation in the area. In effect, migration of animals to nearby areas is also expected.

In any case, it should be noted that the advance of quarrying during the past as well as the proposed expansion (increase in extraction rate) is predominantly done on pre-existing quarry sites, which have long been opened, as explained under the discussion on **Section 2.1.2.1**: "changes in topography". As such, the site has long been cleared to its existing vegetation and as such, the fauna that used to live therein has long since migrated to other areas.

Habitat Loss or Degradation

Habitat fragmentation – This is the break-up of the natural landscape into small patches isolated from one another. It affects the number of species present, movement of species, and transfer of materials among habitats.

The loss of vegetation as a result of land clearing may affect the movement and loss of wildlife species in the area aggravated by the loss of habitat and food for survival. Noise generated during construction activities brought about by working equipment would affect the behavior of wildlife species especially feeding and reproductive habits. Therefore, faunal species would migrate to nearby areas where disturbance of habitat is less.

Birds and insects are displaced during the clearing and stripping of overburden. Afterwards, they will eventually migrate to other areas for sustenance and growth. Since RCMI is extracting ore materials, the disturbed areas will become barren if not properly attended to.

Keystone Species a species on which other species in an ecosystem largely depend, such that if it were removed the ecosystem would change drastically.

Based on the Biodiversity Survey there appears to be no impact to the terrestrial flora on the Plant site but only minimal impact on the quarry site. With respect to fauna the species disturbed may simply relocate to another adjacent site however in the case flora there are mitigating measure to avoid or lessen disruption of the keystone species, such mitigating measures are avoidance or balling and reforestation. This measures are all integral to the final mine rehabilitation plan. The tables below indicate presence of endangered and endemic species

Endangered Species

Table 2.1-24. Threatened Trees and their Conservation Status.

SPECIES	CONSEVATION STATUS	
	IUCN	DAO
Pterocarpus indicus Willd.	VU	VU
Vitex parviflora L.	VU	EN

**EN-Endangered; VU- Vulnerable*

Figures 2.1-42 to 2.1-46 show the GIS map that reflects the distribution of tree species found along the transect line within the five sampled sites. The tree species comprised fruit trees (usually common species), native trees, and some invasive tree species. Seventeen species were recorded in Site 1-A where 6 are common fruit trees, 2 are native trees and 2 are found to be invasive tree species (**Figure 2.1-42**). In Site 1-B, 14 species were recorded comprising 6 fruit trees, 3 native trees, while 1 species is an invasive tree (**Figute 2.1-43**). Fifteen species are listed under Site 2 composed of 7 fruit trees, 3 native trees, and 3 invasive tree species (**Figure 2.1-44**). Site 3 has 19 species comprising 8 fruit trees, 3 native trees, and 1 invasive tree species (**Figure 2.1-45**) while Site 4 has 16 tree species composed of 7 fruit trees, 3 native trees, and 2 invasive tree species (**Figure 2.1-46**). The common fruit trees found in Site 1A are soursop, tamarind, jackfruit, guava, grapefruit, and aratiles while kamansi and Molave are the native tree species that are present in the said site. Ipil-Ipil, Gmelina, and Mahogany are the invasive tree species that were recorded. Other trees that were also recorded are breadfruit, balete, kapok, Tambuyogan, Acacia, Madre de Kakaw, and a few coconuts.

Soursop, santol, avocado, jackfruit, star fruit, star apple, and Aratiles are the fruit trees that were recorded in Site 1-B while kamansi, Gubas, and Alim are the native trees that were found. Ipil-Ipil, an invasive species is present as well. Talisay, Madre de Kakaw, and an extensive stretch of coconut fields were also observed. In Site 2, mango, star apple, jackfruit, guava, santol, and aratiles were the fruit trees found in the said site. Meanwhile, Narra, Alim, and Molave are the native trees that were observed while Ipil-Ipil, Mahogany, and Gmelina are the invasive tree species that were also recorded. Madre de Kakaw and a few coconuts are also present. Site 3 has a number of fruit trees, namely, cacao, mango, soursop, jackfruit, grapefruit, star apple, and aratiles. Native tree species like kamansi, Malapapaya, and Molave were present as well. Gmelina, an invasive tree species has also been recorded while other trees that were present in the said area are breadfruit, African Tulip tree, Fishtail palm, Tambuyogan, Dalunot, and few coconuts. Guava, avocado, soursop, jackfruit, mango, star apple, and Aratiles which are common fruiting trees were recorded in Site 4 while malapapaya, alim, and duhat are the native trees that were also documented. Ipil-Ipil and gmelina are the invasive tree species that were recorded. Presence of other tree species like tan-ag, fishtail palm, and several coconuts were also observed.

Table 2.1-24 above shows the list of threatened trees along with their conservation status. Only two tree species which are also Philippine native trees are under the threatened category. According to the most recent DENR Administrative Order (DAO) 2017, an updated national list of threatened Philippine plants and their categories, *Pterocarpus indicus* (Narra) is under Category C or the VU (Vulnerable) status while *Vitex parviflora* (Molave), or locally known as "Tugas" is under Category B or the EN (Endagered) status. On the other hand, in the IUCN (International Union for the Conservation of Nature) Red List of Threatened Species (2018) both trees belong to the Vulnerable category. Only three Narra trees and five Molave trees were encountered during the assessment in all the five sampled areas. In line with this conservation concern, it was also observed that three species of trees, *Gmelina arborea*, *Leucaena leucocephala,* and *Swietenia mahogani* known as aggressively invasive species, dominate in some sites.

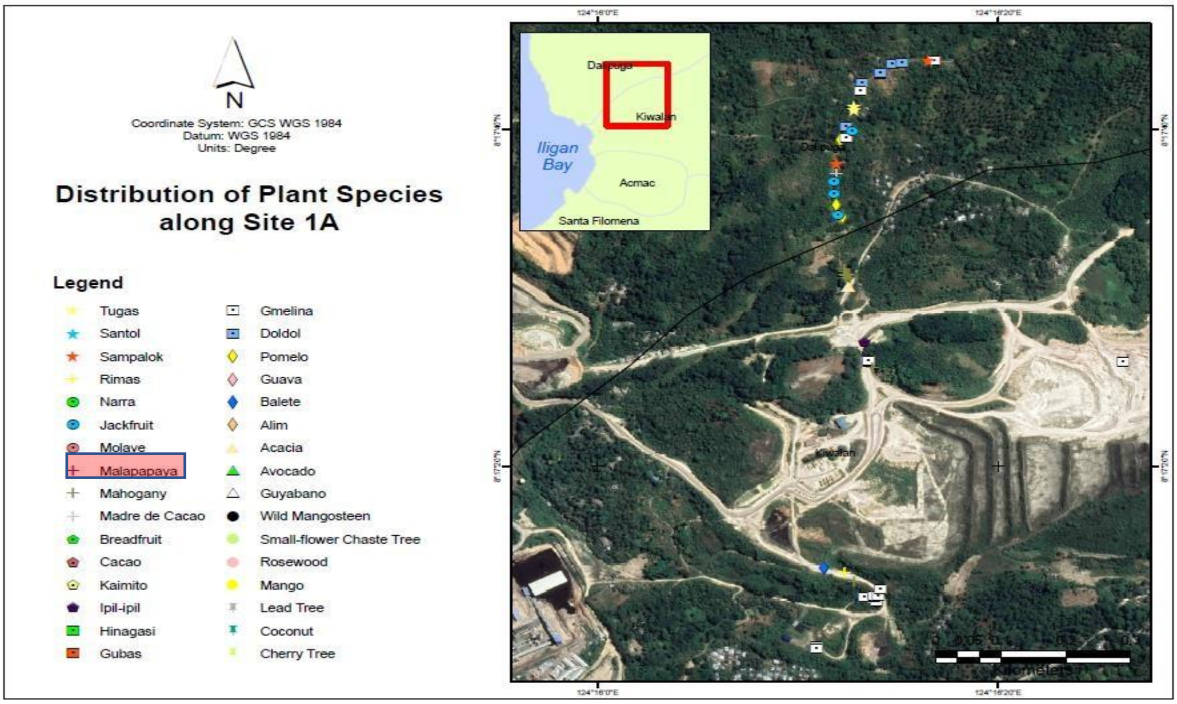


Figure 2.1-42. Distribution Map of Plant Species in Sampling Site 1A (Limestone Quarry)

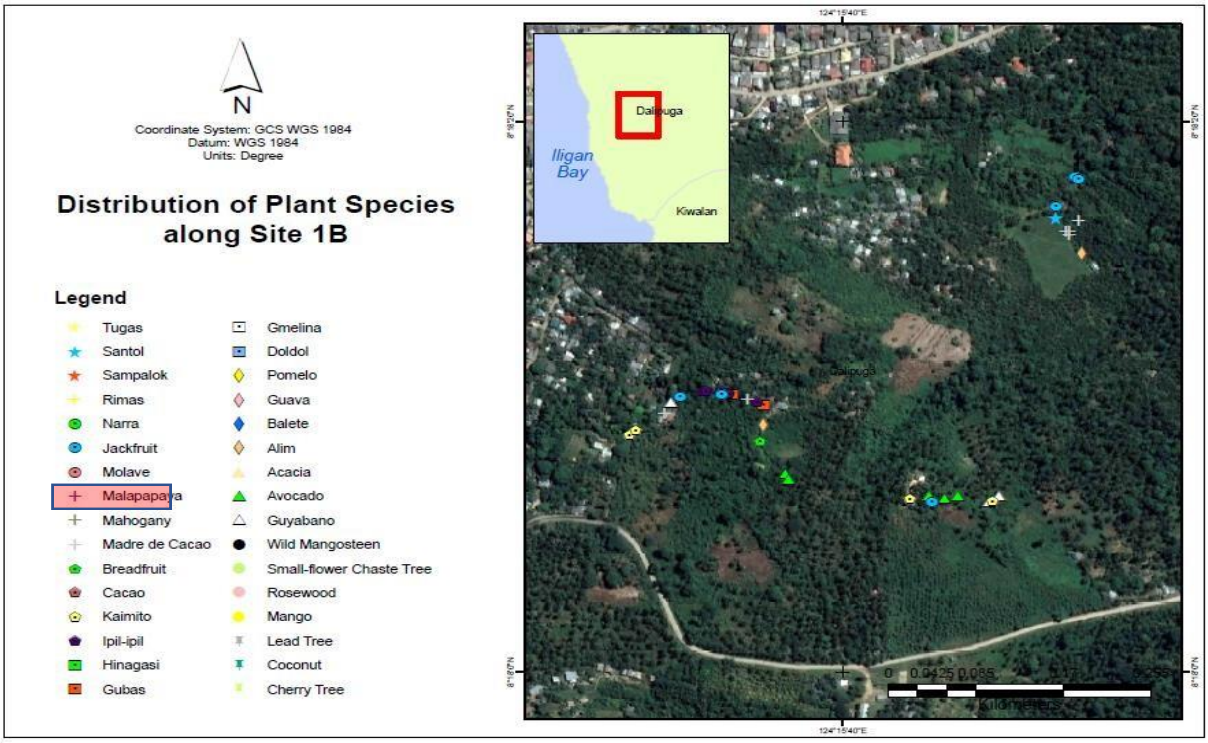


Figure 2.1-43. Distribution Map of Plant Species in Sampling Site 1-B (Coconut field area)

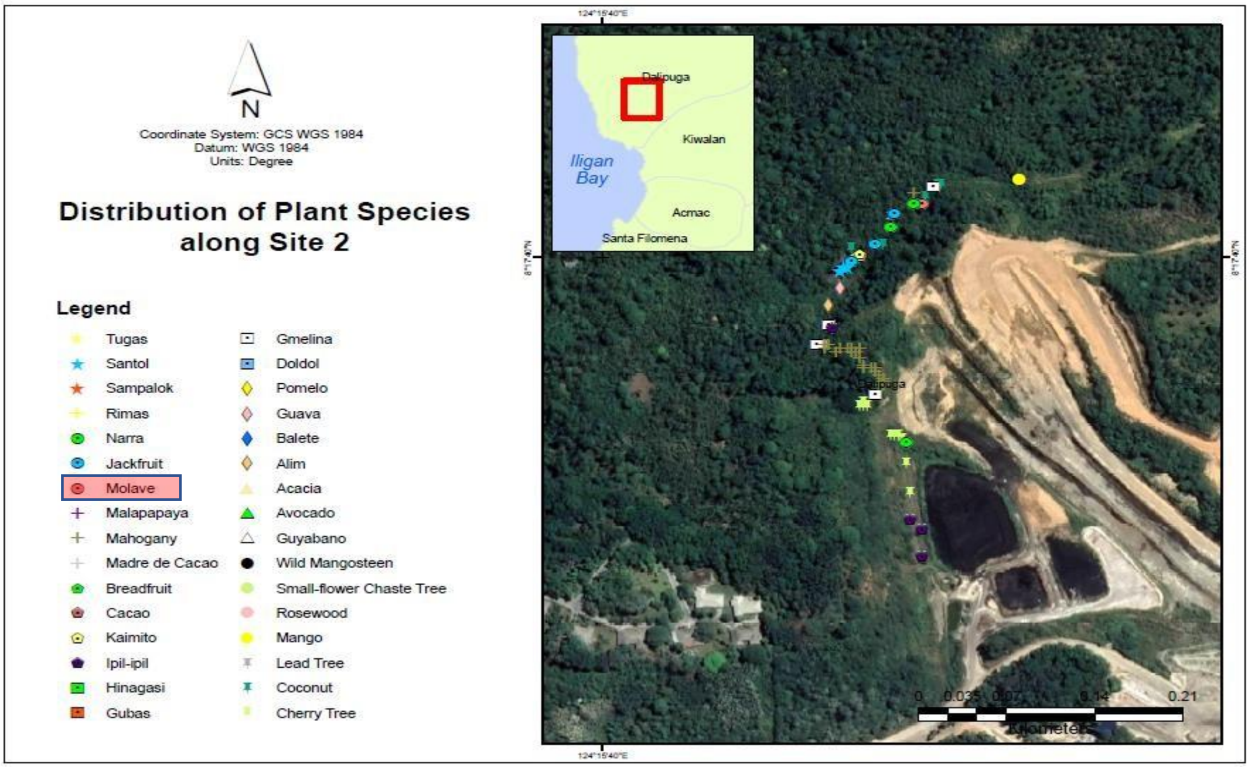


Figure 2.1-44. Distribution Map of Plant Species in Sampling Site 2 (Coal Stockpile Area).

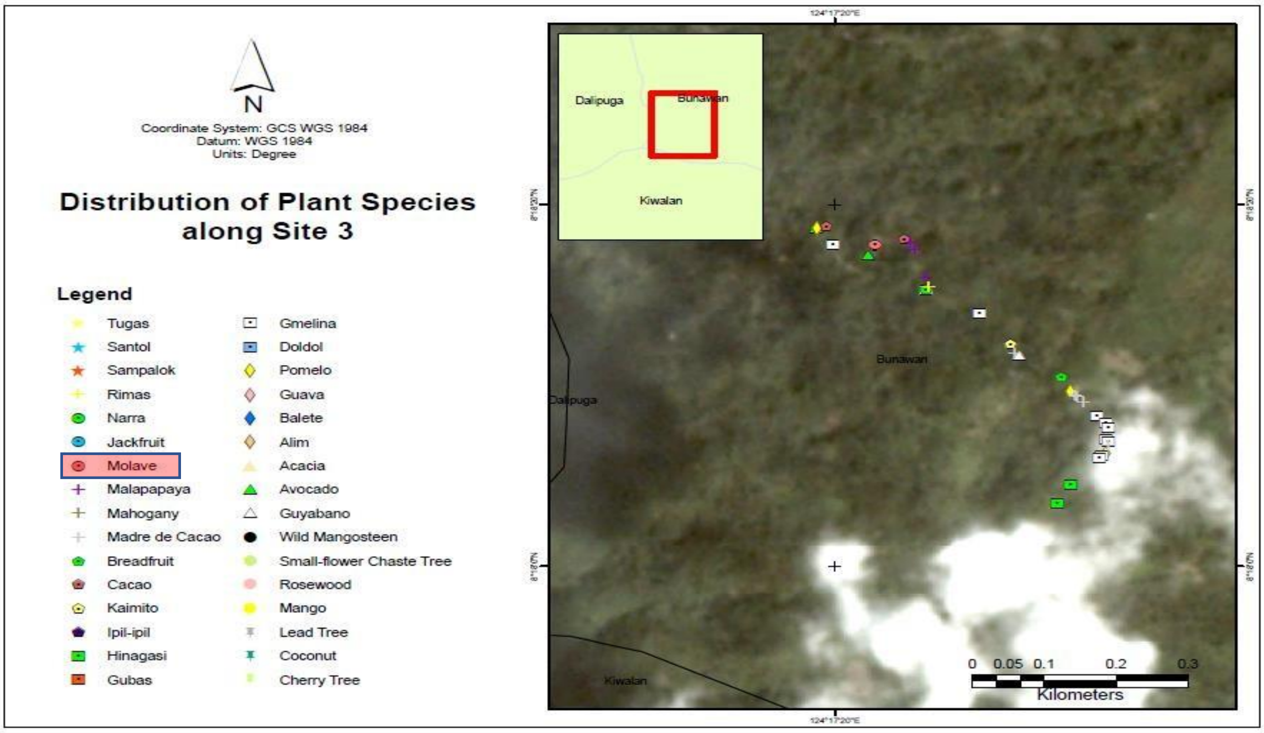


Figure 2.1-45. Distribution Map of Plant Species in Sampling Site 3 (Lacub environ).

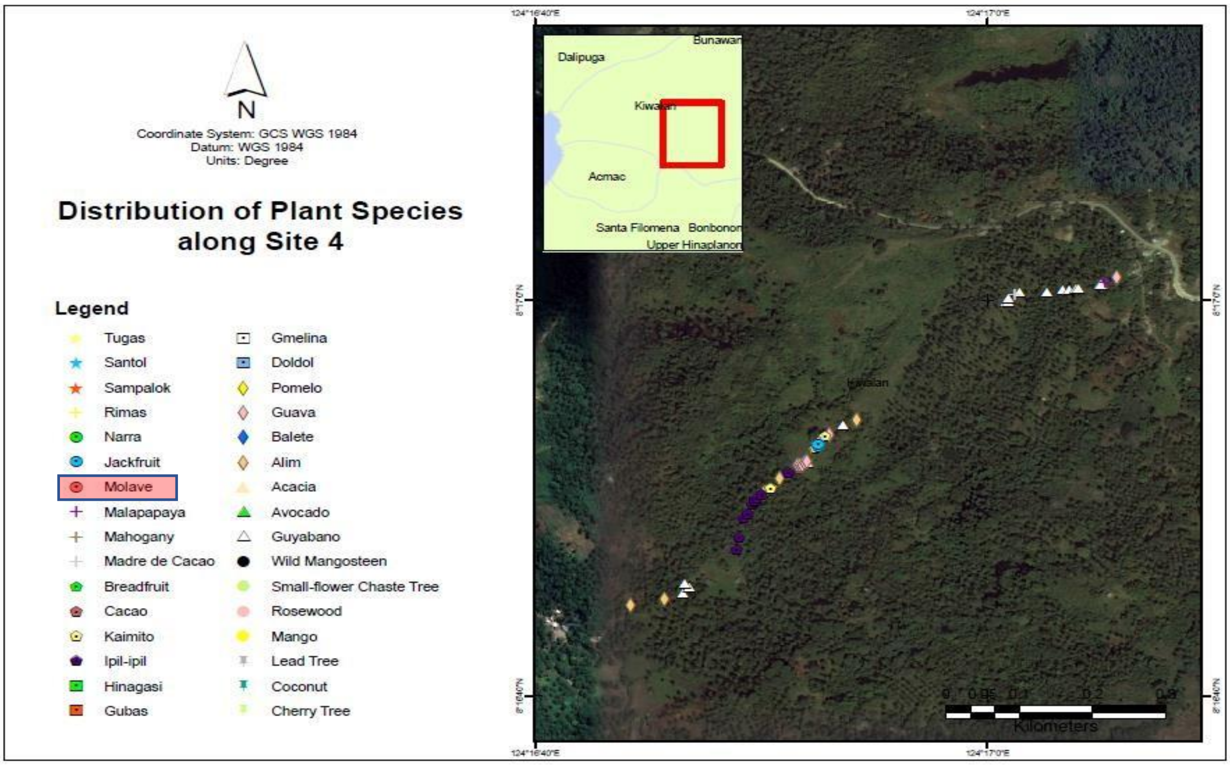


Figure 2.1-46. Distribution Map of Plant Species in Sampling Site 4 (Matood environ).

Endemic Species

Table 2.1-25. Species Composition, Richness, Distribution and Conservation Status of Odonata in RCMI Plant Environ.

Species Name	DS	CS	Sampling Sites					Total
			Site 1-A	Site 1-B	Site 2	Site 3	Site 4	
SUB-ORDER ANISOPTERA								
Family Aeshnidae								
Gynacantha subinterrupta	NE	LC	0	0	1	0	0	1
Family Corduliidae								
Heteronaias heterodoxa	PE	LC	0	0	1	0	0	1
Family Libellulidae								
Agrionptera insignis			0	0	0	1	0	
Crocothemis servilia servilia	NE	LC	0	0	0	0	5	5
Diplacina bolivari	PE	LC	1	0	0	4	4	9
Diplacina braueri	PE	LC	0	0	0	2	3	5
Diplacodes trivialis	NE	LC	20	0	4	0	0	24
Neurothemis ramburii ramburii	NE	LC	11	4	2	3	8	28
Neurothemis terminata	NE	LC	3	3	0	0	0	6
Orthetrum pruinosum clelia	NE	LC	3	1	0	1	6	11
Orthetrum sabina sabina	NE	LC	18	2	4	0	2	26
Orthetrum testaceum testaceum	NE	LC	2	0	3	0	0	5
Pantala flavescens	NE	LC	7	1	2	0	4	14
Potamarcha congener	NE	LC	1	0	0	0	3	4
Trithemis aurora	NE	LC	4	0	0	0	2	6
Trithemis festiva	NE	LC	1	0	0	1	4	6
Tholymis tillarga	NE	LC	2	1	0	0	0	3
SUB-ORDER ZYGOPTERA								
Family Chlorocyphidae								
Rhinocypha colorata	PE	LC	0	0	0	2	3	5
Family Coenagrionidae								
Agriocnemis sp. 1 (White)	NE	LC	7	2	0	0	0	9
Agriocnemis sp. 2 (Red)	NE	LC	3	0	0	0	0	3
Agriocnemis sp. 3 (Green)	NE	LC	2	1	0	0	1	4
Ceriagrion lieftincki	PE	LC	0	2	0	0	3	5
Ischnura senegalensis	NE	LC	1	0	0	0	0	1
Pseudagrion pilidorsum pilidorsum	NE	LC	8	1	0	2	5	16
Family Platycnemididae								
Coeliccia dinocerus	PE	LC	0	0	0	4	0	4
Risiocnemis appendiculata	PE	LC	0	0	0	2	0	2
Family Protoneuronidae								
Prodasineura integra	PE	LC	7	1	0	1	10	19
Total Number of Individuals			101	19	17	23	63	223
Total Number of Species			17	10	7	11	15	27
Total Number of Philippine Endemic			2	2	1	6	5	8
Total Number of Threatened Species			0	0	0	0	0	0

Legend: DS (Distribution Status); CS (Conservation Status); PE (Philippine Endemic); NE (Non- Endemic); LE (Least Concern); Legend: Site 1-A (Quarry Area); Site 1-B (Coconut field area); Site 2 (Coal stockpile area); Site 3 (Lacub environ); Site 4 (Matood environ).

The distribution of odonata species in terms of sampling sites are shown in **Figures 2.1-47 to 2.1-51.**

Site 1A (Quarry Area) is composed of 17 Odonata species of which 15 species are non- endemic and two species are Philippine endemic (*Diplacina bolivari* and *Prodasineura integra*) with no threatened species (Figure 2.1-46). Site 1B (Coconut field area) is composed of 10 species of which eight are non-endemic and two are Philippine endemic (*Ceriagrion lieftincki* and *Prodasineura integra*) with no threatened species (Figure 2.1-47). Site 2 (Coal stockpile area) is composed of seven species of which six are non-endemic and one Philippine endemic (*Heteronaias heterodoxa*) with no threatened species (Figure 2.1-48). Site 3 (Lacub environ) is composed of 11 species of which five are non-endemic and six are Philippine endemic species (*Diplacina bolivari, Diplacina braueri, Rhinocypha colorata, Coeliccia dinocerus, Risiocnemis appendiculata*, and *Prodasineura integra*) with no threatened species (Figure 2.1-49). Site 4 (Matood environ) is composed of 15 species of which 10 are non-endemic and five are Philippine endemic (*Diplacina bolivari, Diplacina braueri, Rhinocypha colorata, Ceriagrion lieftincki,* and *Prodasineura integra*) with no threatened species (Figure 2.1-50).

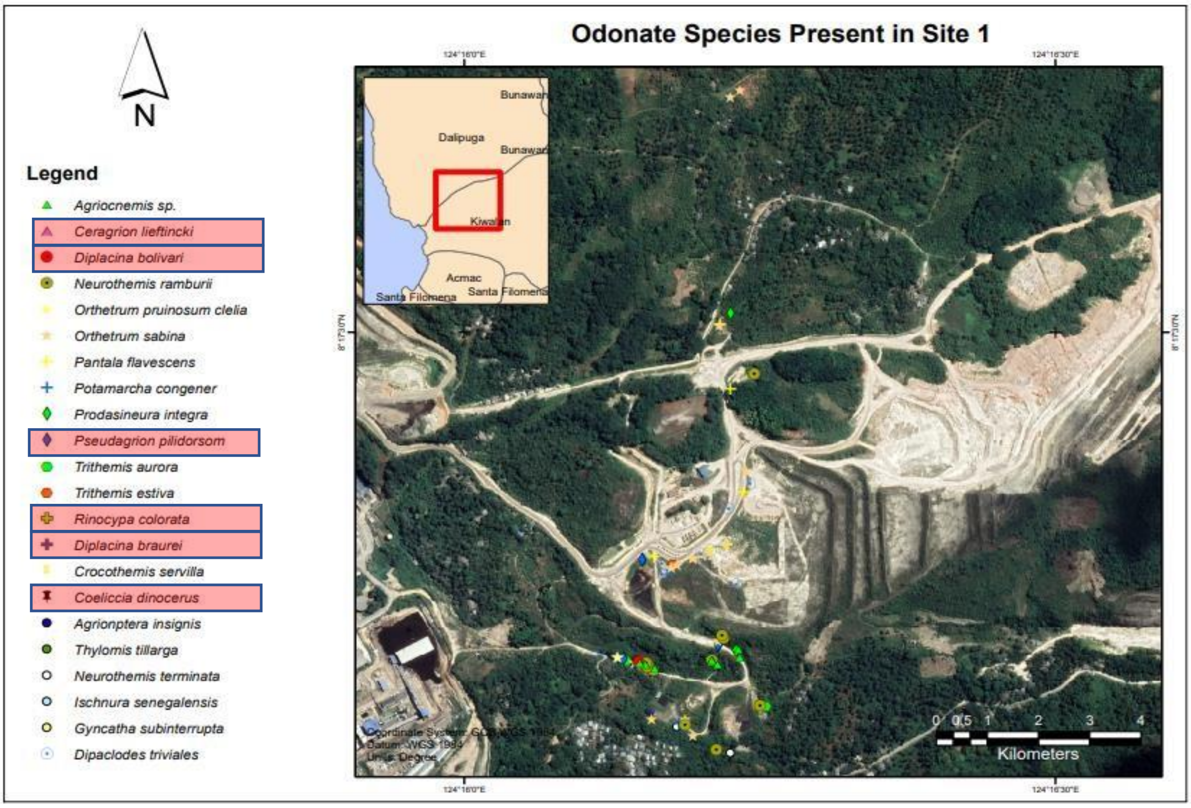


Figure 2.1-47. Distribution Map of Odonata Species in Site 1A (Quarry Area)

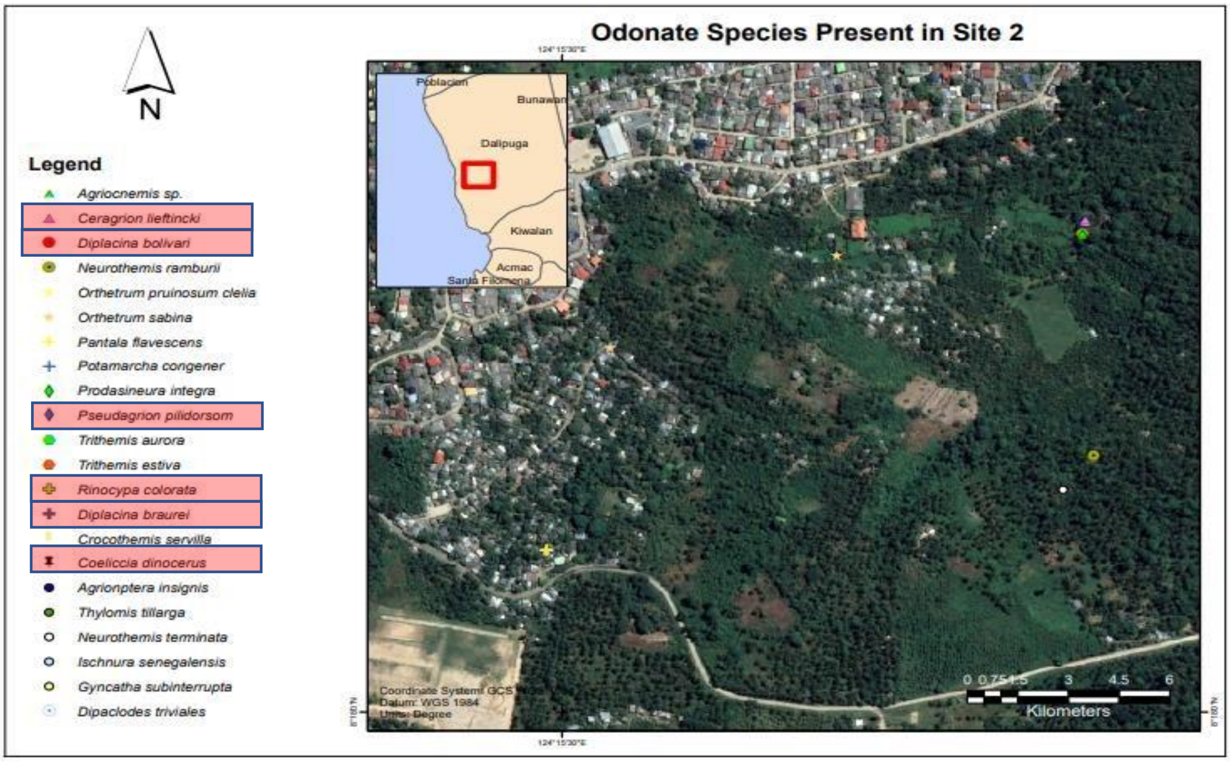


Figure 2.1-48. Distribution Map of Odonata Species in Site 1B (Coconut field area)

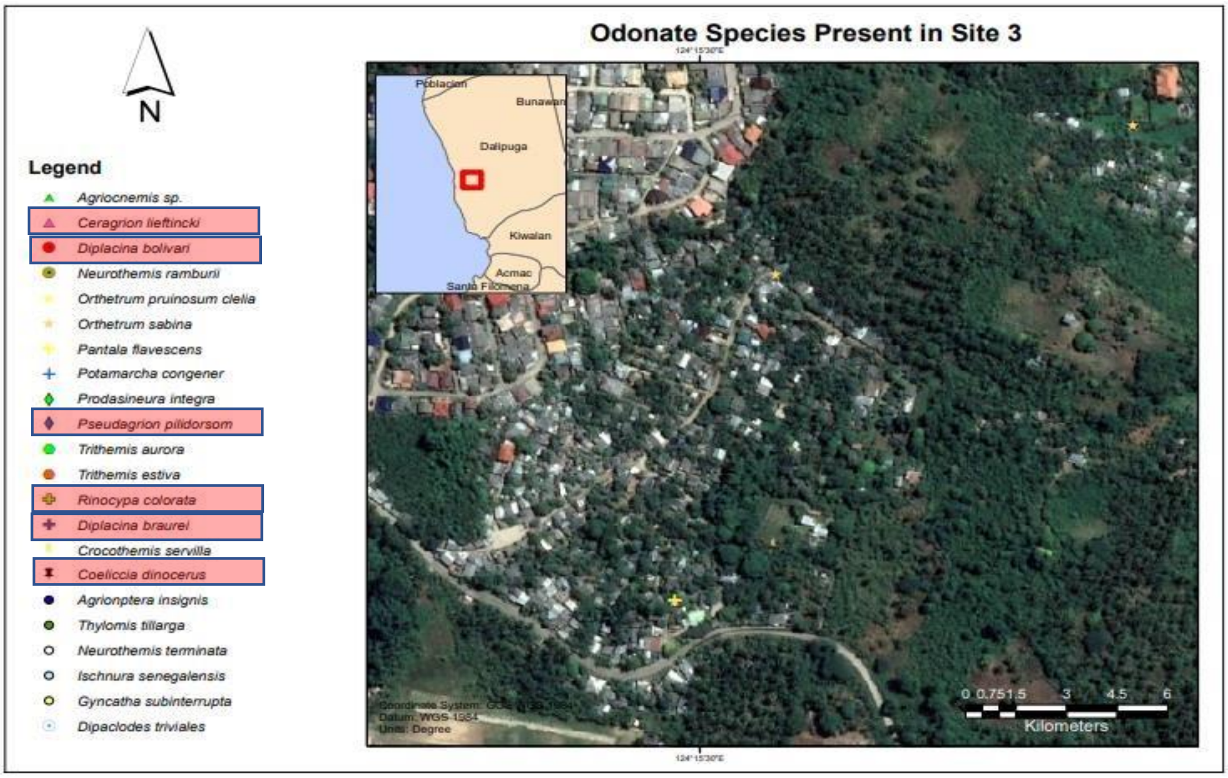


Figure 2.1-49. Distribution Map of Odonata Species in Site 2 (Coal stockpile area)

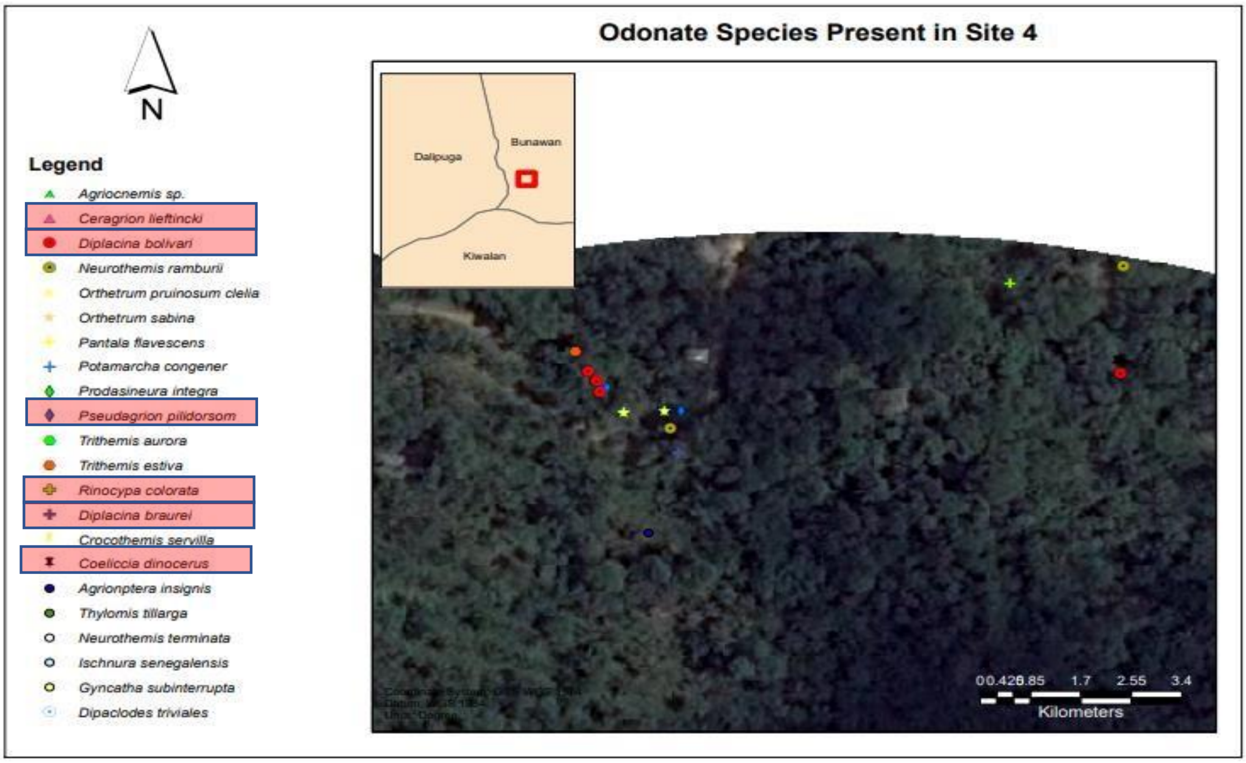


Figure 2.1-50. Distribution Map of Odonata Species in Site 3 (Lacub environ)

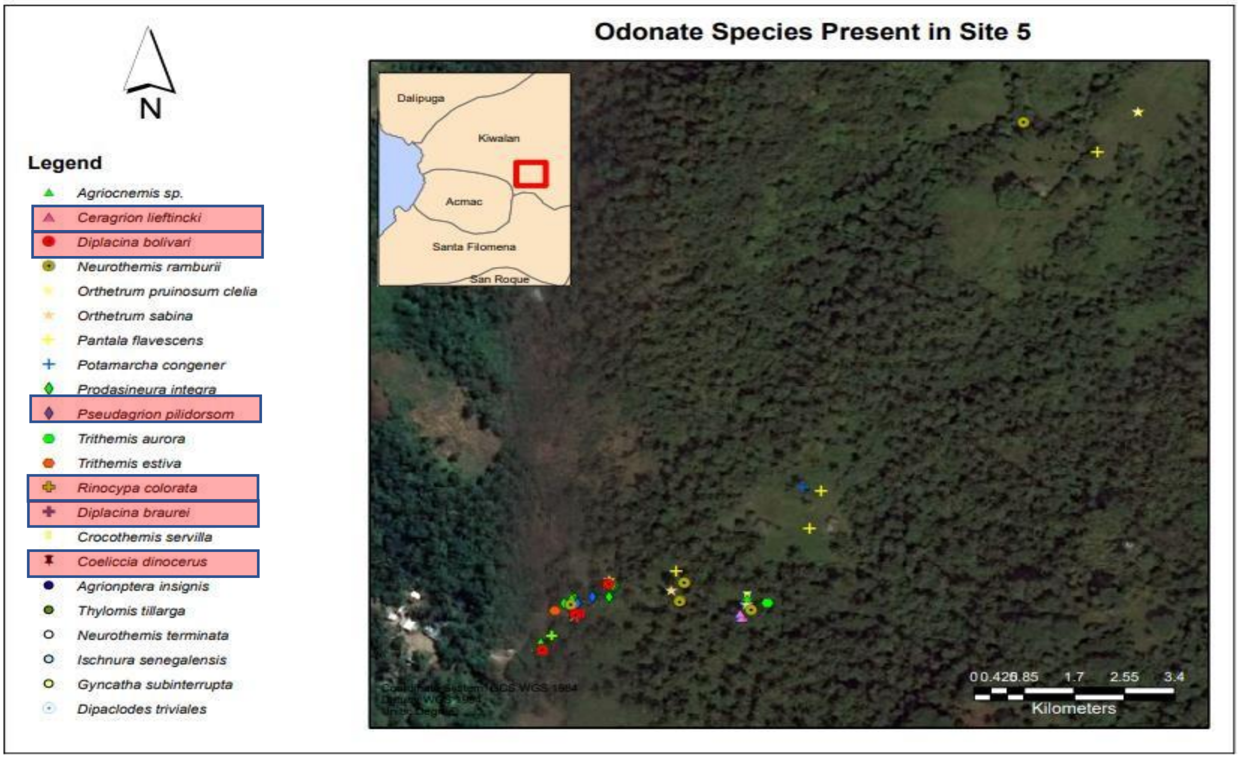


Figure 2.1-51. Distribution Map of Odonata Species in Site 4 (Matood environ)

Photographs of Floral Species (Vegetation)

At Site 1 A Quarry

At Site 1B Coconut Fields

At Site 2 Coal Stockpile

At Site 3

At Site 4

Photographs of Faunal Sampling Sites

At Site 1A Quarry Area

Near Site 2 Coal Stockpile Area

At Site 1B Coconut Fields **At Site 3 A remote Area**

Changes in the Terrrestrial Species

Degradation or improvement is necessarily reckoned from historical observation over a period of time.

The fieldwork from which the foregoing baseline/survey data were obtained was conducted over a two-month period of June to July, 2018 while the plant facilities and quarryinig operations have been on going since 1960's.

The other information/data that have been retrieved at this time are those contained in the EPRMP for the Mindanao Portland Cement Corporation (MPCC) during the Years 2002 and 2003, shown below:

Flora Environment (In the Years 2002 and 2003)

In general, there was low floral biodiversity in the area as the remaining, unquarried lands within the mining claims were utilized for crop production. **Table 2.1-26** presents a list of the most common plants that were observed in the area.

Table 2.1-26. Taxonomic Listing of Plants Observed in the Area

Family	Common Name	Scientific Name	Remarks
Euphorbiaceae	Kakauate	Gliricidia sepium	Common
Euphorbiaceae	Takip asin	Macaranga grandifolia	Common
Euphorbiaceae	Binunga	Macaranga tanarius	Common
Mimosaceae	Ipil-ipil	Leucaena leucocephala	Common
Compositae	Coronitas	Lantana camara	Common
Compositae	Hagonoy	Chromolaena odorata	Common
Sapotaceae	Caimito	Chrysophyllum caimito	Occasional
Palmae	Buri	Corypha elata	Occasional
Araceae	Gabi	Colocassia esculentum	Occasional
Polypodiaceae	Ferns	Platycerium sp.	Occasional
Verbenaceae	Gmelina	Gmelina arborea	Plantation
Meliaceae	Mahogany	Swietenia macrophylla	Rehabilitation species
Palmae	Coconut	Cocos nucifera	Cultivated
Musaceae	Banana	Musa sp.	Cultivated
Graminae	Corn	Zea mays	Cultivated
	Tomato	Lycopercicum sp.	Cultivated
Euphorbiaceae	Kamoteng kahoy	Manihot esculenta	Cultivated

Source: Iligan Cement Corporation EIA, 2002

There are no population data for the 2002 and 2003 population survey.

2.1.4.2 Threat to Existence and/or Loss of Important Local Species or Decrease/ Loss of Faunal Species

With respect to faunal ecology, four sites were identified for the conduct of wildlife studies within the approved MPSA areas. Each of the study sites and their adjacent vicinities were characterized based on the existing habitat condition. A standard 2-km transect route was selected for each of thestudy sites (except for Site IV) for avian inventory. The transect counts were done at least thrice aday, especially during early morning (6:00 a.m. to 9:30 a.m.) and late afternoon (3:30 p.m.). A sound recording of some bird calls was kept so as to provide additional information on the identity of these avian species.

Two mist-nets were set up to catch birds and Volant mammals (i.e., bats) for four days. They were kept open during the day to catch birds (net-day) as well as during the night (net-night) to capture nocturnal birds and bats.

No specific transect routes were utilized for the capture of reptiles and amphibians. Instead, survey for herpetofauna within and along adjacent areas was limited only to observations, collection and identification.Direct observation of footprints, fecal droppings, trails, nesting or roosting sites, animal remains (i.e., skeletal remains, skin, feathers), and shelter areas (i.e., holes or burrows) were noted during transect counts.

Twenty-six bird species belonging to 18 families were recorded in the four study sites. Of these, eight species are Philippine endemics, three of which are endemic only to the Mindanao faunal region, the Oriental Magpie-Robin, locally called as “siloy,” the Mindanao Bleeding-Heart and the Redkeeled Flowerpecker. The rest are resident and common species with a few uncommon ones. The avian fauna in the four study sites is dominated by Family Columbidae (doves and pigeons) which is commonly observed to be typical of most tropical lowland to agro-forest ecosystems in Asia.The endemic White-eared Brown Dove and the Reddish Cuckoo Dove are both arboreal frugivores and the remaining three columbids are terrestrial frugivores.

In the absence of population count on fauna which are principally birds and bats in 2002 and 2003 and the lack of sampling station of 2002 and 2003 it is not feasible to make a good assessment of changes in terrestrial founa

Table 2.1-27. Bird Species at Four Study Sites in Barangay Kiwalan, Iligan City, June 20-24, 2003

Species Name	Common/Local Name	Status
Family ACCIPITRIDAE		
Haliaeetus leucogaster	White-bellied Sea-Eagle	Res, UnC
Family COLUMBIDAE		
Phapitreron leucotis	White-eared Brown Dove	End, C
Macropygia phasianella	Reddish Cuckoo Dove	Res, C
Geopelia striata	Zebra Dove	Res, C
Chalcophaps indica	Common Emerald Dove “manatad”	Res, C
Gallicolumba criniger criniger	Mindanao Bleeding-heart “Limukon”	End ssp, Rare
Family CUCULIDAE		
Centropus viridis	Philippine Coucal “ku-kok”	End, C
Family APODIDAE		
Collocalia troglodytes	Pygmy Swiftlet “sayaw”	End, FC
Family ALCEDINIDAE		
Halcyon chloris	White-collared Kingfisher “Tikarol”	Res, C
Family ALAUDIDAE		
Mirafra javanica	Singing Bushlark “guryon”	Res, UnC
Family CAMPEPHAGIDAE		
Lalage nigra	Pied Triller	Res, C
Family PYCNONOTIDAE		

Species Name	Common/Local Name	Status
Pycnonotus goiavier	Yellow-vented Bulbul "pirok-pirok"	Res, C
Hypsipetes philippinus	Philippine Bulbul	End, C
Family ORIOLIDAE		
Oriolus chinensis	Black-naped Oriole "antulihaw"/ "antulihao"	Res, C
Family CORVIDAE		
Corvus enca	Slender-billed Crow "uwak"	Res, LC
Family TURDIDAE		
Copsychus saularis mindanensis	Oriental Magpie-Robin "siloy"	End ssp, Un C
Family SYLVIIDAE		
Megalurus timoriensis	Tawny Grassbird	Res, C
Orthotomus castaneiceps	Philippine Tailorbird "pirut" / "takuring"	End, C
Family MUSCICAPIDAE		
Cyornis Rufigastra	Mangrove Blue Flycatcher	Res, C
Rhipidura javanica	Pied Fantail "bakiskis"	Res, C
Family LANIIDAE		
Lanius schach	Lond-tailed Shrike	Res, C
Family STURNIDAE		
Aplonis panayensis	Philippine Glossy Starling	Res, C
Sarcops calvus	Coleto "sal-ing"	Near End, C
Family NECTARINIIDAE		
Nectarinia jugularis	Olive-backed Sunbird "tamsi"	Res, C
Family DICAEIDAE		
Dicaeum australe australe	Red-keeled Flowerpecker "panagoto"/ "tagtag"	End ssp, C
Family ESTRILDIDAE		
Lochura malacca	Chestnut Munia "maya"	Res, C

Information were also provided In the Ënvironmental Impact Statement Report" for the Cement Manufacturing and Quarry Expansion Project" dated **17 January 2003.**

However, both of the above-cited reports were based on surveys several years earlier than the recent.

"BIODIVERSITY SURVEY OF TERRESTRIAL FLORA AND FAUNA AND MARINE RESOURCES OF REPUBLIC CEMENT ILIGAN, INC. AND REPUBLIC CEMENT MINDANAO, INC. IN BARANGAY KIWALAN, ILIGAN CITY"

Moreover, the sampling stations are widely different in the previous and recent surveys.

In the absence of historical data and comparable baseline information, it is deemed that no reasonable assessment could be made on whether there have been degradation or changes on the terrestrial ecology.

However, impacts which are prospective in nature may be delineated.

Quarrying will further devastate the existing wildlife in the area. The continued generation of dust, habitat loss from vegetation clearing and noise from blasting and operation of quarrying equipment will disturb these species. The operation of the plant will cause migratory birds to skip the area as temporary resting and foraging place. In the long term, there will be further simplification of the fauna and flora in the area. The impact will be long term, but reversible.

Nevertheless, the area has long been subjected to the impacts of cement plant operation and the presence of the pocket vegetation cover serves as temporary resting areas for these wildlife species.

Abandonment of quarry areas without rehabilitation will further impact wildlife. However, as in any natural environment, habitat regeneration by colonization of pioneer plant species is expected to occur. The growth of vegetation in the abandoned quarry areas will provide temporary habitat for these wildlife species. This is however, expected to take a long time to occur.

The loss of vegetation as a result of land clearing may affect the number or population, frequency, and distribution of wildlife species as a result of further habitat fragmentation and source of food for survival of some species. Other than land clearing and removal of vegetative cover, the noise, dusts, and traffic will be generated from heavy equipment during construction and/or earthmoving activities will affect the behavior of wildlife species. The tendency is for faunal species to migrate to nearby areas where disturbance of habitat is less.

Hindrance to wildlife access during construction is minimal and only for a short-term period. Faunal species will tend to migrate to areas where disturbance is minimal in search for food and habitat.

It may be also noted that there are no major rivers within the area, which by their nature serve as habitats of faunal species.There are no wetlands at the project site which are otherwise critical to ecological processres or for endangered species.

2.1.4.2.1 Mitigating Measures for Terrestrial Ecology

General Notes:

Mitigating measures for loss of lora and fauna. In view of the increase of mining area, avoidance of tree cutting could not be completely undertaken. However, tree cutting permits will necessarily be secured from the DENR CENRO. A tree inventory will first be undertaken which will identify the number of trees and species/classification that would be involved.

The tree cutting permit will impose conditions and/or suggested protocol such as tree balling. Other mitigating measures will be spelled out in this prospective tree cutting permit.

Validation and updating of the report on the Biodiversity study Conduct Biodiversity Assessment and Monitoring System which will forus on the specific areas that could be impacted and pursuant to TB No. 2016 -04 will further provided basis for the Environment Management Plan RCMI/Benjie Cuevas?

The mitigating measures herein discussed are consistent with sound management practices for the protection and preservation of terrestrial ecology.

1. **Strict adherence to the development plan of the quarry site especially during land clearing**

To minimize land clearing and the loss of vegetation cover, a systematic plan for quarrying is being implemented. Land clearing will be confined on designated sites only based on the approved development plan. Likewise, gradual land clearing and removal of vegetation is encouraged to provide sufficient time for non-volant fauna species to transfer in the nearby habitat.

The overburden, which is set aside, will be utilized in the progressive rehabilitation and decommissioning such as utilizing them for the building of the berm. Note that at present, no overburden is produced at the limestone quarry since the area has long been stripped of its overburden. The remaining limestone materials in the quarry are blended to produce the desired grade and all fed to the cement plant.

Gradual land clearing and removal of vegetation is encouraged to provide sufficient time for wildlife species to transfer in the nearby habitat. Further, it is recommended that intact vegetation within the project area shall be protected (in patches) to serve as refuge and forage/ feeding area for wildlife species that can thrive in disturbed area. The planting of naturally growing tree species in the designated areas might encourage the wildlife species to return in the future.

2. Construction of culverts

Moreover, the construction of culverts provides water access from one point to another without distructing the road terrain. Some also of the wildlife species and ground vertebrates (which have only instinct knowledge) may go with water flow and use the culvert as access to migrate and cross through. An illustration of a typical culvert is provided in the image below:

Provided below are images of the culvert to illustrate the above point.

3. Avoiding Cutting of Trees, Progressive Rehabilitation and Replacement of Trees Cut Due to Land Clearing

The rehabilitation of the quarried mine involves reforestation, thus serving as a mitigating measure against threats to local species.

Prior to project implementation, the proponent will coordinate to the DENR to seek clearance for the identification of required documents for the issuance of needed tree cutting permit (PD 705). Moreover, to compensate loss of habitats, the proponent will replace the number of trees removed/cut and plant them to nearby areas or in accordance with the advice of the DENR. Species that will be used for the reforestation must be indigenous trees and/or fruit bearing trees endemic in the place that can attract the return of wildlife species.

The proponent should conduct tree inventory prior to application for tree cutting and/or tree relocation permit for those trees that will be affected by the construction.

As per DENR Memorandum Order no. 05 of 2012 mandated that "*Uniform replacement ratio for cut or relocated trees"* item 2.2 *"For planted trees in private land and forest lands... tree replacement shall be 1:50 while naturally growing trees on the same area, including those affected by the project shall be 1:100 ratio in support of the National Greening Program (NGP) and Climate Change Initiatives of the Government*".

As stated in the foregoing and herewith reiterated in respect of laws and policies:

Technical Bulletein 2016-04 of 02 December 2016 is duly noted. This refers to the conduct of Protected Area Suitability Assessment (PASA) and therefore apparently not relevant to the Project since it is not sited in an E-NIPAS protected area.

Avoidance of tree cutting or disturbance to the extent possible especially when endangered species may be affected. If tree cutting cannot be avoided, a tree cutting permit is secured first prior proceeding.

Threats to abundance, frequency, and distribution of floral species is minimal considering that earhballing of globally important species will be relocated to buffer zone and the replacement planting of tree species that will be affected or removed/cut during the course land development phases will be implemented.

4. Prohibit hunting of wildlife

Land clearing will be confined on designated sites. During construction, the contractor will ensure to prohibit his employees to engage in any mode of wildlife collection and/or hunting, rather, the contractor shall promote conservation and protection of remaining wildlife species. Promote wildlife protection using innovative means such as putting up of warning signage's on strategic areas for public information and warning.

The proponent should also ensure that its employees must be prohibited/ warned/ informed not to engage in any mode of wildlife collection and/or hunting for the conservation and protection of remaining wildlife species. Promote wildlife protection using innovative means such as putting up of warning or signages on strategic areas for public information and warning.

5. Establishment of natural perimeter fence as landmark using fruit-bearing trees

To consider in the planning the establishment of natural perimeter landmark within the project site using fruit bearing trees. This method could also help provide a natural abode to some wildlife as well as source of food. At present, trees and/or bamboos line the waste dumpsite and other buffer zones.

6. Baselining/Monitoring

In terms of project performance relative to migration of wildlife, there has been no monitoring on this in the SMRs, CMVRs and MMT Reports. Moreover the report "Biodiversity Survey of Terrestrial Flora and Fauna and Marine Resources of RCMI in Brgy. Kiwalan, Iligan City" which was undertaken by the team of Olga M. Nuñeza, Ph.D. (Animal Physiology, Zoology, Wildlife studies) Karyl Marie F. Dagoc, MSc. (Biology, Biodiversity and Conservation, GIS and Remote-sensing) Muhmin Michael Manting, MSc. (Biology, Botany) Jose Angelo A. Responte, Ph.D. (Biology, Marine Biology) could not have included specific sites for baselining/monitoring inasmuch as the areas to be quarried were not yet fully delineated during the conduct of this survey.

More updated baselining and monitoring will be undertaken prior to implementation of the activities pertinent to land clearing and preparation especially in the specific quarry areas to be worked on..

Progressive NGP Accomplishments of RCMI

Reforestation activities conducted in the past showed positive results. The formerly logged-over mountainous area is now revegetated with a variety of trees. These grown trees in some areas of the plant premises are sources of fresh air and helps enhance the aesthetics of the surroundings.

Mature trees have grown more or less 15-30 years old. These have a diameter of more or less 1 foot. The height could reach as high as 50 feet or more.

Figures 2.1-52 to 56 show the reforestation accomplishments.

A. Adopt-a-Mining Forest Program

This is being implemented in consonance with the progressive rehabilitation in order to bring back the former forest vegetation. Pursuant to the National Executive Committee Resolution No. 99-01, otherwise known as the "Adopt a Mining Forest Program", the Company submits an Annual Reforestation Work Program to MGB.

The Program not only determines suitable tree species to be planted in specific areas, propagating various endemic forests seedlings, fruit trees, bamboos and ornamental plants for reforestation, enrichment planting, replanting and landscaping activities. Also includes mai ntenance activities such as brushing, weeding, applying fertilizer, replanting, and conducting protection of planted areas.

To date, 12,530 trees have been grown by RCMI covering 23.77 hectares under its Mining Forest Program (**Table 2.1-28**). Of these, mahogany is the most common planted specie with 7,479 grown trees plus 869 other forest trees. In addition, there are 917 giant bamboo, 417 bamboo, 110 cacao, 110 coffee, 1,006 madre de cacao, 226 fruit trees, and others. The survival rate is 91.96% as shown in **Table 2.1-29**.

In addition, the Proponent also partners with its host communities in the reforestation efforts wherein seedlings were donated by RCMI to LGUs, organizations and individuals. 2017 to 2020 records show a total of 14,160 seedlings donated.

Additional baselining information are hereunder provided.

CUT TREES AS OF 2020 (within MPSA 031-95-XII only)
Shale quarry lot 3551: Total land area = 2.03 hectares
Planted Trees =117 (Already cut) -- Replacement =5,850 seedlings (1:50)
Native trees = 130 (waiting for FMB approval)

Shale quarry lot 3597: Total land area = 0.987 hectares
Planted Trees =152 (Already cut) -- Replacement =7,600 seedlings (1:50)
Native trees = 105 (waiting for FMB approval)

As indicated in the foregoing, prospective information will be based on the tree inventory and the cutting permit that will be provided in the application for future tree cutting.

Table 2.1-28. Reforestation Accomplishments of RCMI

Reforestation Area	No. of Grown Trees	Area Planted (ha)	Year Planted
1	901	0.81	1985
2	1,184	0.47	2000
3	1,186	1.07	1987
4	551	2.7	1981
5	563	0.9	1985
6	149	0.63	1989
7	447	1.61	2002
8	83	0.53	1988
9	285	0.46	1995
10	1,090	1.74	2017
RCMI Buffer Zone	342	1.34	2018
Limestone Quarry & B+240	667	2.71	2019

Reforestation Area	No. of Grown Trees	Area Planted (ha)	Year Planted
Near Corehouse	613	1.015	2020
11	170	0.34	1987
12	199	0.4	2000
13	1186	1.07	1987
14	363	0.33	2015 & 2016
15	54	0.06	2017
Refo - 2017 Q1	1,080	1.29	2017
Refo – 2018	887	3.23	2018
Refo – 2019	100	0.25	2019
RCII Buffer Zone	430	0.81	2020
TOTAL	**12,530**	**23.77**	

Table 2.1-29. Survival Rate of Seedlings Planted

	until 2018	2019	2020	TOTAL
Seedlings Planted	11765	767	1093	13625
Seedlings Replanted	534	0	50	584
Surviving Plants	10,876	767	887	12,530
% Survival Rate	92.44	100.00	81.15	91.96

The additional area to be cleared for Expansion Project is 81.432 ha, while the additional trees to be cut = 8,150 to 12, 215. In estimating the number of trees to be cut in the proposed expansion, the average number of trees that may be affected in land clearing operation is estimated at 100 to 150 trees/hectare (both naturally-grown trees and planted trees with a diameter-at-breast height (dbh) at 5cm and above). This is based on the tree inventory conducted by DENR-CENRO for application of tree cutting permit for areas adjoining or adjacent to the proposed quarry expansion area.

B. National Greening Program (NGP)

In 2013, RCMI partnered with the DENR-MGB-10 for a National Greening Project (NGP) covering 100 Hectares Agro-Forestry Development Project at Brgy. Pualas, Baungon, Bukidnon together with the Pualas, Higaonon Tribal Small Landowners Association. The group commited to plant 73,150 of forest trees (rubber, mahogany, falcata) and assorted fruit-bearing trees. Today, the number of surviving trees (272,032) exceeds the group's commitments. RCMI continues with its financial support to the group to sustain the project and future expansion will commence in year 2021.

Table 2.1-30. NGP Accomplishments in Brgy. Pualas, Baungon, Bukidnon

	until 2018	2019	2020	TOTAL
Seedlings Planted	296,235	1,896	1,816	299,947
Seedlings Replanted	52,727	20,744	12,362	85,833
Surviving Plants	268,420	1,896	1,716	272,032
% Survival Rate	90.61	100.00	94.49	90.69

Note: Plantation area is outside RCMI's project area.

C. Mangrove Rehabilitation Project

In addition to its reforestation initiatives, RCMI, together with its partner groups and organizations, likewise launched a Mangrove Rehabilitation Project in 2017 with the aim of growing 100,000 propagules. By the end of 2019, the group has planted more than 200,000 mangrove propagules (newly planted and replanted) since its launching.

Portion of Falcata (Left) and Rubber (right) plantation of RCMI NGP Area

Portion of Coffee, Cacao and Buko Plantation of NGP Area at Pualas, Baungon, Bukidnon

Seedling Nursery of the NGP Area in Pualas, Baungon, Bukinon

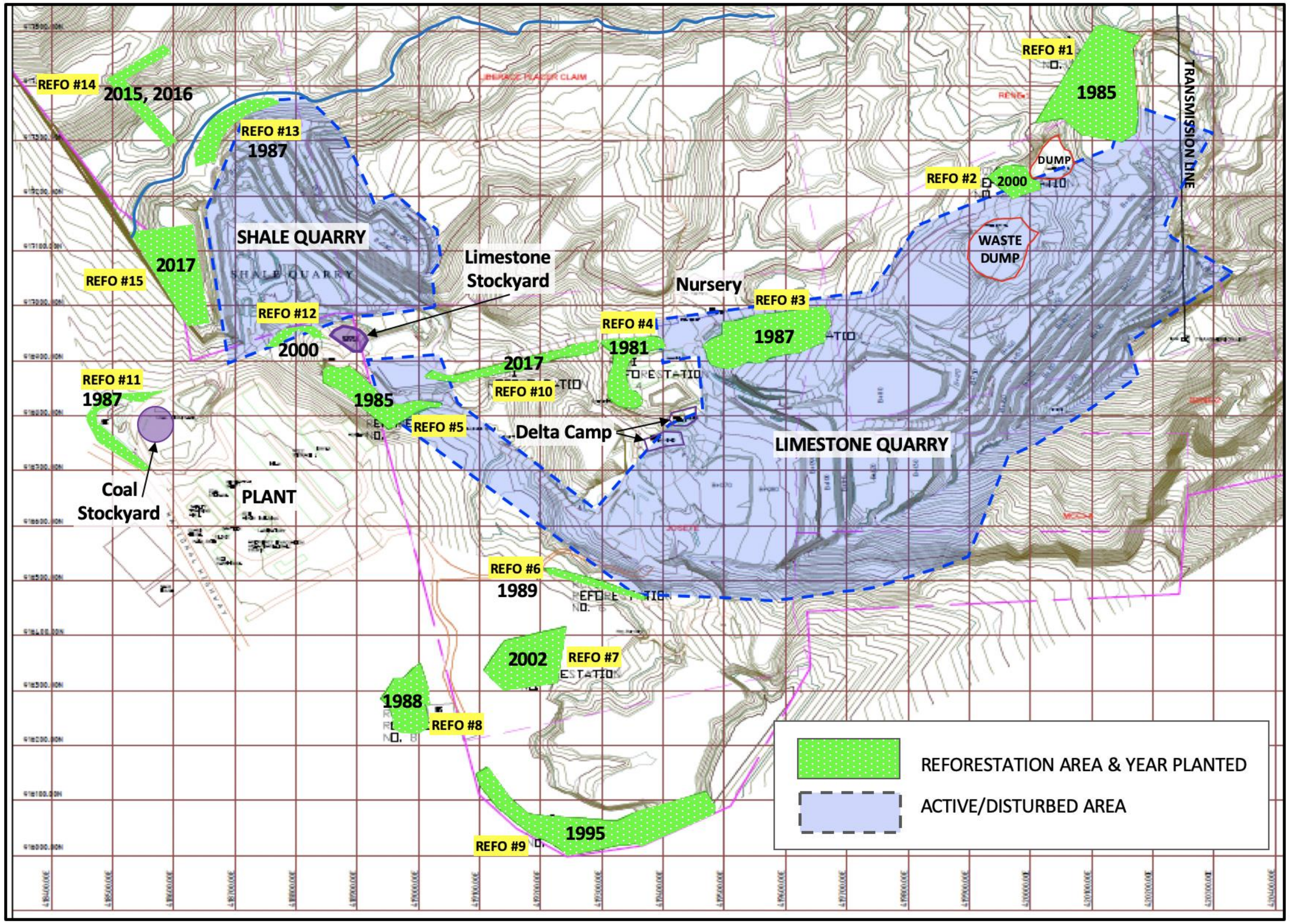


Figure 2.1-52. Reforestation Areas of RCMI vis-à-vis Disturbed Areas

Figure 2.1-53. Aerial photo showing the Reforestation Areas within MPSA 104-98-XII Amended

Figure 2.1-54. Aerial photo showing the Reforestation Areas within MPSA 031-95-XII

Planned Final Mine Rehabilitation

This is shown by the series of maps below.

Figure 2.1-55. Projected Rehabilitation/Reforestation 5 Years After End of Limestone Quarrying Operations

Figure 2.1-56. Projected Rehabilitation/Reforestation 5 Years After End of Shale Quarrying Operations

2.2 WATER

2.2.1 Hydrology/Hydrogeology

2.2.1.1 Change in Drainage morphology/ Inducement of flooding/ Reduction in stream volumetric Flow

2.2.1.1.1 Change in Drainage Morphology

The drainage systems of relevance are (a) the internal drainage within the project site and (b) the external drainage outside of the plant.

The in-plant drainage is shown in **Figure 2.2-1** wherein maybe noted the existing and the enhanced or proposed additional drainage system. It is to be noted that wherein "RCMI" and "RCII" are referred to separately the maps and information are for the merged RCMI.

The external drainage system which is outside the plant will not be changed. The ultimate drainage basin is the Iligan Bay to which all the plant water drains and also the storm waters will discharge to. **Figure 2.2-2** is the hydrogeologic map of the project area, i.e. the project site and the vicinities.

On the matter of percentage use from each source of water supply, i.e. surface, groundwater, utility, etc. these are deemed not related to the drainage system because:

The main factor in drainage design is storm water flow.

In terms of "performance" of the project with respect to these aspects, these are reflected in the SMRs and CMRs (**Annex 2.3.4**) and in **Section 3 "Environmental Compliance Monitoring"**

2.2.1.2 Change in stream, lake water depth

There are no water bodies (streams) or lakes within or adjacent to the project area. There is a small canal discharging to the Bay near the pier area. Accordingly, there will be no change in stream flows or of water depths.

With respect to the important surface water body i.e. the Iligan Bay there will not be any change in the depth of the Bay because:

There will not be any additional major structures to be constructed in the Bay that will alter its bathymetry. There will not be any reclamation activities that would involve dredging of the Bay.

RCMI will utilize its existing beach pad under the Foreshore Lease Agreement (FLA) No. 103504-20 with Revocable Permit No. 2020-0002.

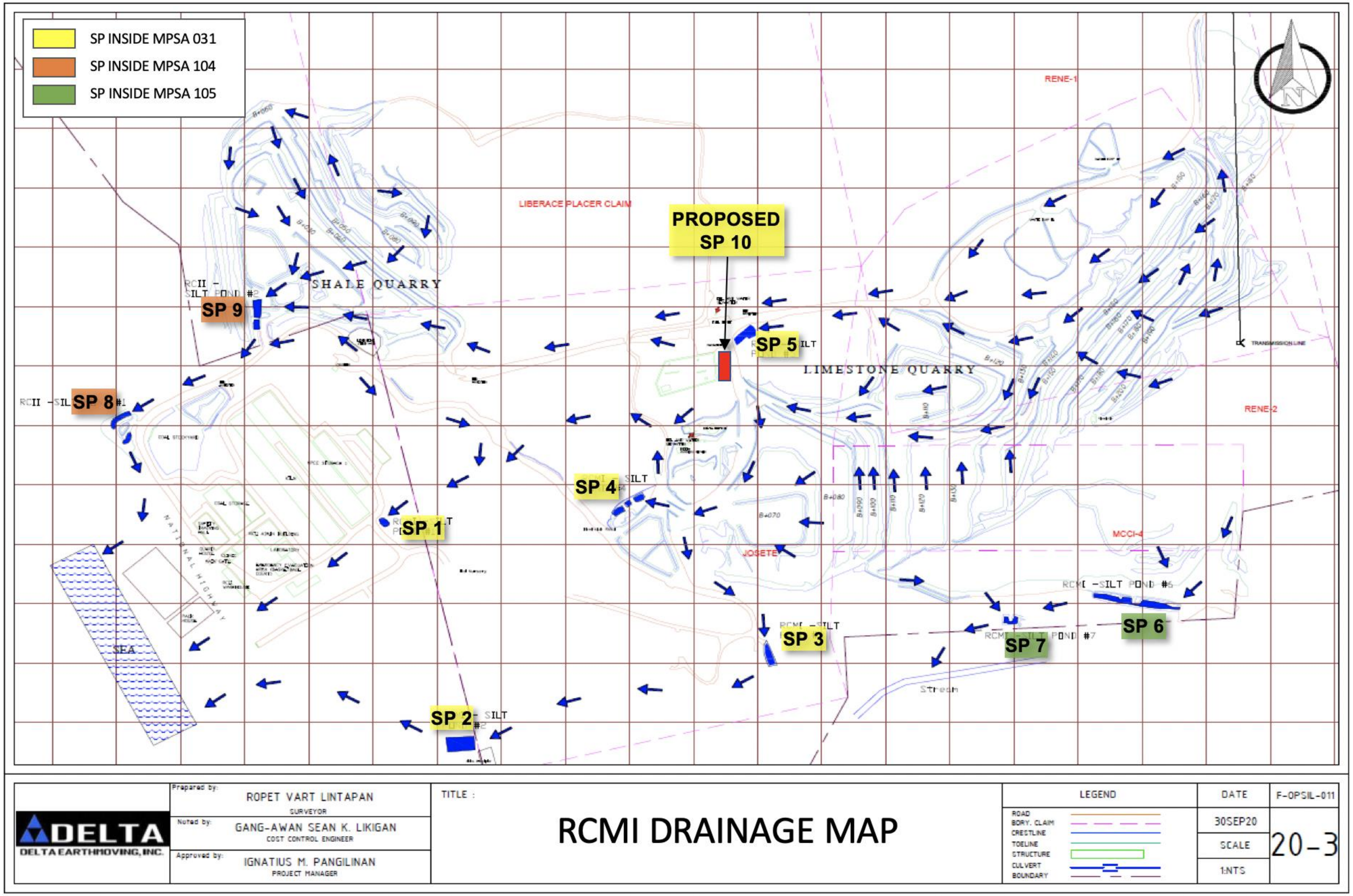
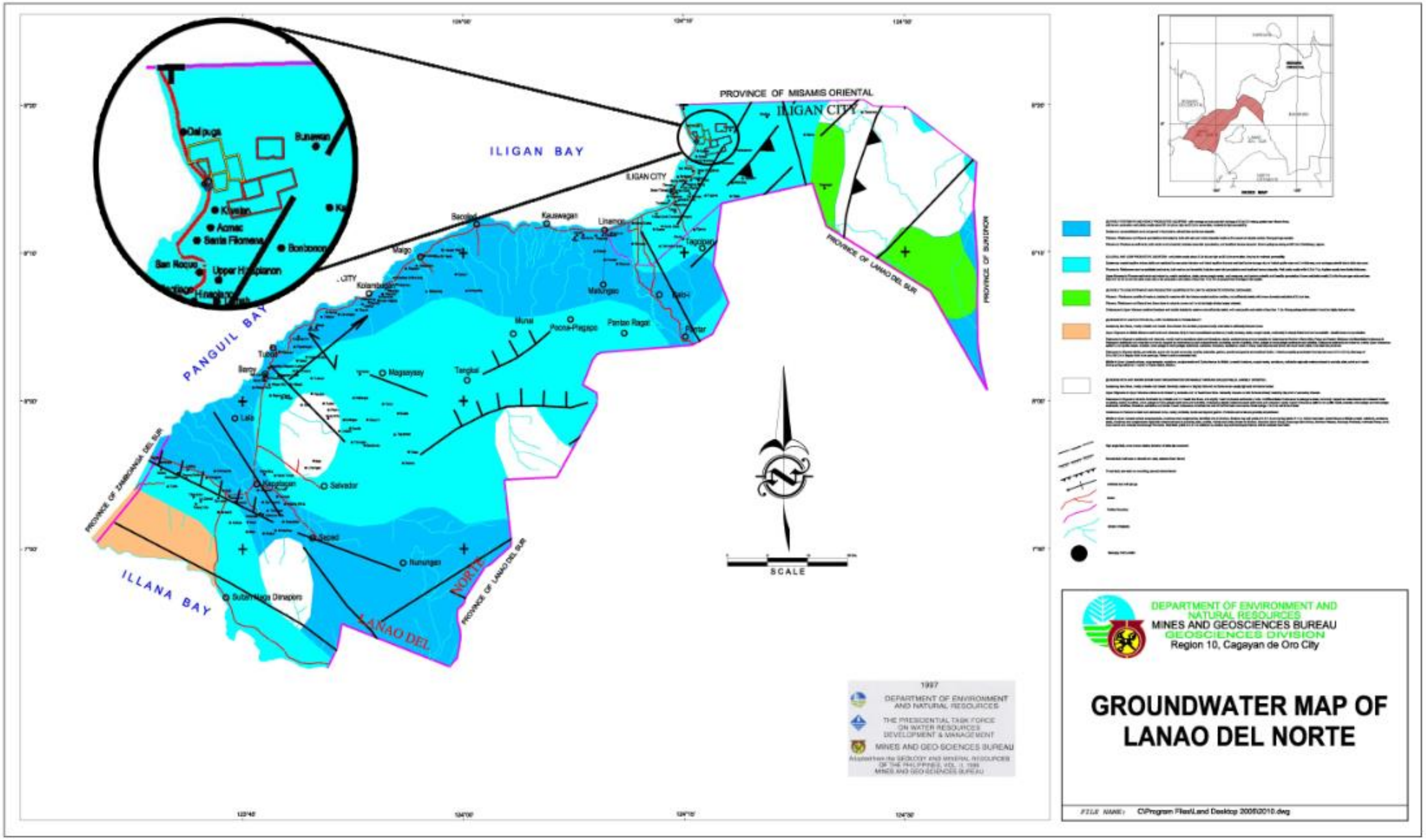


Figure 2.2-1. Map Showing the Existing and Proposed Project Drainage System and Morphology and the Location of the Existing Drainage Systems (Iligan Bay)



Source: Mines and Geoscience Bureau, Geoscience Division, Region 10

Figure 2.2-2. Hydrogeologic Map of Lanao del Norte

Aquifer Characterization

The water-bearing and transmitting characteristics of the rocks and the groundwater condition in the study area were assessed using data from the literature review, geologic mapping and well and spring inventory. A grain-size analysis of 3 rock samples from the shale quarry was also done for hydraulic conductivity determination.

Well and Spring Inventory

A total of 10 wells and 14 springs were inspected to help in assessing the characteristics of the aquifers in the area. The inspection included an examination of the physical characteristics of the water and onsite measurements of electrical conductivity (EC) and pH. Since the amount of total dissolved solids (TDS) in natural water is generally 0.55 to 0.75 of the EC value, the measured EC values were subsequently multiplied by 0.65 to get the approximate TDS values of the water (Hem, 1985 and Carlson, 2005). **Figure 2.2-3** displays the well and spring locations, while **Table 2.2-1** summarizes the collected information.

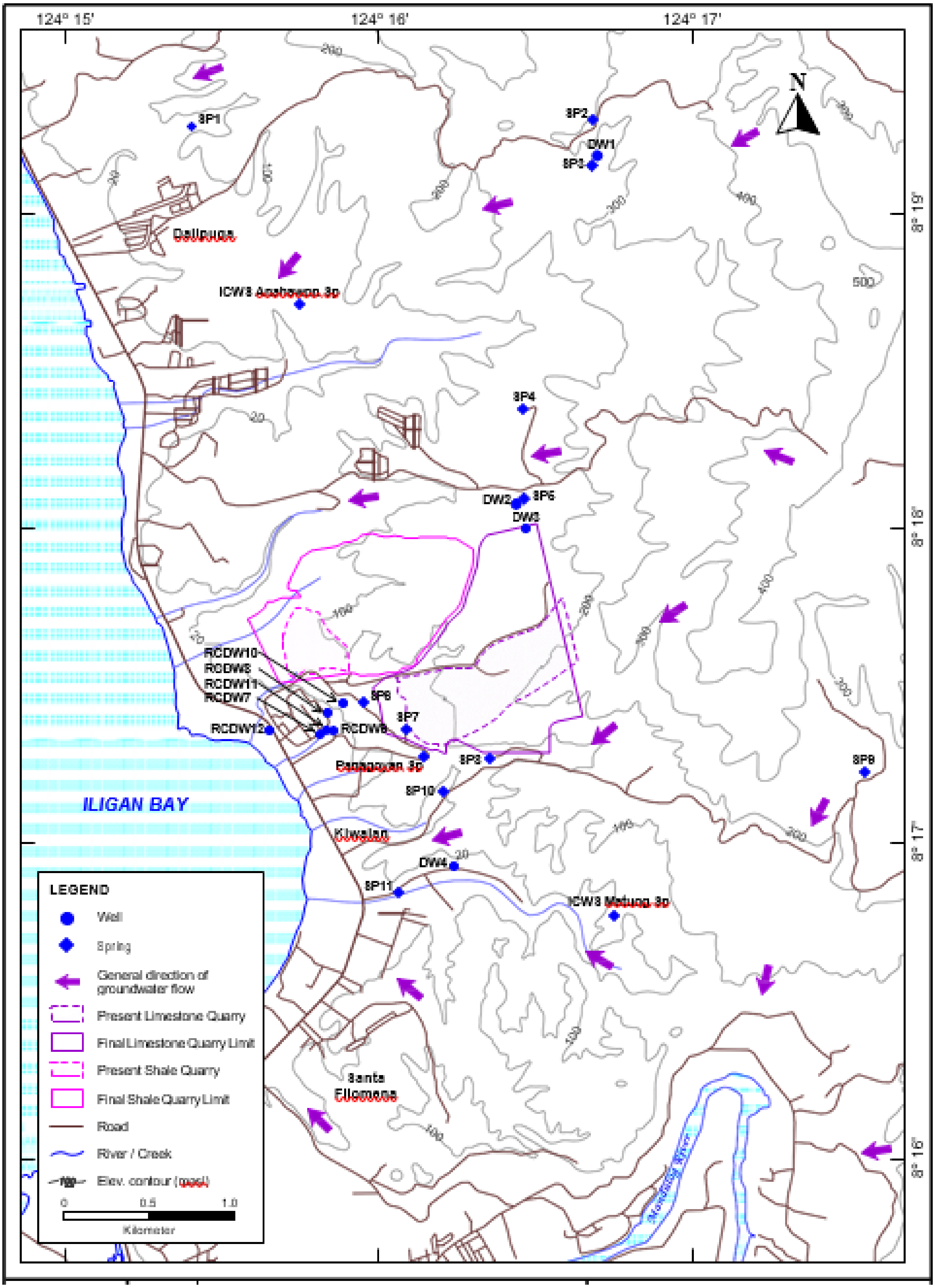


Figure 2.2-3. Well and Spring Location Map

Table 2.2-1. Summary of Wells and Springs Data

Well / Spring ID	Location	Owner	Depth (m)	Casing (mm)	SWL (mbgs)	TDS (mg/L)	pH	Remarks / Status
DW-1	Dalipuga	public	100	102	---	343	7.3	Uses submersible pump, clear and odorless, for all types of domestic use
DW-2	Dalipuga	public	---	152	---	369	6.9	Uses submersible pump, clear and odorless, for all types of domestic use
DW-3	Dalipuga	public	99	71	free-flowing	350	7.4	Former exploration drillhole IL- 1612, clear and odorless, for all types of domestic use
DW-4	Kiwalan	Teresita Actub	18.3	32	< 12.0	424	6.9	Uses jetmatic pump, clear and odorless, for domestic use except drinking
RCDW7	Kiwalan	RCMI	---	---	---	374	7.1	Uses submersible pump, clear and odorless, industrial use
RCDW8	Kiwalan	RCMI	---	203	---	---	---	Uses submersible pump, clear and odorless, industrial use **CURRENT SOURCE OF RCMI**
RCDW9	Kiwalan	RCMI	---	---	---	351	7.4	Uses submersible pump, clear and odorless, industrial use
RCDW10	Kiwalan	RCMI	---	203	free-flowing	374	7.2	Centrifugal pump not working, clear and odorless, for domestic use of plant workers **CURRENT SOURCE OF RCMI**
RCDW11	Kiwalan	RCMI	100	254	---	---	---	Uses submersible pump, clear and odorless, industrial use
RCDW12	Kiwalan	RCMI	---	---	---	806*	7.3	Uses submersible pump, clear and odorless, industrial use
SP-1	Dalipuga	public	---	---	---	388	7.3	Depression spring, diminishes during summer, clear and odorless, for all types of domestic use
SP-2	Dalipuga	public	---	---	---	317	7.2	Depression spring, diminishes during summer, clear and odorless, for all types of domestic use
SP-3	Dalipuga	public	---	---	---	316	7.3	Depression spring, diminishes during summer, clear and odorless, for all types of domestic use
SP-4	Dalipuga	public	---	---	---	302	7.1	Depression spring, diminishes during summer, clear and odorless, for all types of domestic use
SP-5	Dalipuga	public	---	---	---	352	6.9	Depression spring, diminishes during summer, clear and odorless, for all types of domestic use
SP-6	Kiwalan	public	---	---	---	364	7.2	Depression spring, diminishes during summer, clear and odorless, for all types of domestic use
SP-7	Kiwalan	public	---	---	---	321	7.8	Depression spring, diminishes during summer, clear and odorless, used by RCMI quarry workers
SP-8	Kiwalan	public	---	---	---	304	7.2	Depression spring, diminishes during summer, clear and odorless, for all types of domestic use

Well / Spring ID	Location	Owner	Depth (m)	Casing (mm)	SWL (mbgs)	TDS (mg/L)	pH	Remarks / Status
SP-9	Kiwalan	Emilia Macacua	---	---	---	274	7.3	Depression spring, diminishes during summer, clear and odorless, for all types of domestic use
SP-10	Kiwalan	public	---	---	---	312	7.2	Depression spring, diminishes during summer, clear and odorless, for all types of domestic use
SP-11	Kiwalan	public	---	---	---	356	7	Depression spring, diminishes during summer, slightly cloudy and odorless, for domestic use except drinking and cooking
Panagoyan Spring	Kiwalan	public	---	---	---	390	7.5	Appears to be fracture spring with confined aquifer source, does not weaken in summer. Formerly maintained by ICWS, clear and odorless, for all types of domestic use
Anahawon Spring	Dalipuga	ICWS	---	---	---	---	---	Appears to be fracture spring with confined aquifer source, does not weaken in summer. Main domestic water source of Dalupiga proper, Q ~ 2.0 Lps
Matu-ug Spring	Kiwalan	ICWS	---	---	---	---	---	Appears to be fracture spring with confined aquifer source, does not weaken in summer. Main domestic water source of Kiwalan proper, Q ~ 2.5 Lps

TDS exceeds 500 mg/L which is the national standard limit for drinking water

The well and spring inventory indicates that residents in barangays Kiwalan and Dalipuga rely mainly on springs for their domestic water requirements. Springs are favored over wells because there is no need for pumping. Most were observed to be depression springs whose water comes from the intersection of the water table with an abrupt break in the slope of the land. Depression springs often diminish in yield or even dry out during the dry season.
The larger Anahawon, Matuog and Panagoyan springs however appear to be springs that obtain water from confined aquifer conditions since their outputs remain steady even during the dry season.

The discharge from the springs is generally clear and odorless. Some however become turbid during heavy rains. Their TDS values range from 274 to 390 mg/L which indicate moderate amounts of dissolved solids. The values are however below the 500 mg/L, national standard limit for drinking water. The pH of the spring water range from 6.9 to 7.8 which are within the standard drinking water range of 6.5 to 8.5.

Two of the 4 domestic wells in the inventory, namely DW-1 and DW-2, have been found to be equipped with submersible pumps and tanks, and are connected to a water distribution system. These are deep wells located in hilly areas where spring water sources are limited. DW-3 is exploration drillhole IL-1612. This drillhole began to free-flow upon intersecting a confined aquifer at depth and was subsequently used as a source of domestic water. DW-4 is a shallow cased well is fitted with a manual pump.

Several other shallow cased wells with manual pumps were observed near the highway at the coastal plain. These wells which are mostly 9 to 12 meters deep, have not been included in the inventory as they mainly standby wells used when interruption of the ICWS water supply occurs.

RCMI as well as other industrial plants in the area also rely on wells for their industrial water requirements. These industrial wells are designed using large diameter casings and are often coupled to submersible pumps. Only the wells of RCMI were visited during the inventory. Other than seeing that RCDW10 is a free-flowing well, not much groundwater information has been gleaned from these wells.

The wells yield clear and odorless water. Except for RCDW12, their TDS values range from 317 to 424 mg/L which is below the standard TDS limit for drinking water. RCDW12 on the other hand yielded a TDS value of 806 mg/L. The elevated TDS is probably due to minor seawater contamination since this well is just 132 meters from the shoreline. The pH values of the wells range from 6.9 to 7.4, which are within the standard pH range for drinking water.

Aquifer Characteristics of the Indahag Limestone

Although there is no available hydraulic conductivity data on the limestone, the inventory of water sources reveals that springs and wells with significant discharge are situated in these rocks. Geologic mapping moreover reveals that the limestone is moderately to highly fractured. In many instances, it is also oxidized due to percolation of oxygen-rich water. RCMI personnel also mentioned that the limestone in their quarry has a relatively high water content of 20%. All these suggest that the limestone is a generally porous and permeable. It stores and transmits water and is essentially an aquifer.

Depression springs signify the existence of unconfined aquifers while fracture springs that do not weaken seasonally point to the occurrence of confined aquifers. The free-flowing wells likewise manifest confined aquifer conditions.

Aquifer Characteristics of the Iponan Formation

Wells and springs are likewise found in areas underlain by rocks of the Iponan Formation. The slightly compacted sandstone and siltstone layers of this formation are inherently permeable and constitute the aquifers in this rock unit.

In the RCMI quarry, grain size analysis of fine-grained sandstone and siltstone samples yielded a collective hydraulic conductivity (K) of 2 m/d following Hazen's Method (Brassington, 1988). This K value is at the upper range for values typical of laminated sandstone, siltstone and mudstone, and indicates that the sandy and silty rocks in the RCMI shale quarry are permeable. This is corroborated by the observed water seepage along the quarry slopes during the fieldwork.

Groundwater Level and Flow Direction

The scant groundwater level data does not allow delineation of water level contours in RCMI quarries and surrounding area. What is certain is that the presence of shallow wells in the coastal plain indicates that the unconfined aquifers in this area have static water levels that are most likely less than 9 meters below ground surface (mbgs). The static water level undoubtedly becomes deeper at higher elevations.

Groundwater moves from high to low elevation head and will therefore follow the topographic gradient. This means that from the high mountainous and hilly areas, the groundwater will move west towards the coastal plain following the general flow direction of the drainage systems in the area. The groundwater will ultimately discharge at Iligan Bay.

IMPACT OF QUARRYING TO NEARBY WATER SOURCES

The inner slopes of the RCMI quarries act as a free surface where groundwater exits from the surrounding areas and flow down towards the quarry floors as seepage that is ultimately drained out. The rapid removal of groundwater in this manner will eventually lower the groundwater levels in the immediate vicinity of the quarries.

The well and spring inventory reveals that there are important community water sources near the RCMI quarries. These are DW-2, DW-3, SP-5, SP-6, SP-8, SP-10 and Panagoyan Spring. The proposed expansion of the quarries may diminish or dry up the yield of these water sources as the local groundwater level drops and portions of the aquifers they draw water from are mined out.

RCMI may have to find alternative water sources for affected residents to avert possible resentment to the quarry operations.

The industrial wells of RCMI may also diminish in yield as they likewise face the same changes in groundwater conditions.

2.2.1.3 Depletion of Water Resources/ Competition in water use

The quarrying operation is dry and does not use water except for routine sprinkling of dusts in roads or in stockpiles for the purpose of preventing fugitive dust emissions. The process technology for the cement/clinker production is “dry” using minimal make-up water, majority of which, is being recycled back into the production line. Landscaping will also require use of water.

FOR THE EXISTING SET-UP, the water requirements for the entire project is 703.3 m^3/day.

FOR THE PROPOSED EXPANSION: This shall be increased to 3,100 m^3/day for the proposed increase in quarry and plant production rates. This is taken from the 2 existing deep wells with rated discharge of 385 gpm or 87.6 m^3/hr.

No additional deep wells are to be constructed.

Accordingly, there will not be any additional impact on water resources nor competition with the communities on water use arising from the proposed expansion project.

RCMI’s water extraction is within the allocation limits set in the Conditional Water Permits issued by NWRB and will continue to be as such for the proposed expansion. This is measured by installing meter in the pipelines.

Domestic water for routine housekeeping and for domestic/workers’ use for cooking, toilets and baths will be supplied from local concessioner while drinking water will be from purchased bottled water, which is the case of drinking purposes.

Water Balance

This is shown in Project Description **Figure 1-26** for which the following notes are herewith made:

For 2019, the intake water (IW) is 223,014 m^3. The total process water (PW) is the combination of IW plus the recycled water (RcyW) of 400m3, or a total of 223,014 m^3. Of these, 13,010 m^3 is discharged, and thus, the consumed water is 210,004 m^3.

The source of IW is from the existing groundwater / deep well system that is covered by permits from the NWRB. There are no envisioned expansion of the deep well/underground water systems and thus, it is deemed that the expansion project will not result in water competition. The approval/permits of the NWRB always factor in and consider water competition.

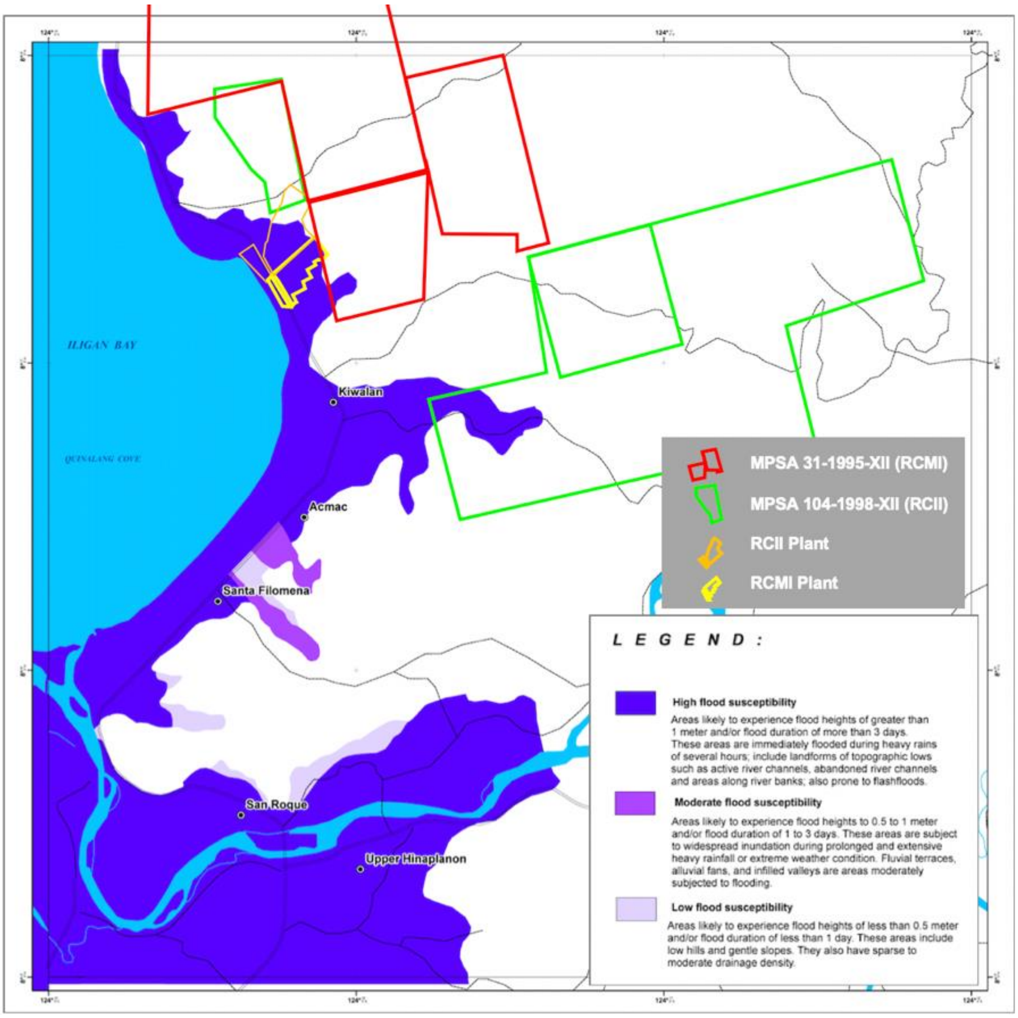
2.2.2 Oceanography
2.2.2.1 Change/disruption in water circulation pattern, littoral Current, and coastal erosion and deposition

The proposed expansion of the project will not affect the existing Oceanography of Iligan Bay for the following reasons:

The natural elements of oceanography are tides, wind directions and speed and bathymetry of the sea which, however, are not altered by the expansion project.

Structures at sea may also impact on oceanography; however, there are no envisioned changes, rehabilitation of construction of new pier. The pier has been constructed under ECC No 08-26-3037-50200.

Figure 2.2-4. Map Showing Iligan Bay Relative to the Project Site



***Source**: MGB-10, 2012*

Figure 2.2-5. Flooding Susceptibility Map of Iligan City

2.2.2.2 Change in Bathymetry

Depth/Bathymetry.

Depth of seabed across the pier area was determined using a HONDEX handheld Depth Sounder Ps-7 A423 067. Depth soundings will be plotted in Google-referenced maps. A total of 53 location points were measured around the pier area. The coordinates of the bathymetry points are listed in **Table 2.2-2** and presented in **Figure 2.2-8.**

Table 2.2-2. Location of bathymetry/depth measurements in the vicinity of RCMI Pier

WP Code	LATITUDE	LONGITUDE	DATE & TIME	DEPTH
BTH01	08.286979°	124.261060°	12/14/2017 0916H	8.70
BTH02	08.286673°	124.261621°	12/14/2017 0917H	6.80
BTH03	08.286457°	124.261804°	12/14/2017 0918H	4.20
BTH04	08.286637°	124.261947°	12/14/2017 0919H	2.30
BTH05	08.286828°	124.261798°	12/14/2017 0919H	3.30
BTH06	08.287082°	124.261575°	12/14/2017 0920H	3.70
BTH07	08.287418°	124.261261°	12/14/2017 0921H	2.30
BTH08	08.287559°	124.260902°	12/14/2017 0922H	1.70
BTH09	08.287445°	124.260897°	12/14/2017 0923H	2.90
BTH10	08.287169°	124.261257°	12/14/2017 0924H	5.40
BTH11	08.286857°	124.261581°	12/14/2017 0925H	5.80
BTH12	08.286663°	124.261786°	12/14/2017 0926H	3.60
BTH13	08.286518°	124.261901°	12/14/2017 0927H	3.50
BTH14	08.287085°	124.260932°	12/14/2017 0929H	9.60
BTH15	08.287288°	124.259971°	12/14/2017 0930H	11.30
BTH16	08.287138°	124.260422°	12/14/2017 0931H	15.60
BTH17	08.286920°	124.260841°	12/14/2017 0932H	12.40
BTH18	08.286650°	124.261192°	12/14/2017 0932H	13.40
BTH19	08.286288°	124.261508°	12/14/2017 0933H	13.10
BTH20	08.285791°	124.261905°	12/14/2017 0934H	12.20
BTH21	08.285653°	124.262156°	12/14/2017 0934H	12.50
BTH22	08.285221°	124.262402°	12/14/2017 0935H	16.40
BTH23	08.284865°	124.262683°	12/14/2017 0935H	16.00
BTH24	08.284663°	124.261786°	12/14/2017 0937H	28.50
BTH25	08.285193°	124.261574°	12/14/2017 0938H	26.10
BTH26	08.285456°	124.261313°	12/14/2017 0939H	24.10
BTH27	08.285835°	124.261033°	12/14/2017 0939H	25.30
BTH28	08.286230°	124.260674°	12/14/2017 0939H	23.30
BTH29	08.286461°	124.260409°	12/14/2017 0940H	20.60
BTH30	08.286778°	124.260078°	12/14/2017 0940H	13.70
BTH31	08.287060°	124.259665°	12/14/2017 0941H	17.40
BTH32	08.286795°	124.258770°	12/14/2017 0943H	19.30
BTH33	08.286423°	124.258471°	12/14/2017 0944H	30.30
BTH34	08.285928°	124.259037°	12/14/2017 0944H	39.70

WP Code	LATITUDE	LONGITUDE	DATE & TIME	DEPTH
BTH35	08.285549°	124.259327°	12/14/2017 0945H	47.30
BTH36	08.285196°	124.259627°	12/14/2017 0945H	55.30
BTH37	08.284840°	124.259947°	12/14/2017 0946H	56.90
BTH38	08.284500°	124.260263°	12/14/2017 0946H	54.80
BTH39	08.284658°	124.263202°	12/14/2017 0948H	2.30
BTH40	08.285095°	124.263085°	12/14/2017 0949H	2.30
BTH41	08.285477°	124.262831°	12/14/2017 0951H	2.50
BTH42	08.285905°	124.262657°	12/14/2017 0952H	1.70
BTH43	08.286237°	124.262328°	12/14/2017 0953H	2.50
BTH44	08.286269°	124.262194°	12/14/2017 0954H	5.20
BTH45	08.286431°	124.262112°	12/14/2017 0955H	4.10
BTH46	08.286428°	124.262025°	12/14/2017 0956H	4.80
BTH47	08.286329°	124.261936°	12/14/2017 0956H	4.80
BTH48	08.286221°	124.262000°	12/14/2017 0957H	5.20
BTH49	08.286298°	124.262048°	12/14/2017 0957H	5.30
BTH50	08.286055°	124.262157°	12/14/2017 0959H	7.20
BTH51	08.285656°	124.262377°	12/14/2017 1001H	9.50
BTH52	08.285280°	124.262625°	12/14/2017 1002H	13.10
BTH53	08.284883°	124.262833°	12/14/2017 1003H	14.80

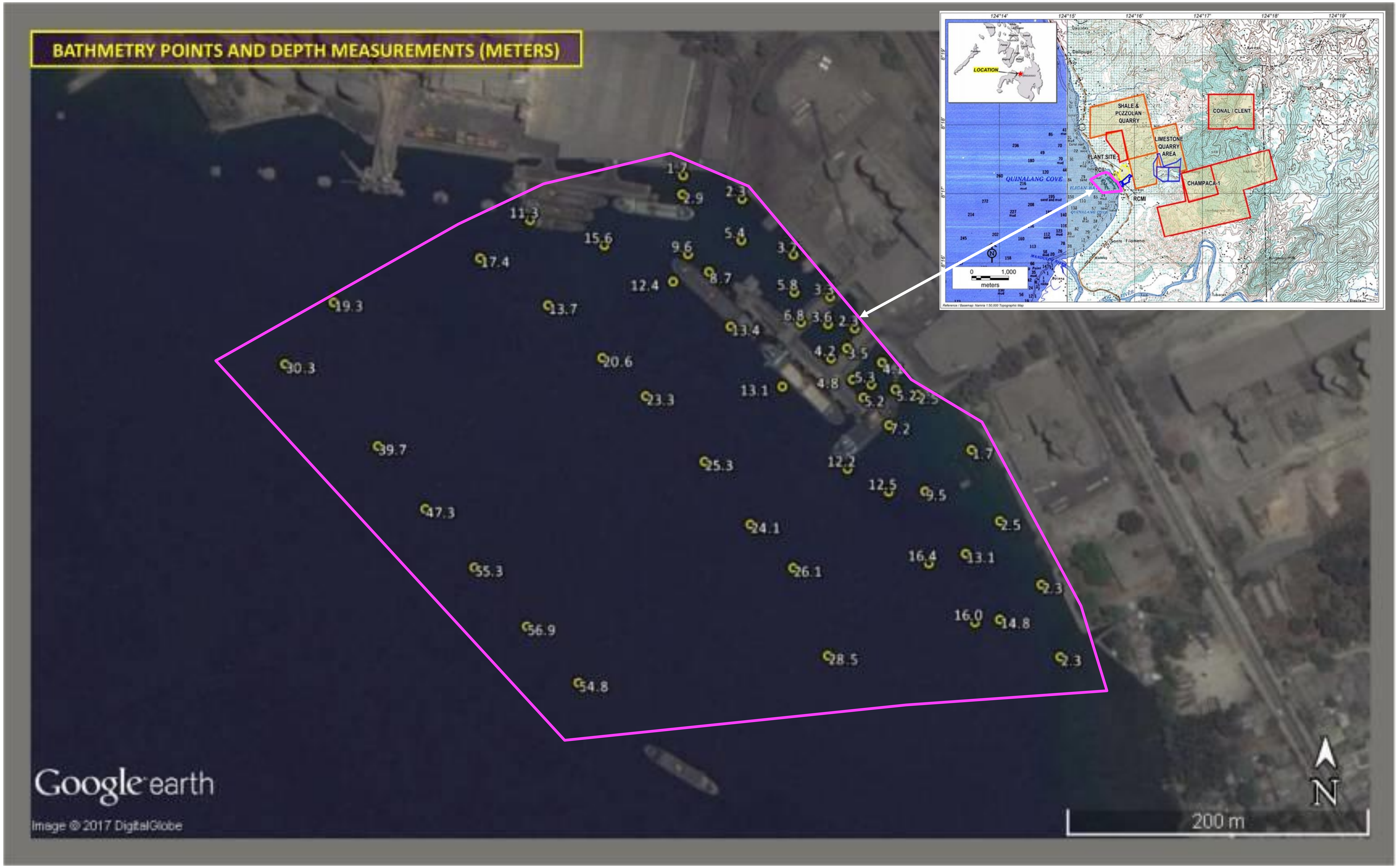


Figure 2.2-6. Bathymetry Stations Measured for Depth

2.2.3 Water Quality

2.2.3.1 Degradation of ground water Quality

An in-depth assessment of the groundwater quantity and quality in the coastal plain particularly focusing on evaluation of saline intrusion and compliance with the PNSDW.

Groundwater sampling in 2002 were collected 5 locations in the project vicinity as below, and the results are presented in **Table 2.2-3**.

Sta B - water reservoir in Kalibuhan, serving the "habitat" community
Sta C - spring reservoir in Brgy. Kiwalan, outside project site
Sta E - water reservoir in Kalibuhan, serving RCMI
Sta 2 - spring reservoir in Brgy. Kiwalan
Sta 6 - well water in Brgy. Acmac

Table 2.2-3. Groundwater Quality Test Results (2002)

Station	pH	Temp (deg C)	Ca (mg/L)	Mg (mg/L)	Color (PCU)	Hardness, $CaCO_3$ (mg/L)	Total Coliform (MPN/100 ml)
Sta B	6.5	22	109.035	11.428	<5	319.321	<2
Sta C	6.5	21.8	97.353	11.428	<5	290.151	20
Sta E	7.1	no data	78.4	25.81	<5	302.05	90,000
Sta 2	7.35	no data	85.5	29.1	5	320	300
Sta 6	no data	no data	86.1	70.6	5	466	<2
DOH Standards	6.5 - 8.5	none	75	50	5	300	0

Based on the findings, there is an exceedance in the calcium content and total hardness level. This explains the viscous sensation obtained from using water for washing in the RCMI premises. Station E yielded higher coliform exceedance probably due to more users flocking the reservoir. This is evidently unfit for potable consumption. For Station C, which is located outside the project premises, the calcium and bacteriological content are above the permissible levels, thus, non-potable. However, the community still used it for drinking.

There was no groundwater quality monitoring conducted for the project in the past years. The SMRs, CMVRs and the MMT have not required such monitoring. However, in compliance with the requirements for the expansion, water quality sampling/tests were conducted on October 08, 2019. results of which are seen in **Table 2.2-5.**

Note that the parameters in the 2019 tests are not the same as those in the 2002 tests, and therefore, not cannot be compared.

Table 2.2-4. Location of Water Quality Sampling and Monitoring Stations (Post 2002)

Sampling Station	Description	Latitude	Longitude
Effluent Water			
EW1	Drainage Canal	8.28685°	124.26382°
EW2	Canteen	8.28779°	124.26373°
EW3	Drainage Canal - OWS2	8.28894°	124.26284°
EW4	Drainage Canal - OWS3	8.28767°	124.26301°
EW5	Silt Pond No. 1	8.28790°	124.26518°
EW6	Drainage Canal	8.28673°	124.26380°
EW7	Silt Pond No. 2	8.28423°	124.26696°
Groundwater			
GW1	Water Softener	8.288889°	124.2654°
GW2	Panaghuyan Spring	8.286667°	124.2703°
GW3	Deep Well No. 9	8.29°	124.2653°
Marine Water			
MW1	Pier, 100 m away from jetty	8.285097°	124.261878°
MW2	Pier, 100 m away from jetty	8.285720°	124.261027°

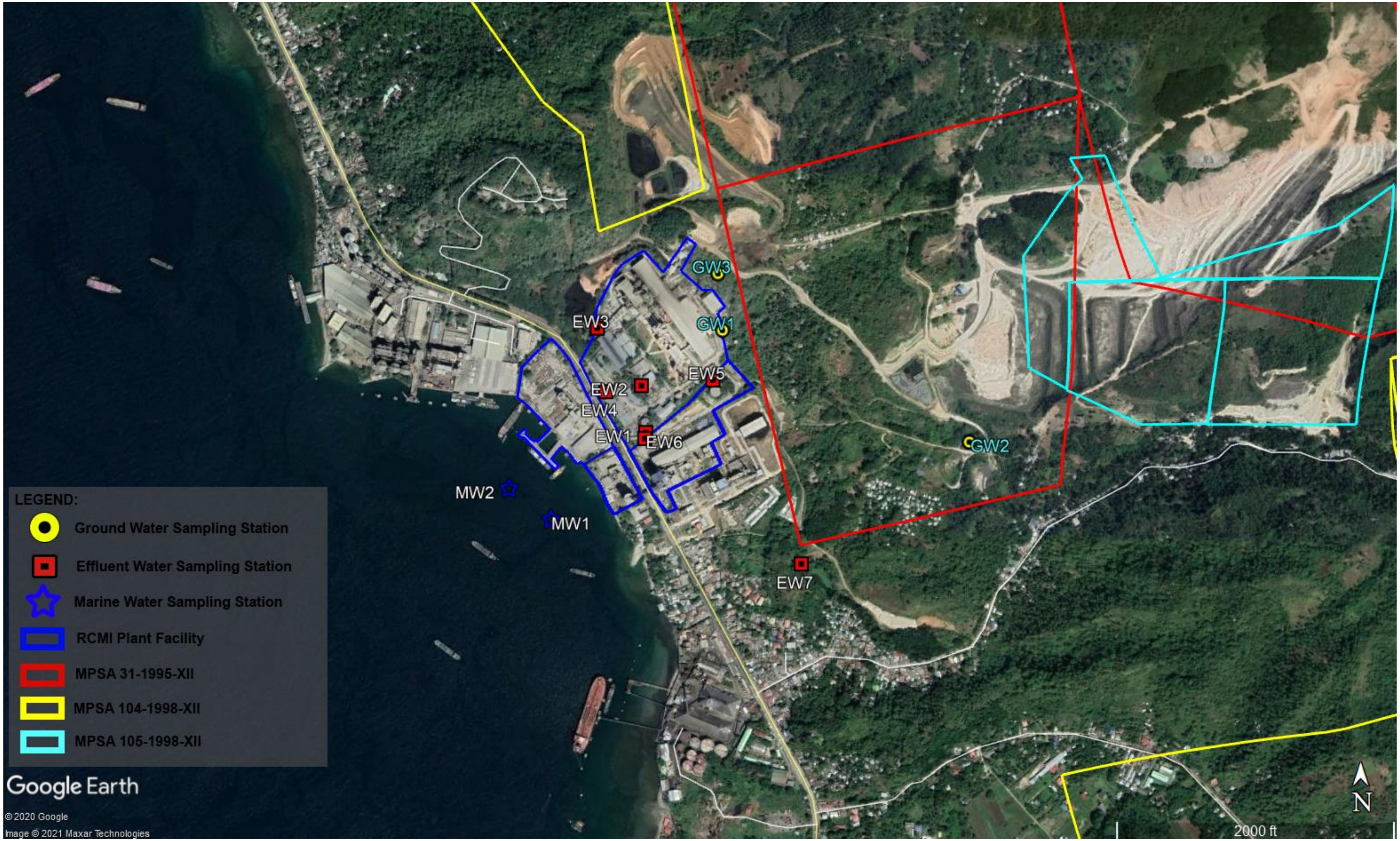


Figure 2.2-7. Water Quality Sampling and Monitoring Station Map

Table 2.2-5. Groundwater Quality Test Results (Oct. 10, 2019)

Sta #	Station Description	Hexavalent Chromium mg/L	Ammonia mg/L	Phosphate mg/L	Nitrate mg/L	Arsenic mg/L	Cadmium mg/L	Mercury mg/L	Lead mg/L
	DENR Standards Class A	**0.02**	**0.5**	**1**	**14**	**0.02**	**0.006**	**0.002**	**0.02**
GW1	Water Softener Well	<0.01	<0.03	0.02	0.32	<0.001	<0.003	<0.0001	<0.01
GW2	Panaghoyan Spring	<0.01	<0.03	0.02	0.50	<0.001	<0.003	<0.0001	<0.01
GW3	Deepwell 9	<0.01	<0.03	0.02	0.85	<0.001	<0.003	<0.0001	<0.01

Source: Ostrea Mineral Laboratories, Inc. Test Results, CR No. 086/2018

Graph 2.2-1 below illustrates these results.

Based on the results for metallic content, there is no deemed significant effect of the project to the groundwater quality in the area near the RCMI plant. It is supported by the graphical representation of each parameter that the water quality of the tested areas are lower than the DENR standard for metalic contamination.

The existing deep wells are properly covered by permits from the National Water Resource Board (NWRB) with Water Permit No. 024256, pursuant to provision of Presidential Decree Nos. 424 and 1067 promulgated on March 28, 19784 and December 31, 1976 respectively, and their Implementing Rules and Regulation.

Mitigating Measures

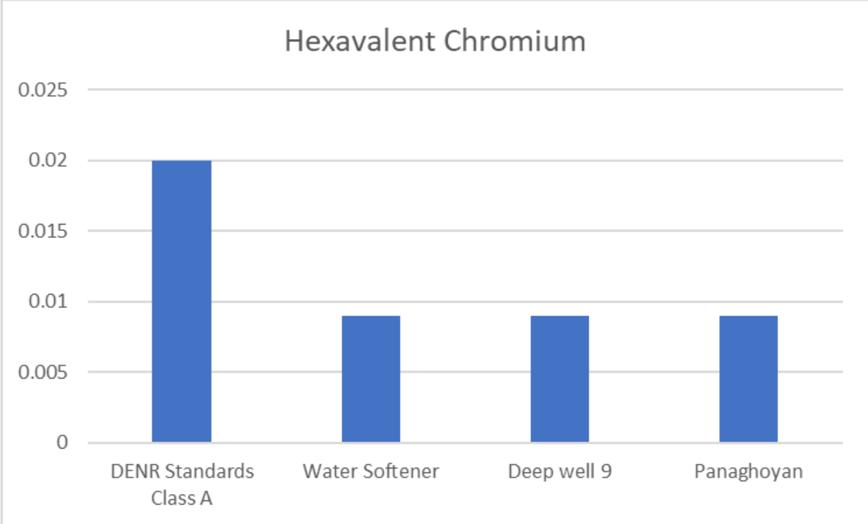
Mitigation measures are the following:

- Based on geohydrological study, clastics and limestone can be quarried provided that a minimum of 10m of cover on top of the aquifer is maintained to serve as protection.

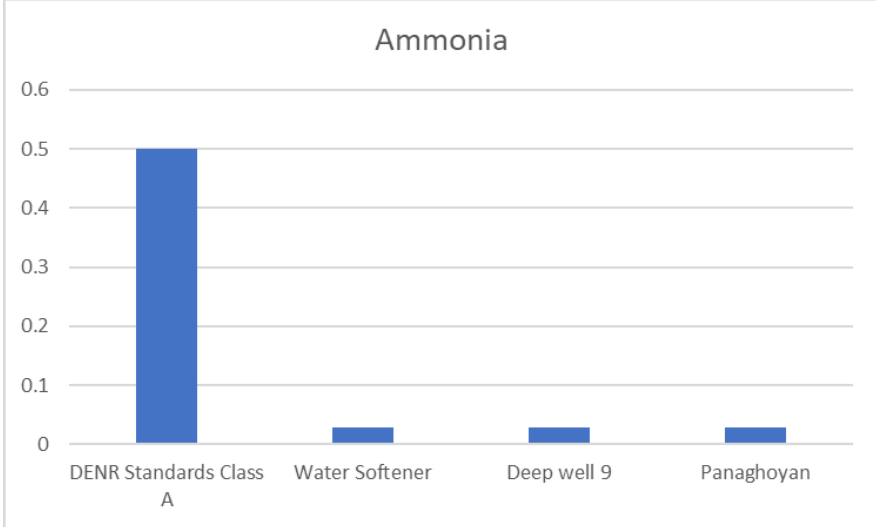
- Avoiding the penetration of aquifers below the limestone deposits. Quarrying conducted above the natural spring's w/ buffer of at least 50m. The final pit bottom will be at +60 masl for limestone and at +30 masl for shale, which are both above the level of known aquifers/springs.

- Deep-ripping of compacted soil surfaces will be observed.

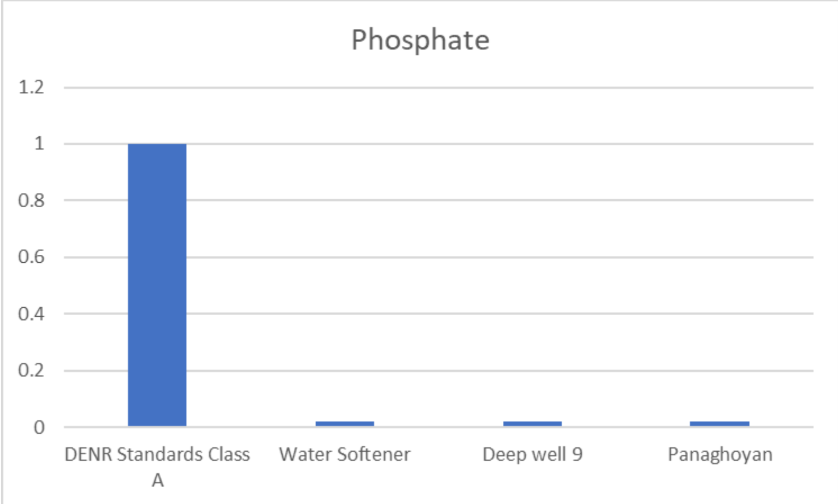
- Controlled blasting employed at all times.



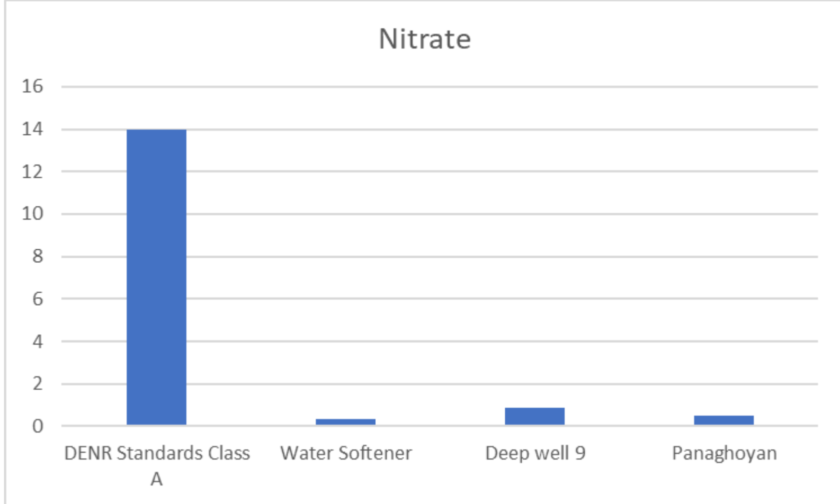
Hexavalent Chromium



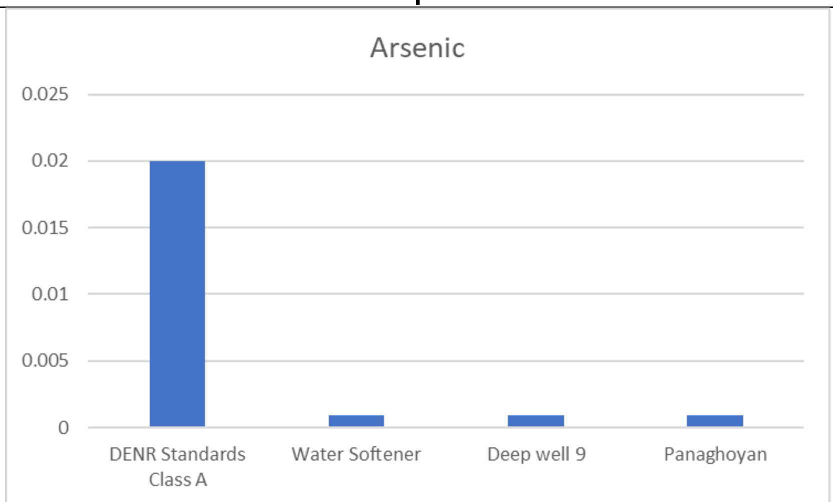
Ammonia



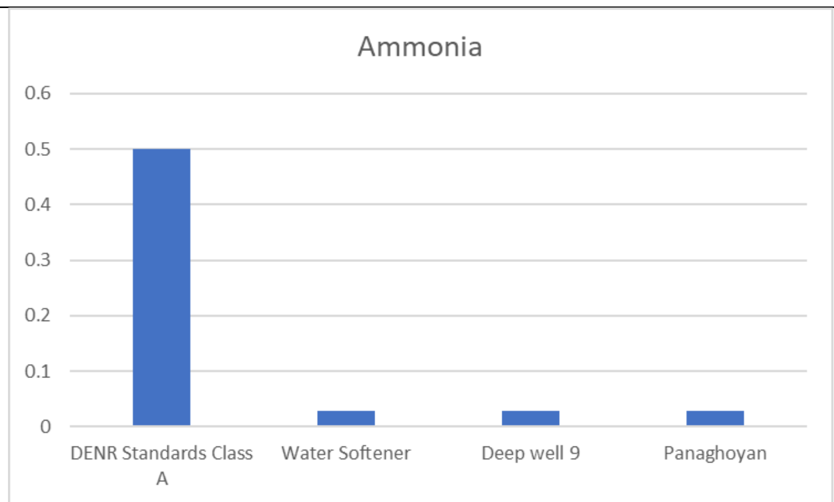
Phosphate



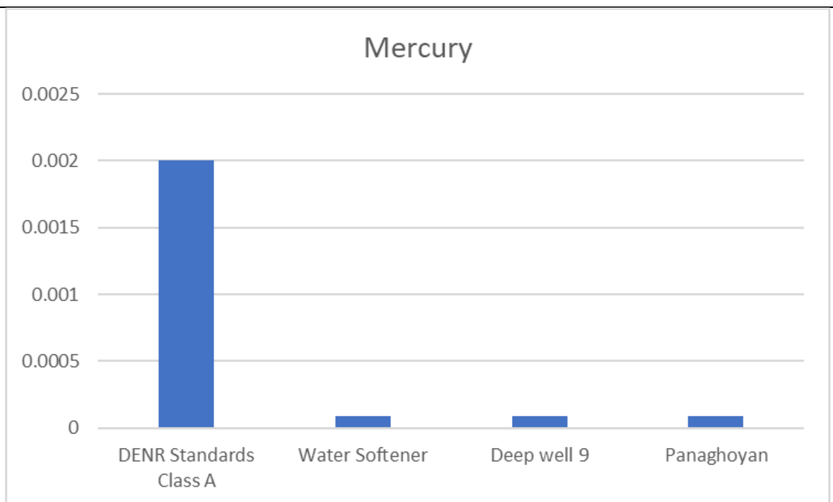
Nitrate



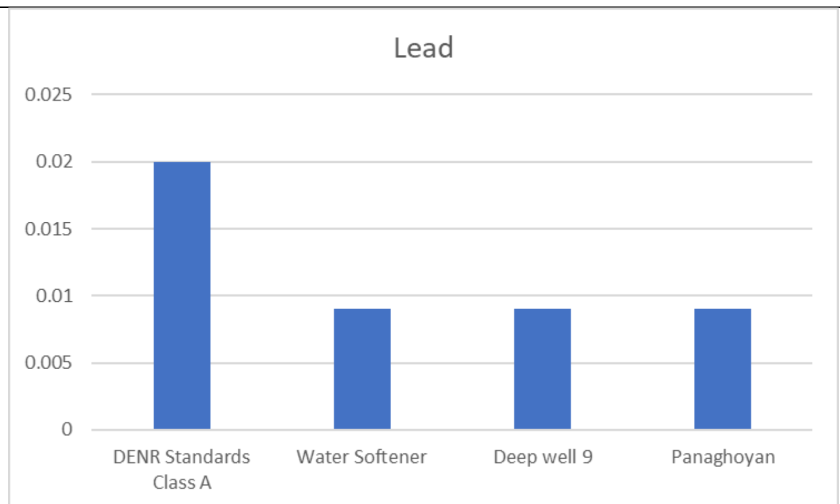
Arsenic



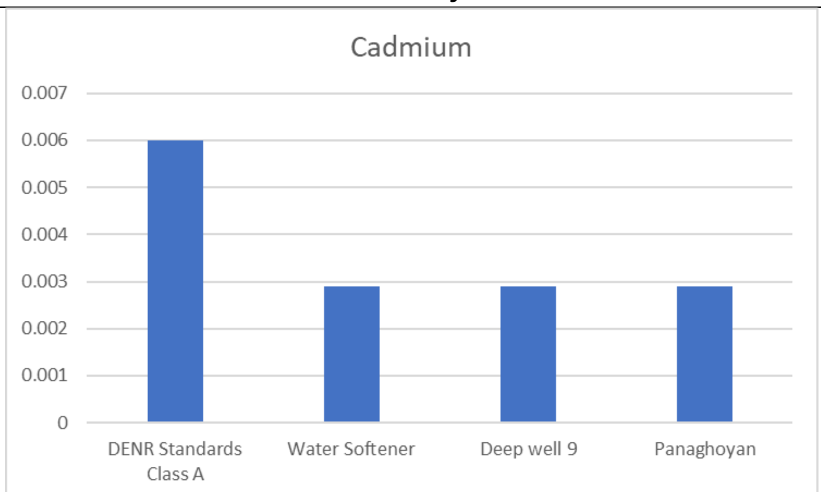
Ammonia



Mercury



Lead



Cadmium

Graphical Representation of Grounwater Quality Test Results (2019)

Graph 2.2-1. Graphical Representation of Grounwater Quality Test Results (2019)

2.2.3.2 Degradation of Surface Water Quality

Water sampling from the nearest portion of Tag-ibo Creek (300m from project site and does not receive direct effluents from project) was taken in 2001. Results show fairly high oxygen levels and permissible rates for physico-chemical parameters. The high levels of oxygen and low BOD rates are characteristic of an estuarine inhabited by various aquatic species. The high coliform content, however, is attributed to the bacteriological quality of runoff from the uplands where more domestic activities are undertaken. The results are shown below.

Table 2.2-6. Water Quality of Tag-ibo Creek (2001)

Parameter	DENR Standards Class B	Tag-ibo Ck Sample
pH	6.5 - 8.5	7.8
DO (mg/L)	5	9
BOD5 (mg/L)	5	4
Phosphate (mg/L)	0.2	<0.01
TSS (mg/L)	< 30% increase	4
TDS (mg/L)	none	245
Turbidity (NTU)	none	1.1
Total Coliform (MPN/100 ml)	1000	2400

Two canals were sampled in 2001 within the premises of RCMI. These are:

EW1 - canal that receives effluents from production activities
EW2/DENR Sta 12 - canal that receives effluents from canteen/admin offices

Both drainage channels merge with the public sewers before conveyance to Iligan Bay, which is more than 500m away. Oftentimes especially during dry season and low production, the amounts of effluents is too ineffectual for the flow to even reach 250 meters. The results show that the quality of effluents produced from both production and domestic activities are within the permissible limits, except for BOD_5 in EW1. See table below.

Table 2.2-7. Water Quality Test Results for Effluents (July 9 - 11, 2001)

Station	pH	Color (PCU)	Temp (deg C)	DO (mg/L)	BOD5 (mg/L)	TSS (mg/L)	TDS (mg/L)	Total Coliform (MPN/ 100 ml)	O&G (mg/L)
EW1	7.8	<5	29	8	16	1	997	160,000	<1
EW2/ DENR Sta 12	8	15	26	5.1	4.8	35	399	no data	no data
DENR Standards	6.0 - 9.0	no abnormal discoloration	< 3 increase	5	7 (10)	150	-	-	10

RCMI conducts regular monitoring of the water quality of Paniangan - Talocao Creek 1, its drainage canals, as well as the settling ponds.

The various tables below provides the baseline water quality for the key surface water body, i.e. the Iligan Bay for each sampling station.

Moreover, additional parameters for heavy metals and nutrients from 1 drainage canal and 1 settling pond were tested in 2019. This is shown in **Table 2.2-13**.

Based on the test results, there is no deemed significant effect of the project to the surface water quality in the area near the RCMI plant. The graphical representation of each parameter shows that the water quality of the tested areas are well within the DENR standard for metalic contamination.

No lake nor river will be affected by the project activities. The nearest surface water body is Iligan Bay, which is discussed already. **Figure 2.2-8** below shows that the distance of the edge of the project site to the nearest river is approximately 2.25 km. The nearest point of Tag-ibo Creek at Dalipuga side is about 300m to the northwest.

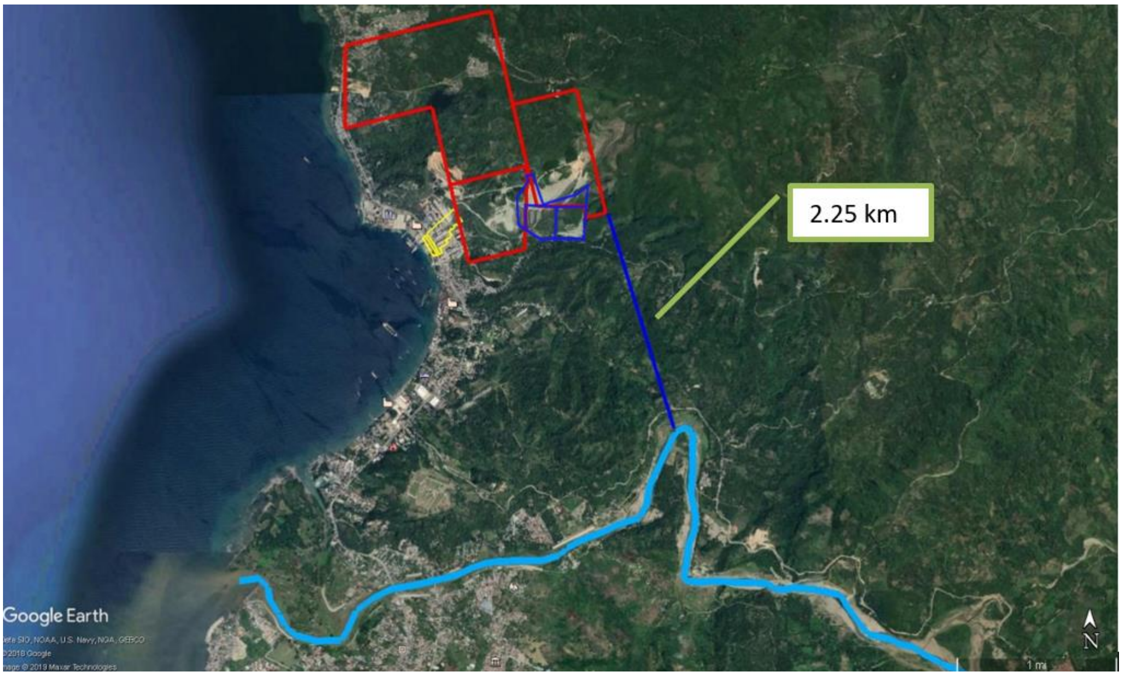
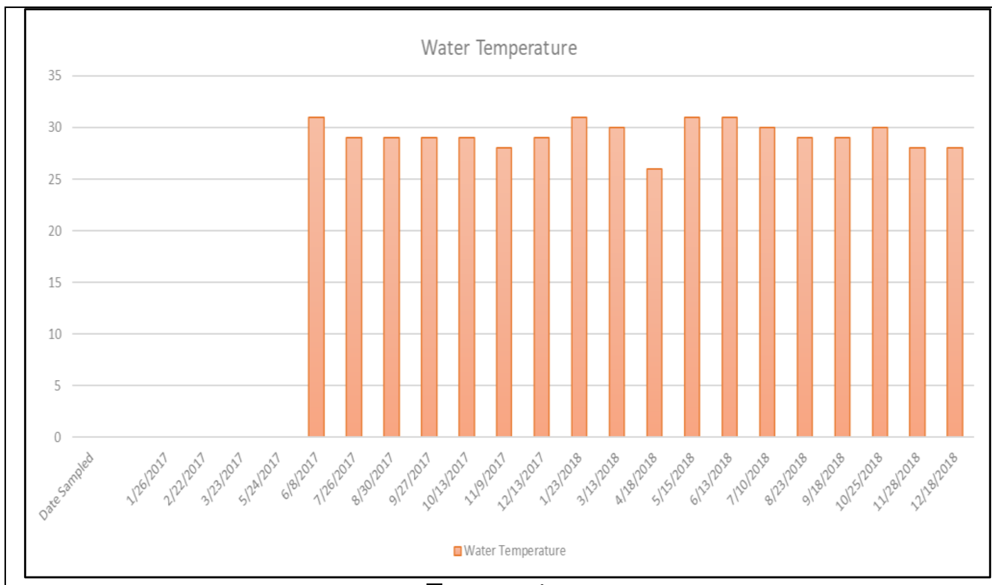


Figure 2.2-8. Google Earth Map of nearest river to the project area

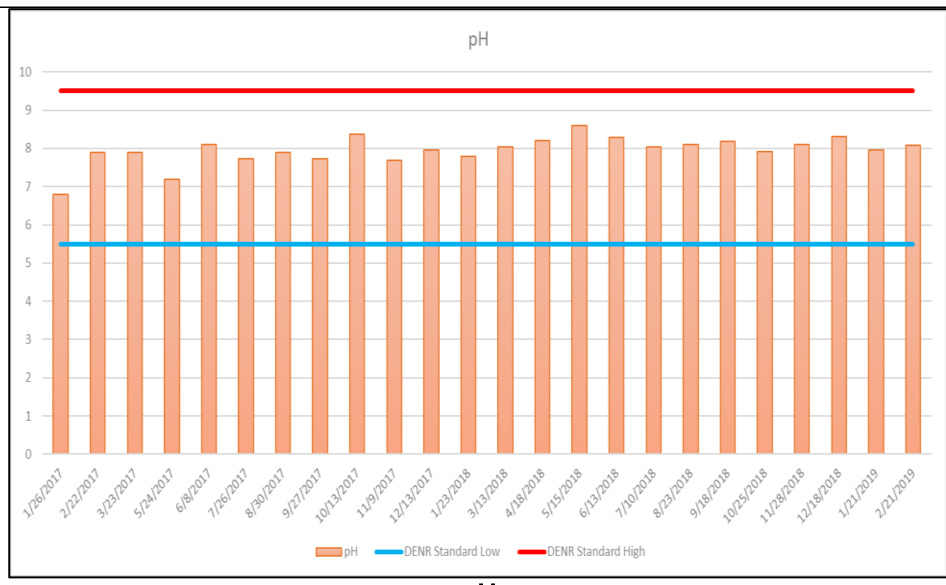
Table 2.2-8. Surface Water Quality Monitoring Results (EW1: Drainage Canal)

Date Sampled	Water Temperature	pH	Color (TCU)	DO (mg/L)	BOD5 (mg/L)	TSS (mg/L)	Oil & Grease (mg/L)
DENR Standard **Class "SC"**		**6.5- 8.5**	**75**	**N/A**	**100**	**80**	**3**
1/26/2017	NS	6.8	10	7	3	43	2
2/22/2017	NS	7.9	5	6	2	27	1
3/23/2017	NS	7.9	2	6	5	21	2
5/24/2017	NS	7.2	2	6	5	30	2
6/8/2017	NS	8.1	2	8	9	33	6
7/26/2017	NS	7.73	15	7.2	14	31	0.3
8/30/2017	31	7.89	20	7.2	12	4	4.1
9/27/2017	29	7.73	25	5.2	12	5	0.9
10/13/2017	29	8.37	25	5.7	38	1	1.3
11/9/2017	29	7.68	15	5.7	17	38	4
12/13/2017	29	7.96	20	5	10	1	2.3
1/23/2018	28	7.78	20	5	10	1	2.5
3/13/2018	29	8.04	15	4.7	7	5	1.2
4/18/2018	31	8.21	5	3.9	7	3	2.8
5/15/2018	30	8.59	5	5.8	14	10	1.1
6/13/2018	26	8.29	5	6.3	12	3	2.4
7/10/2018	31	8.03	10	6	4	24	1.5

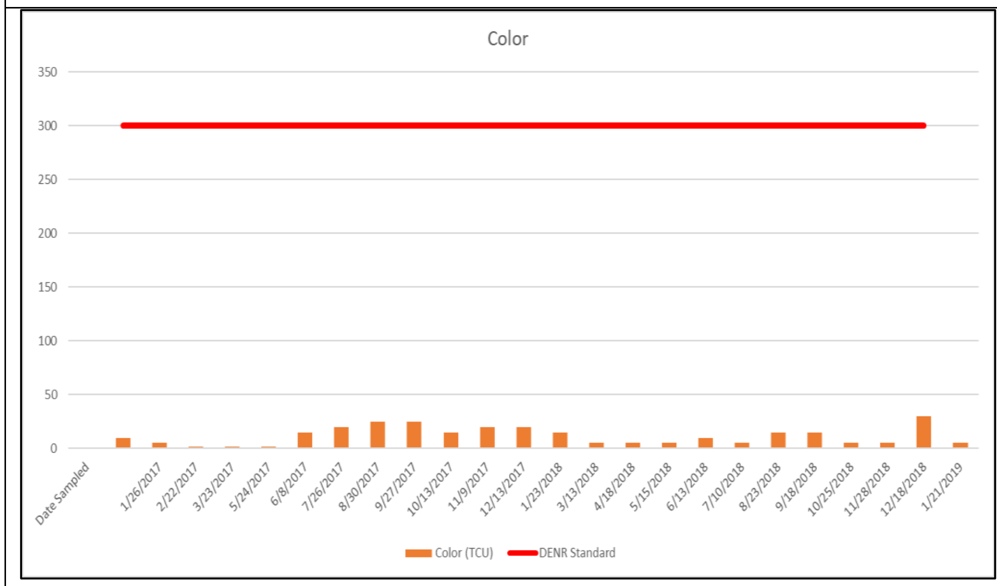
Date Sampled	**Water Temperature**	**pH**	**Color (TCU)**	**DO (mg/L)**	**BOD5 (mg/L)**	**TSS (mg/L)**	**Oil & Grease (mg/L)**
DENR Standard **Class "SC"**		**6.5- 8.5**	**75**	**N/A**	**100**	**80**	**3**
8/23/2018	31	8.09	5	5.9	8	17	2.4
9/18/2018	30	8.18	15	5.1	23	20	2.6
10/25/2018	29	7.91	15	6.5	8	25	2.4
11/28/2018	29	8.09	5	5.8	6	10	2.6
12/18/2018	30	8.31	5	4.8	18	26	2.4
1/21/2019	28	7.95	30	6.6	9	9	2
2/21/2019	28	8.08	5	7	3	7	2



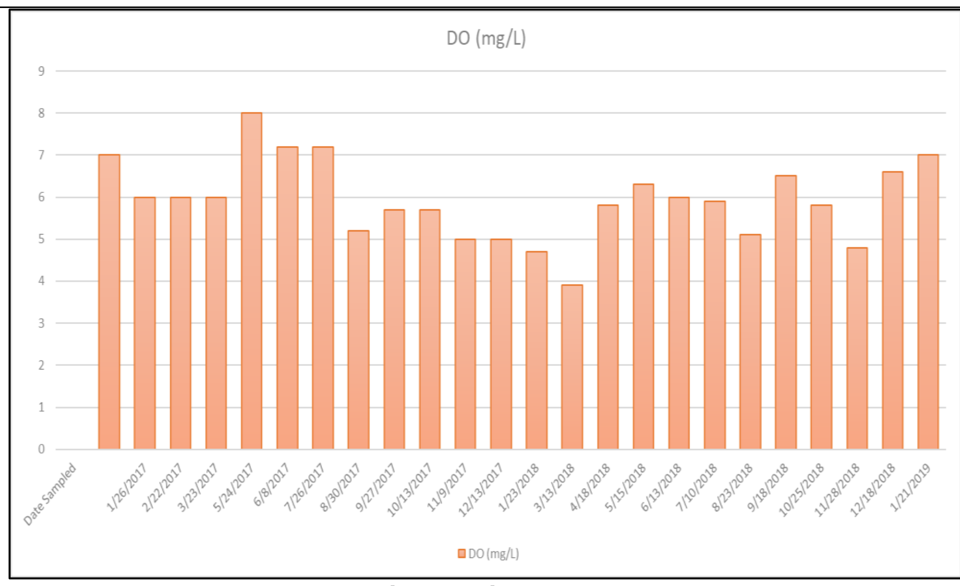
Temperature



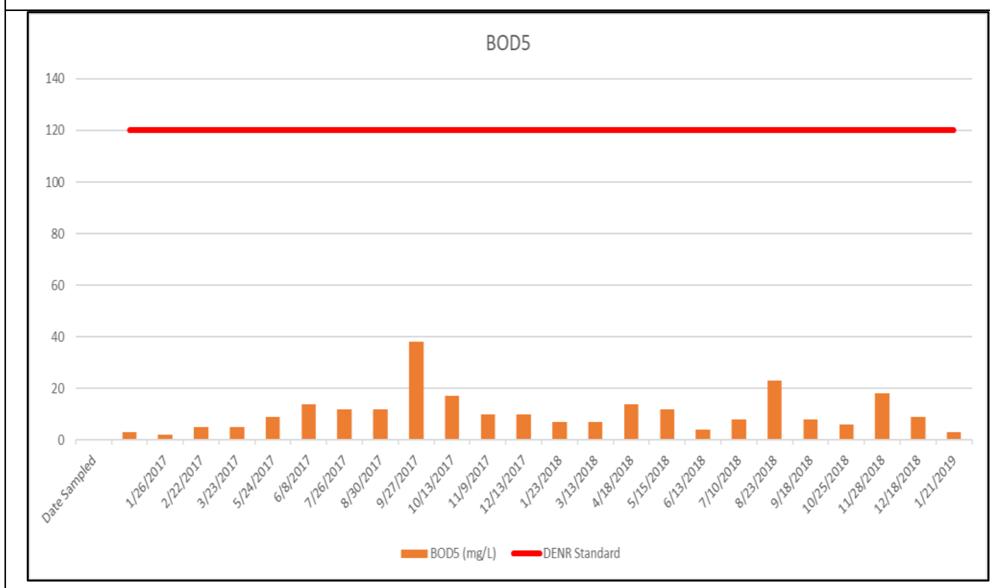
pH



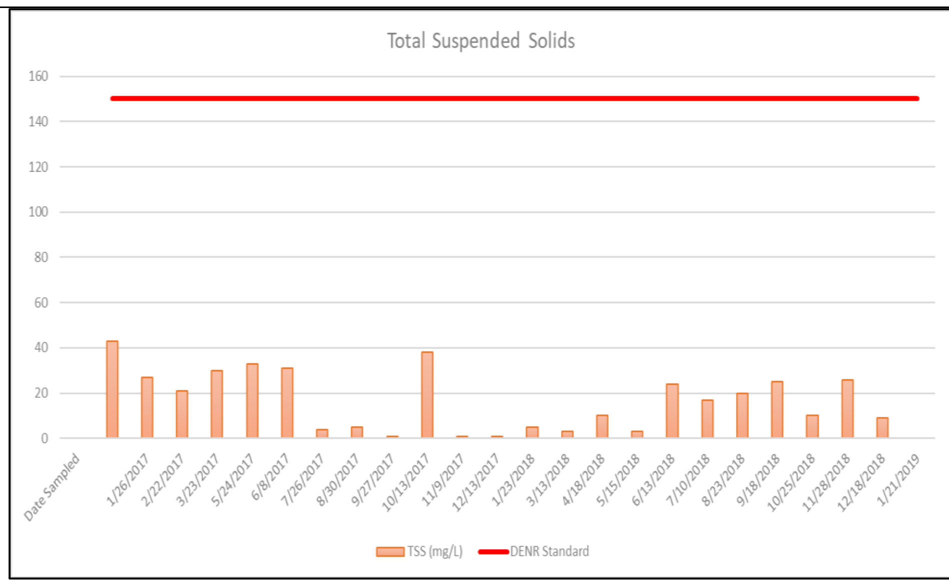
Color



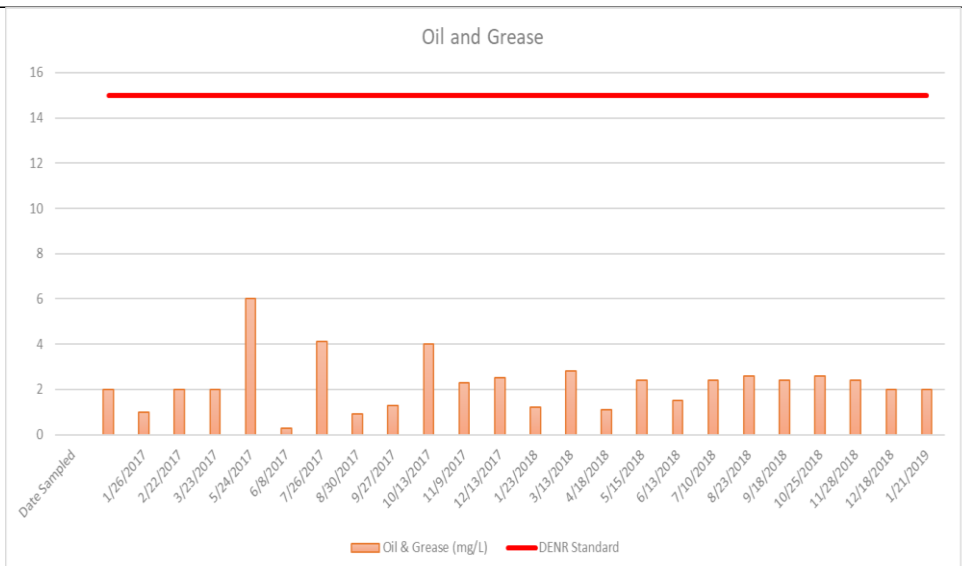
Dissolved Oxygen



Biological Oxygen Demand (5)



Total Suspended Solids



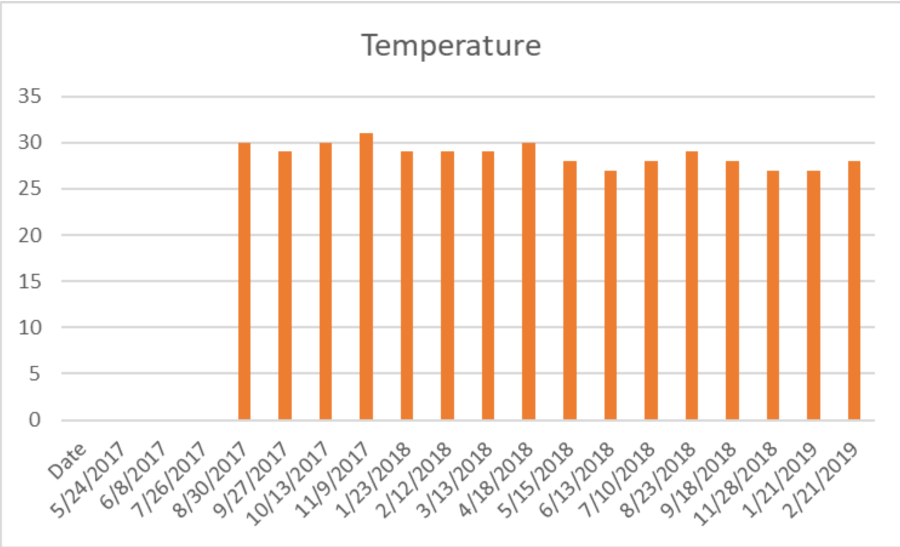
Oil and Grease

Water Quality Monitoring Results at EW1:Drainage Canal

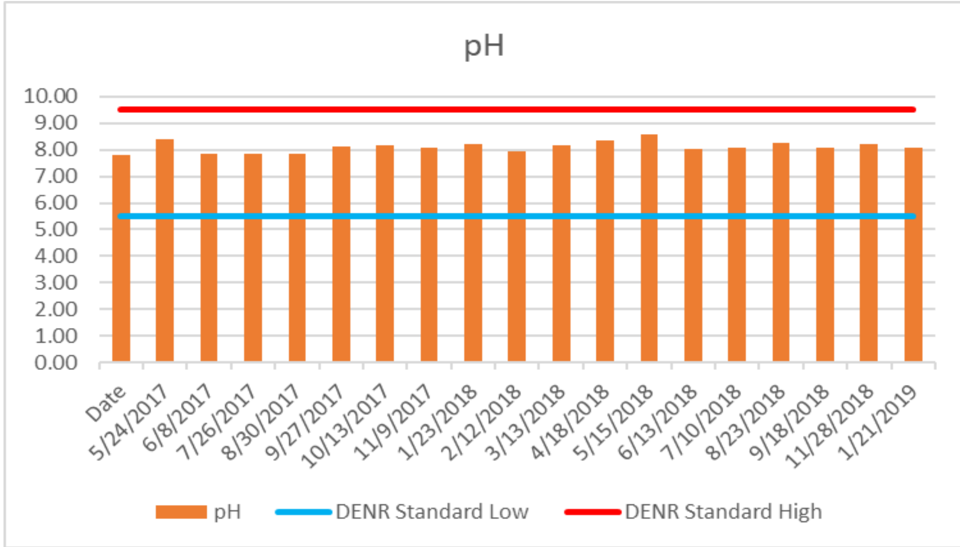
Graph 2.2-2. Water Quality Monitoring Results at EW1: Drainage Canal

Table 2.2-9. Surface Water Quality Monitoring Results (EW2: Canteen)

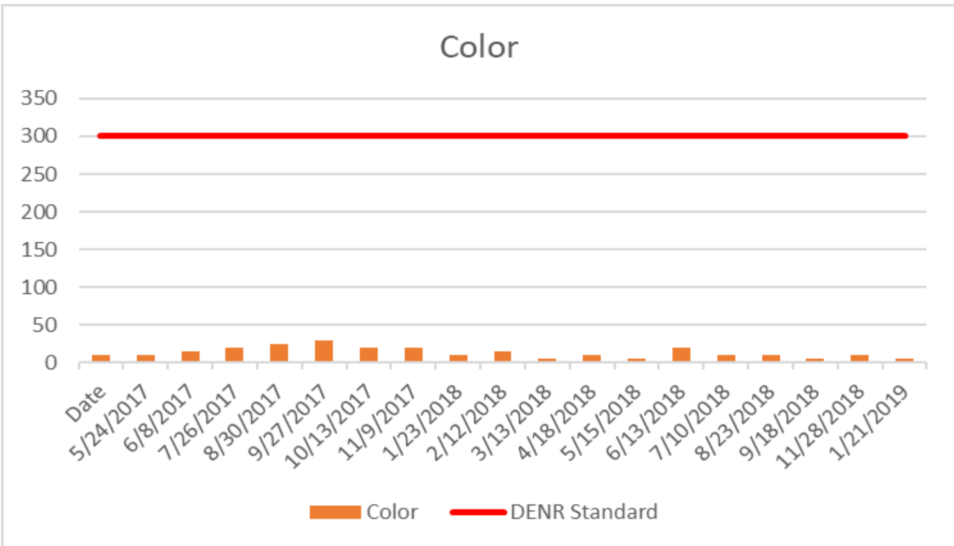
Date	Temperature	pH	Color	DO	BOD5	TSS	Oil and Grease
DENR Standard	N/A	5.5 - 9.5	< 300	N/A	< 120	< 150	< 15
5/24/2017	NS	7.80	10	6	4	1	5
6/8/2017	NS	8.40	10	8	9	17	3
7/26/2017	NS	7.86	15	4.6	17	5	0.6
8/30/2017	30	7.86	20	3.6	13	3	3.4
9/27/2017	29	7.84	25	7.3	10	5	1
10/13/2017	30	8.10	30	5.3	18	1	0.5
11/9/2017	31	8.18	20	5.3	14	11	3.3
1/23/2018	29	8.08	20	6.6	12	12	3
2/12/2018	29	8.21	10	5.1	9	3	2.3
3/13/2018	29	7.96	15	6.9	18	20	0.2
4/18/2018	30	8.17	5	7.3	10	29	3.3
5/15/2018	28	8.34	10	4.6	22	16	2
6/13/2018	27	8.56	5	5.5	10	10	1.4
7/10/2018	28	8.05	20	4.9	7	19	0.6
8/23/2018	29	8.06	10	3.3	8	11	1
9/18/2018	28	8.25	10	3.7	17	3	1.1
11/28/2018	27	8.08	5	4.3	8	4	1.4
1/21/2019	27	8.22	10	5.4	3	21	2.2
2/21/2019	28	8.09	5	2.6	22	3	1.9



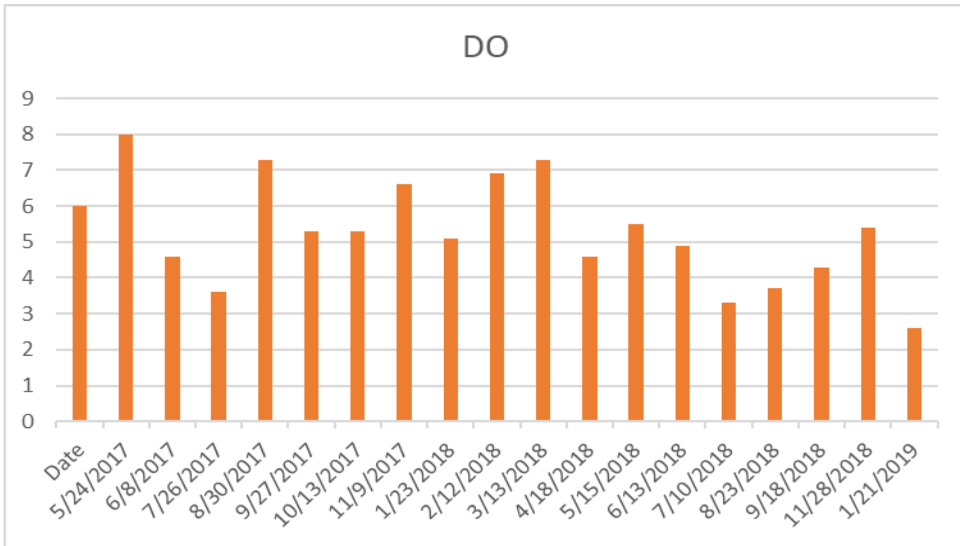
Temperature



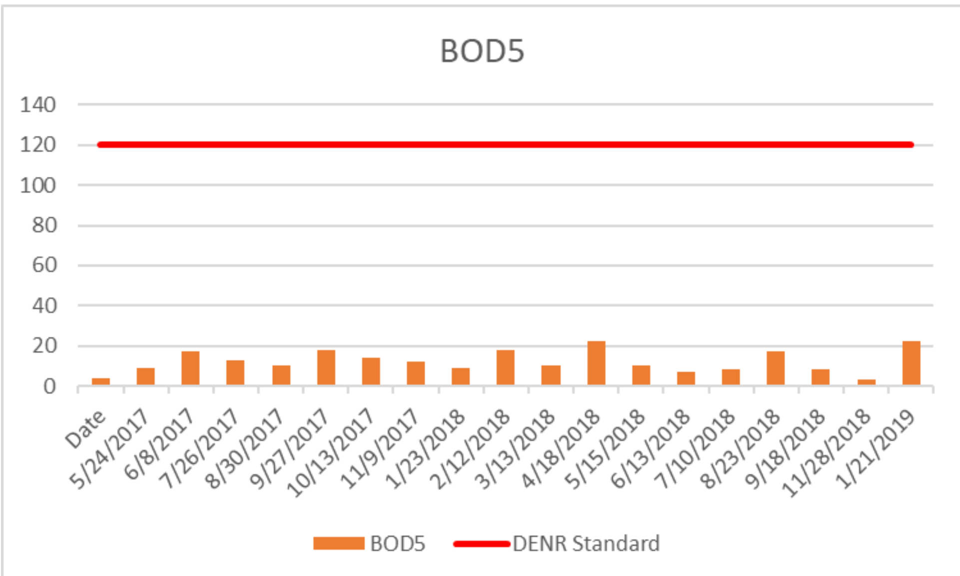
pH



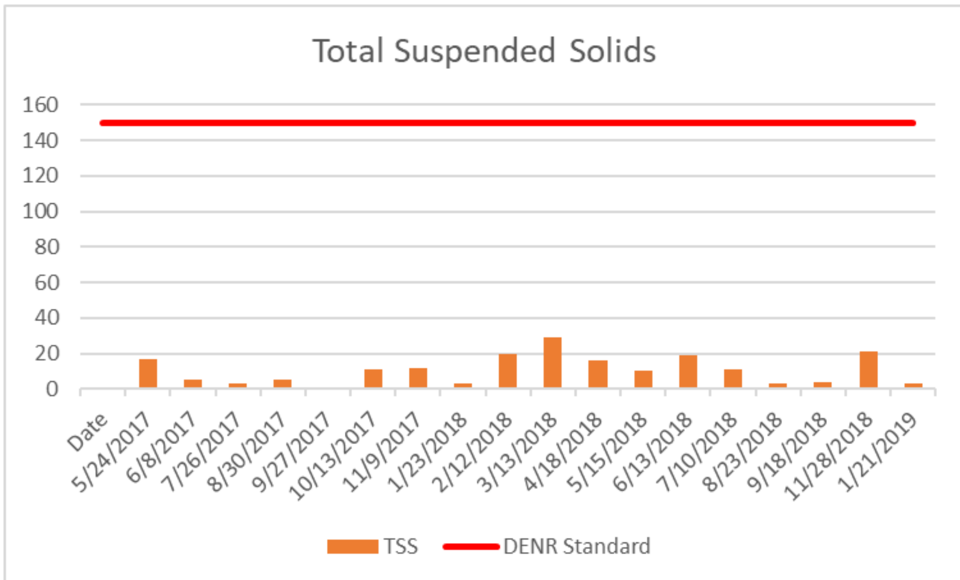
Color



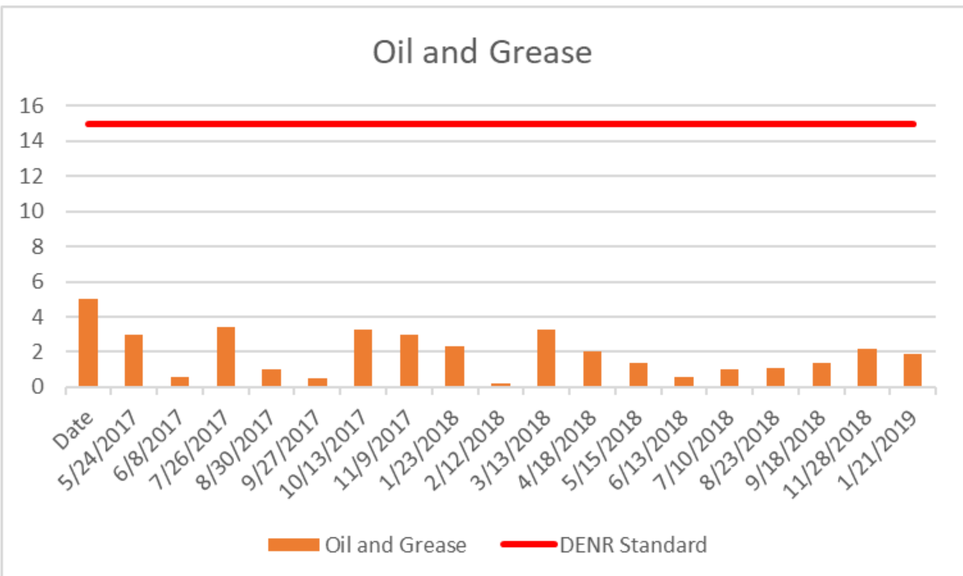
Dissolved Oxygen



Biological Oxygen Demand (5)



Total Suspended Solids



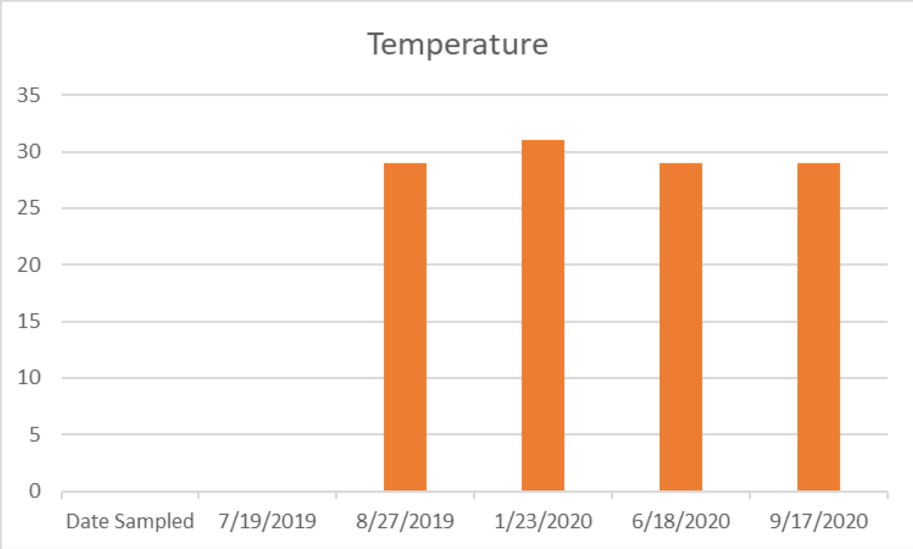
Oil and Grease

Water Quality Monitoring Results at EW2: Canteen

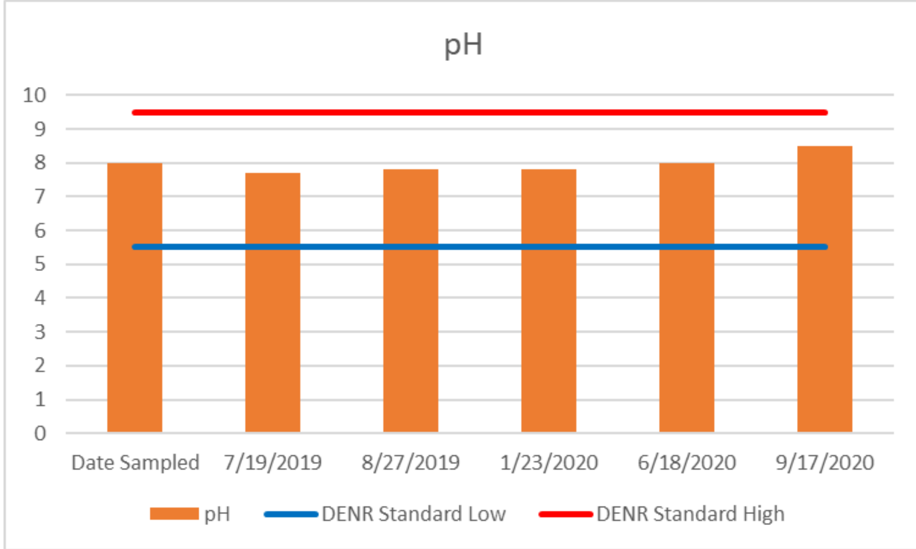
Graph 2.2-3 Water Quality Monitoring Results at EW2: Canteen

Table 2.2-10. Surface Water Quality Monitoring Results (EW4: Drainage Canal - OWS3)

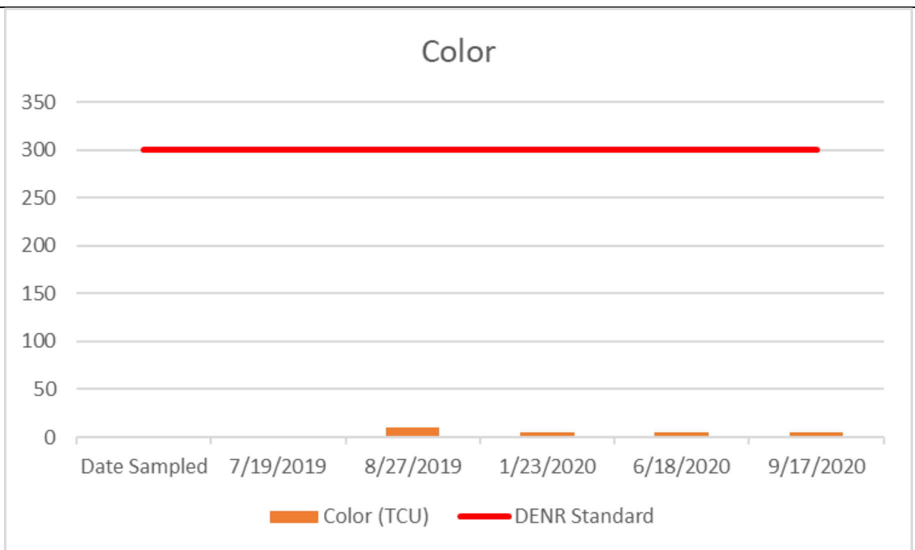
Date Sampled	Temperature	pH	Color (TCU)	DO (mg/L)	BOD5 (mg/L)	TSS (mg/L)	Oil & Grease (mg/L)
DENR Standard	**N/A**	**5.5-9.5**	**300**	**N/A**	**120**	**150**	**15**
7/19/2019	n/a	8	n/a	n/a	n/a	12	10
8/27/2019	n/a	7.7	n/a	n/a	n/a	24	10
1/23/2020	29	7.80	10	6	5	16	5
6/18/2020	31	7.80	4.9	6	6	10	2
9/17/2020	29	8.00	4.9	9	5	20	0.9
11/18/2020	29	8.50	4.9	8	0.9	30	2



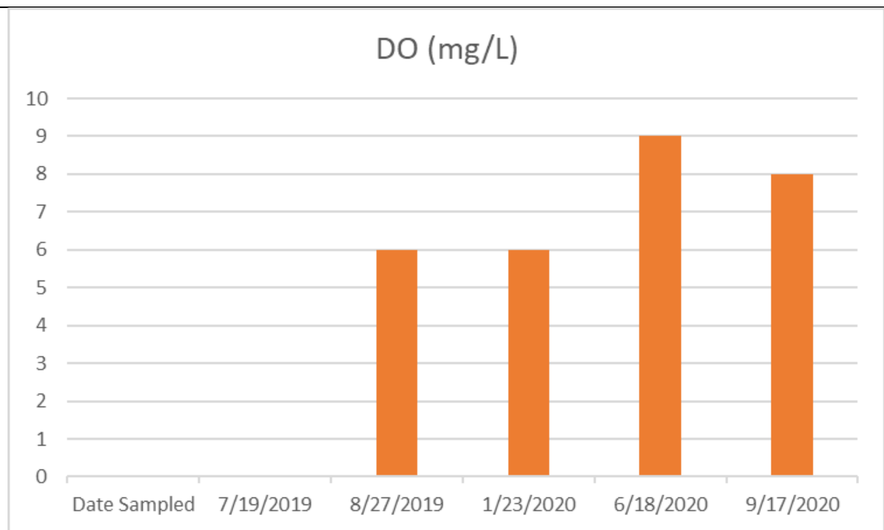
Temperature



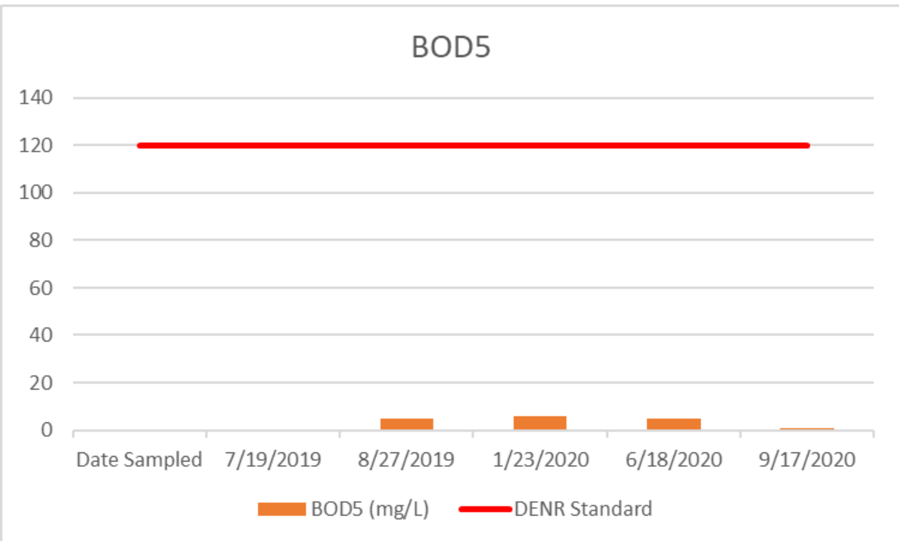
pH



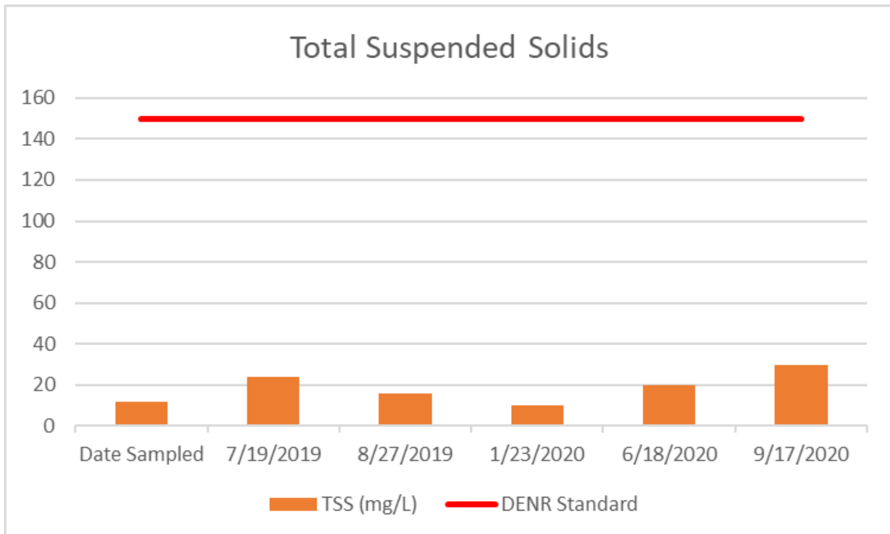
Color



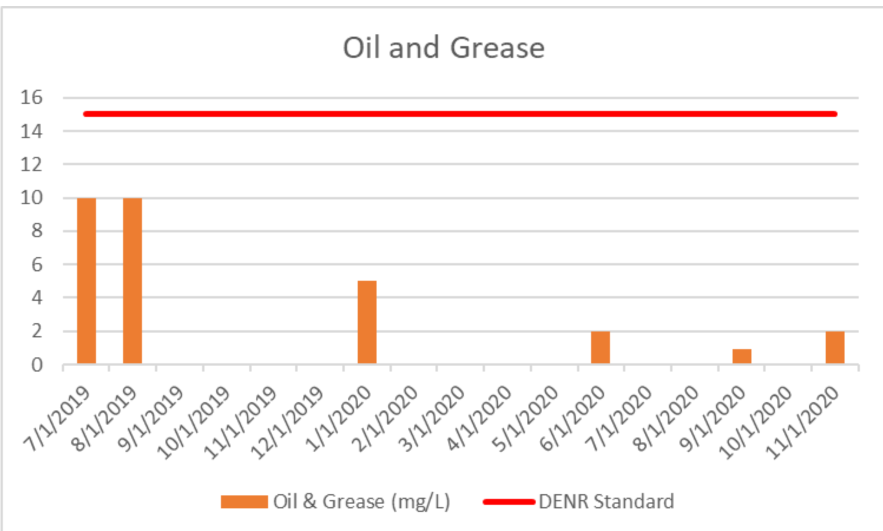
Dissolved Oxygen



Biological Oxygen Demand (5)



Total Suspended Solids



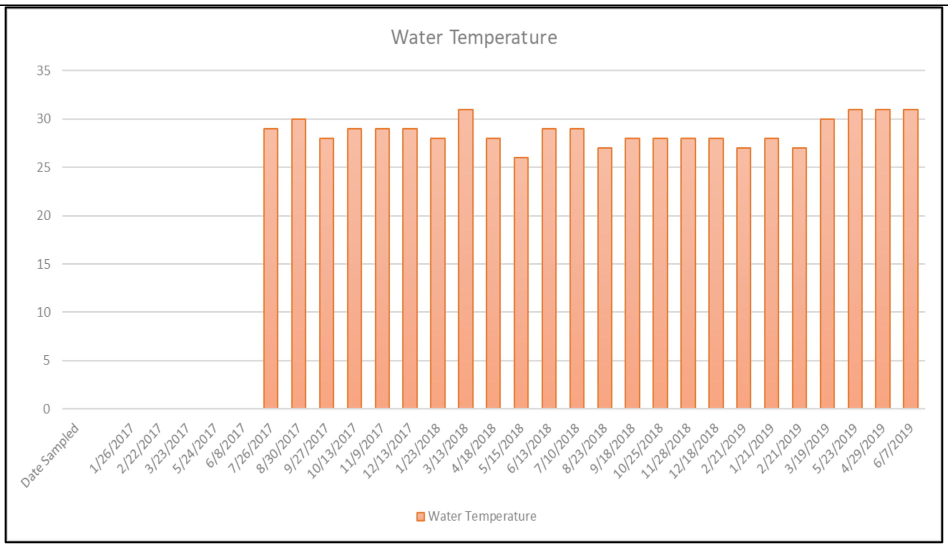
Oil and Grease

Water Quality Monitoring Results at EW4: Drainage Canal - OWS3

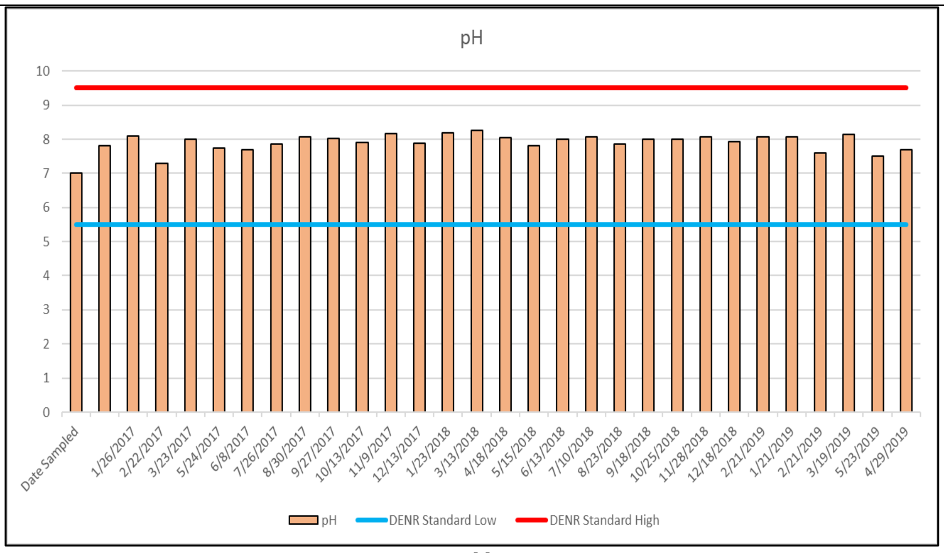
Graph 2.2-4 Water Quality Monitoring Results at EW4: Drainage Canal - OWS3

Table 2.2-11. Surface Water Quality Monitoring Results (EW6: Drainage Canal)

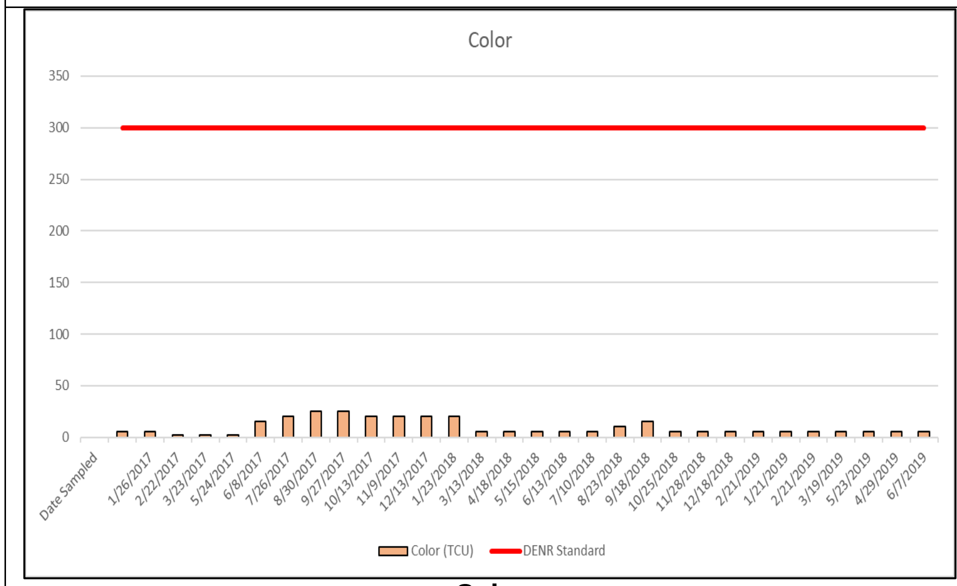
Date Sampled	Water Temperature	pH	Color (TCU)	DO (mg/L)	BOD5 (mg/L)	TSS (mg/L)	Oil & Grease (mg/L)
	DENR Standard	**6.5-9.5**	**75**	**N/A**	**100**	**80**	**3**
1/26/2017	NS	7	5	7	8	26	1
2/22/2017	NS	7.8	5	6	<1	18	2
3/23/2017	NS	8.1	2	6	8	35	3
5/24/2017	NS	7.3	2	6	8	3	2
6/8/2017	NS	8	2	9	4	9	7
7/26/2017	NS	7.74	15	9	12	28	0.4
8/30/2017	29	7.7	20	10.3	13	6	3.8
9/27/2017	30	7.86	25	7.2	10	9	1.2
10/13/2017	28	8.07	25	7	36	1	0.6
11/9/2017	29	8.02	20	5.9	33	7	4.5
12/13/2017	29	7.91	20	6.3	9	1	1.8
1/23/2018	29	8.16	20	3.5	10	3	1.9
3/13/2018	28	7.88	20	6.1	66.1	25	1.4
4/18/2018	31	8.18	5	4.7	11	2	2.3
5/15/2018	28	8.26	5	6.7	14	8	2.2
6/13/2018	26	8.05	5	7	8	6	4
7/10/2018	29	7.81	5	6.6	6	7	2.7
8/23/2018	29	7.99	5	6.3	6	17	1.5
9/18/2018	27	8.07	10	5.8	13	13	1.4
10/25/2018	28	7.85	15	6	6	15	1.6
11/28/2018	28	8.01	5	6.2	8	7	1.5
12/18/2018	28	8	5	6.8	11	1	1.6
2/21/2019	28	8.06	5	8.2	3	1	1.8
1/21/2019	27	7.94	5	6.8	3	12	1.4
2/21/2019	28	8.06	5	8.2	3	1	1.8
3/19/2019	27	8.06	5	4.6	3	3	3.7
5/23/2019	30	7.6	5	8	<1	8	2
4/29/2019	31	8.14	5	5	5	3	2.9
6/7/2019	31	7.5	5	2	2	46	1
6/7/2019	31	7.7	5	6	1	8	2



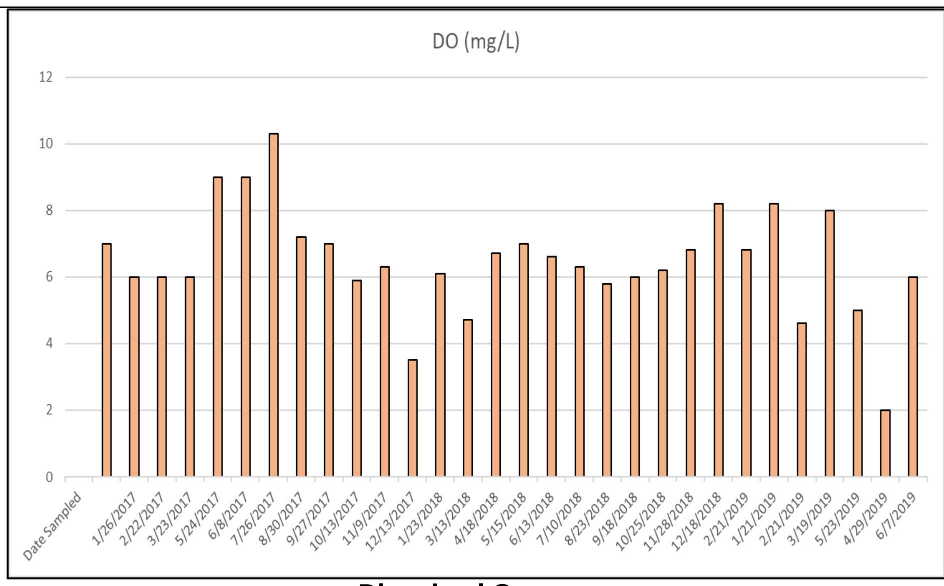
Temperature



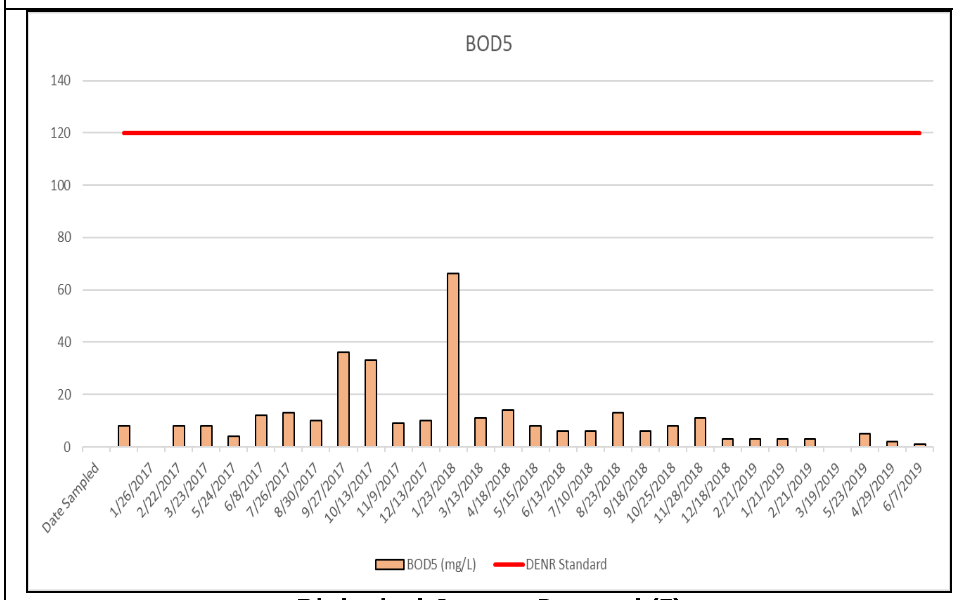
pH



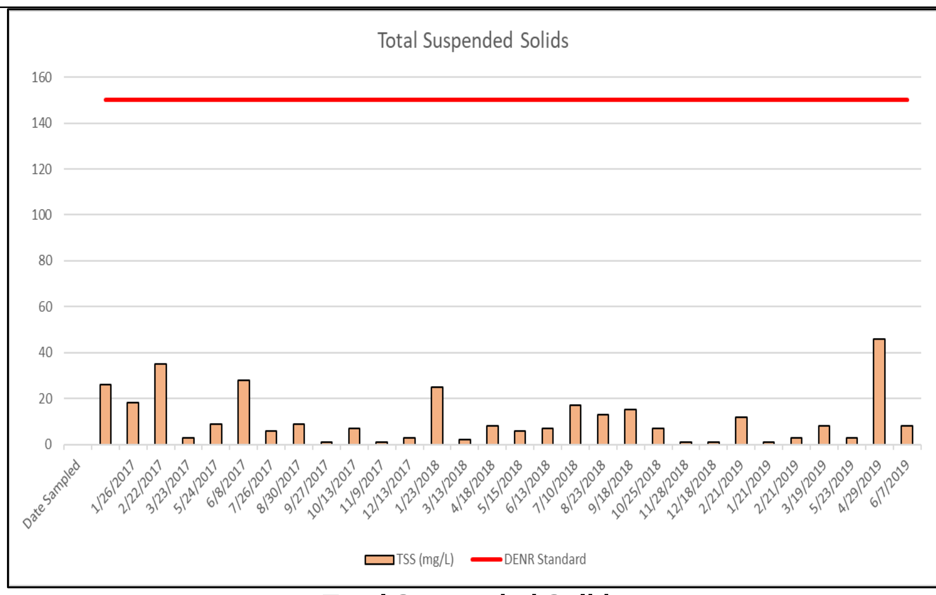
Color



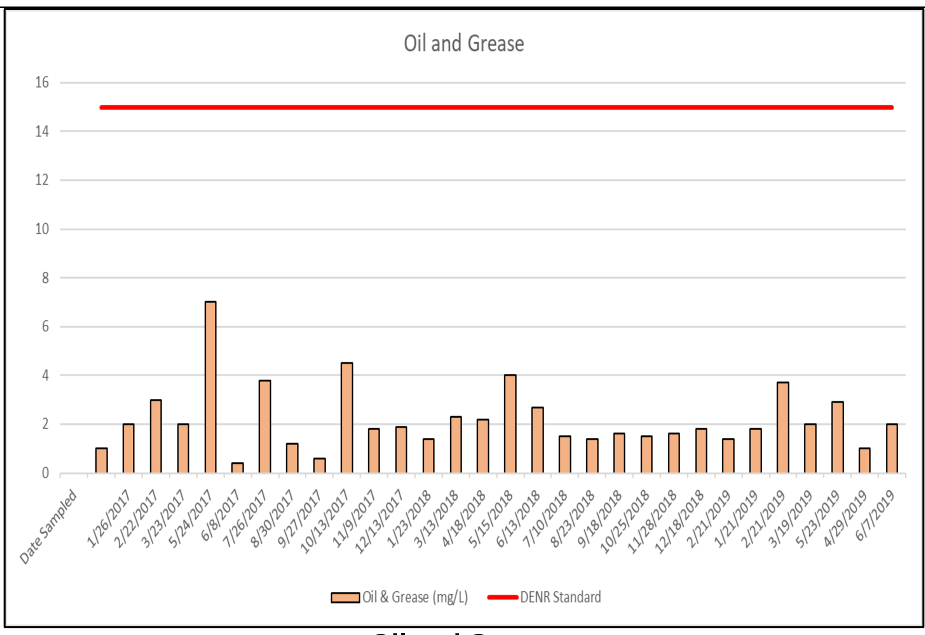
Dissolved Oxygen



Biological Oxygen Demand (5)



Total Suspended Solids



Oil and Grease

Water Quality Monitoring Results at EW6: Drainage Canal

Graph 2.2-5. Water Quality Monitoring Results at EW6: Drainage Canal

Table 2.2-12. Surface Water Quality Monitoring Results (Paniangan Talocao Creek 1)

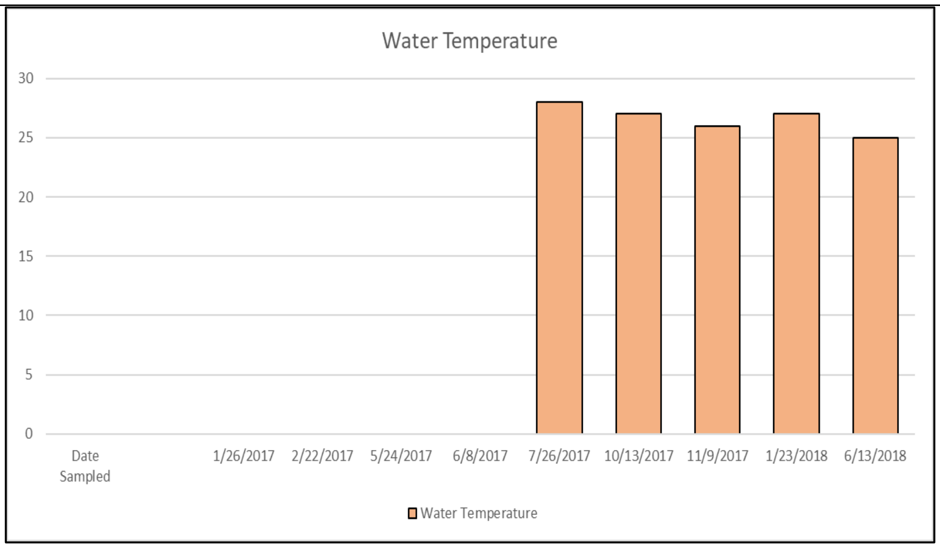
Date Sampled	Water Temperature	pH	Color (TCU)	DO (mg/L)	BOD5 (mg/L)	TSS (mg/L)	Oil & Grease (mg/L)
DENR Standard		**6.5-9.5**	**75**	**N/A**	**100**	**80**	**3**
1/26/2017	NS	7.2	10	7	11	3	<1
2/22/2017	NS	7.7	15	6	7	32	<1
5/24/2017	NS	7.9	10	5	2	11	3
6/8/2017	NS	7.9	5	8	5	11	3
7/26/2017	NS	7.96	15	8.8	9	6	2.3
10/13/2017	28	8.11	25	5.3	40	1	2.1
11/9/2017	27	7.81	20	4.3	12	33	5.3
1/23/2018	26	8.13	20	7.1	9	1	2.4
6/13/2018	27	8.03	5	7.1	10	1	3.3
9/18/2018	25	7.45	10	6.1	17	139	2.1

Its graphical representation is shown in Graph 2.2-4.

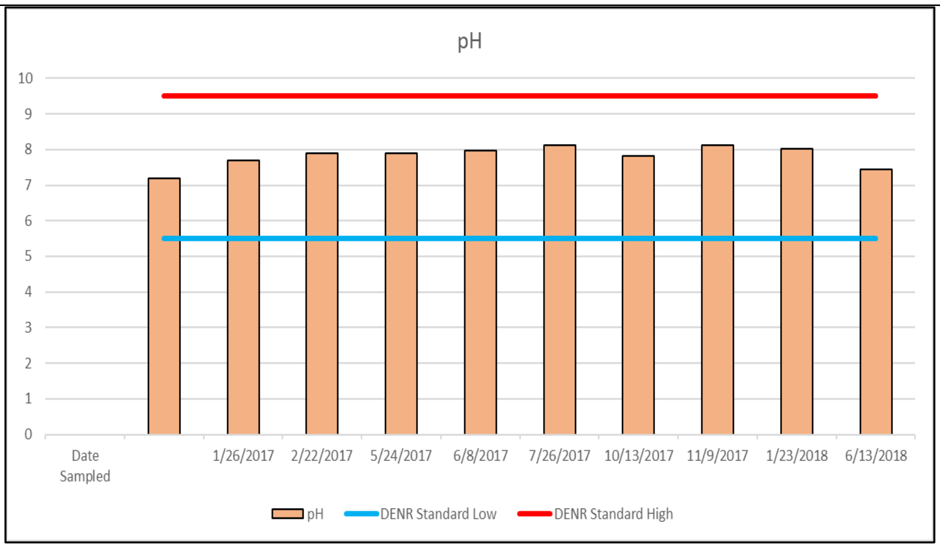
Table 2.2-13. Surface Water Quality Monitoring Results (EW7: Silt Pond No. 2)

Date Sampled	Water Temperature	pH	Color (TCU)	DO (mg/L)	BOD5 (mg/L)	TSS (mg/L)	Oil & Grease (mg/L)
	DENR Standard	**6.5-9.5**	**75**	**NA**	**100**	**80**	**3**
9/27/2017	32	7.86	25	6.6	12	9	NS
10/13/2017	-	NS	40	5.8	39	11	0.5
12/13/2017	-	7.96	20	6.5	10	11	1.4
1/23/2018	NS	7.81	20	5.7	10	27	2.7
2/12/2018	NS	7.55	15	6.9	6	48	1.5
3/13/2018	-	NS	20	5.4	10	2	2.8
9/18/2018	NS	NS	15	4.1	6	47	2.2

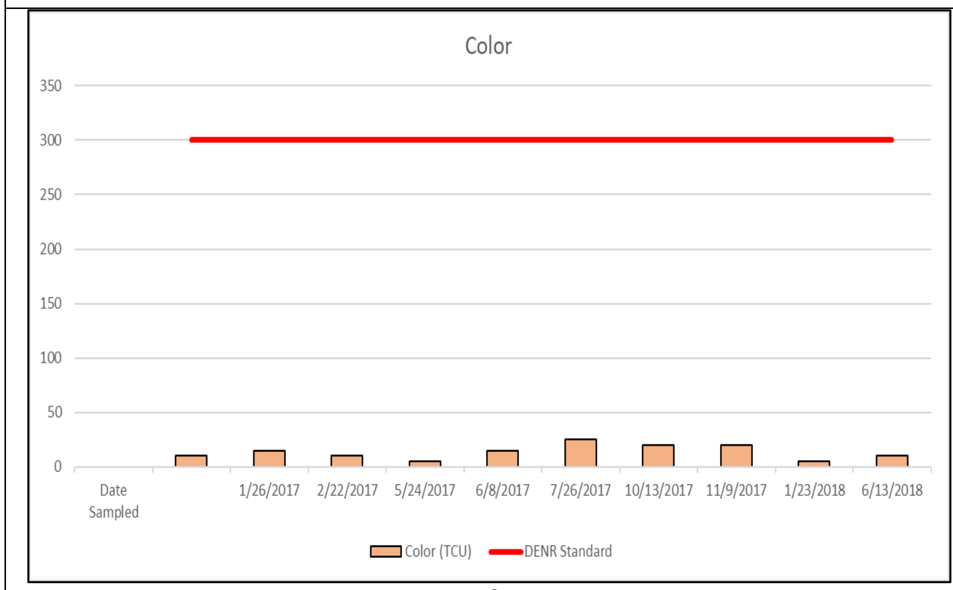
Its graphical representation is shown in Graph 2.2-5.



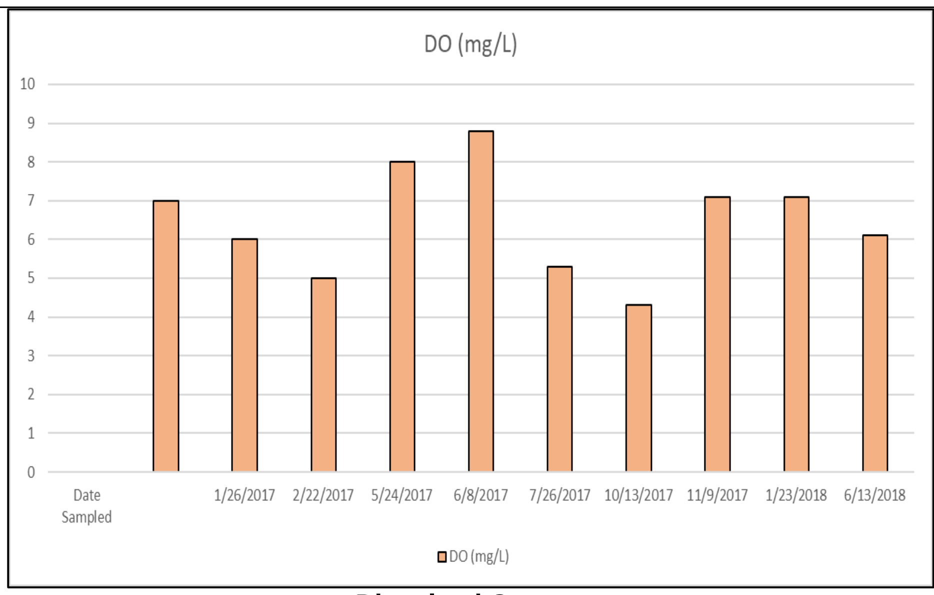
Temperature



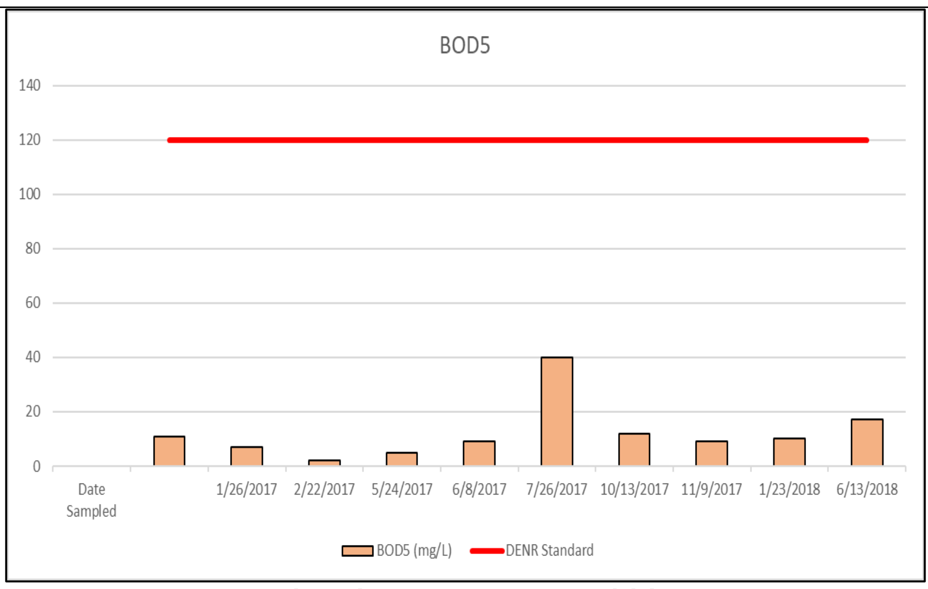
pH



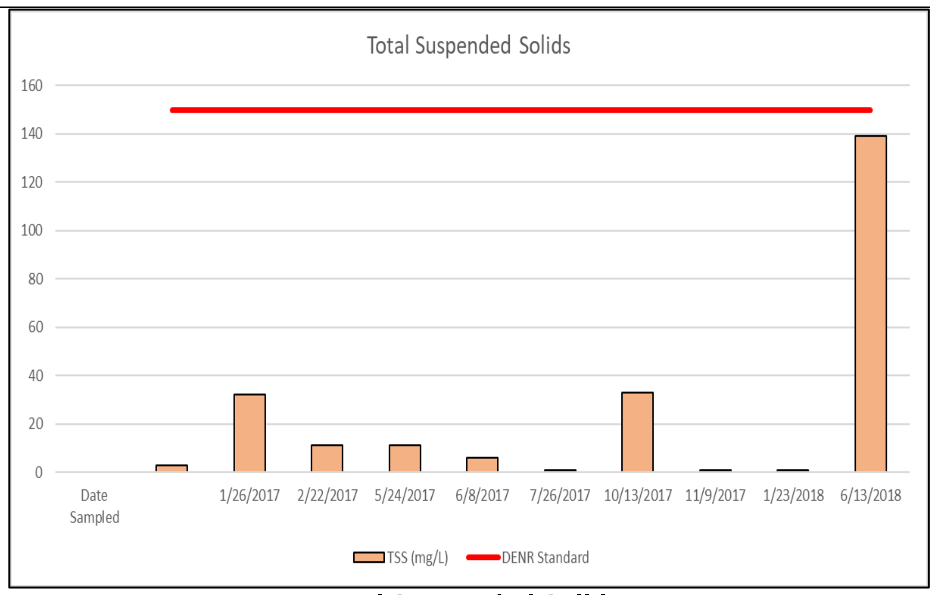
Color



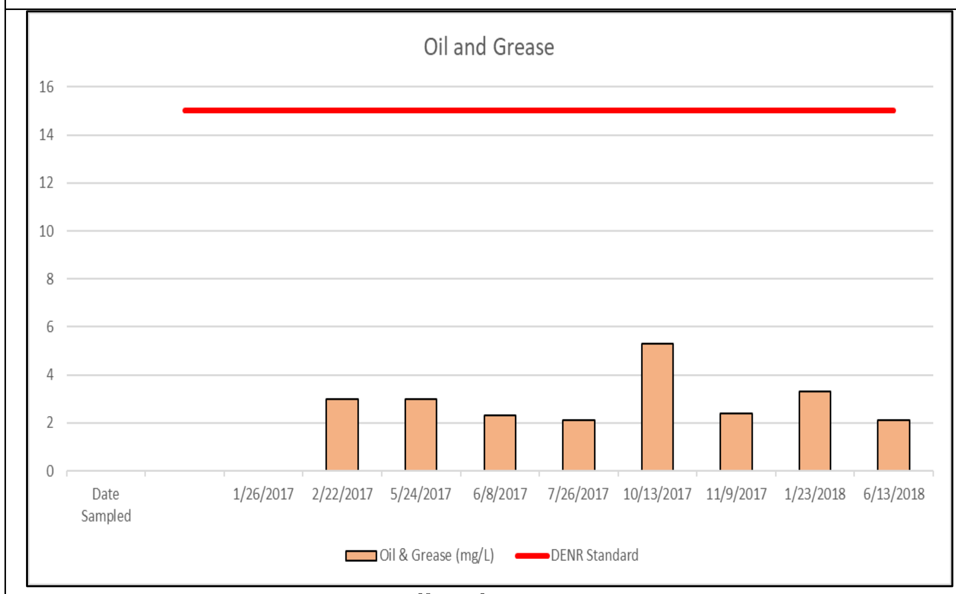
Dissolved Oxygen



Biological Oxygen Demand (5)



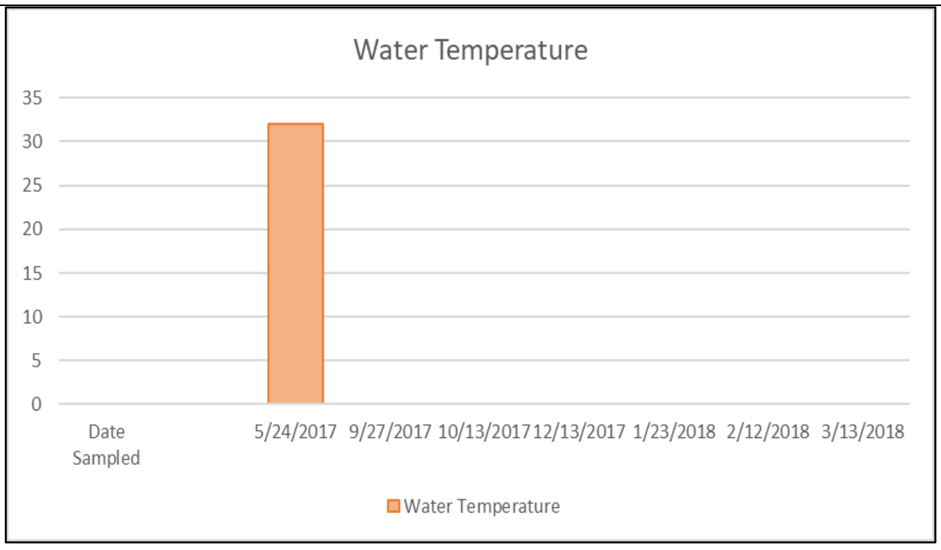
Total Suspended Solids



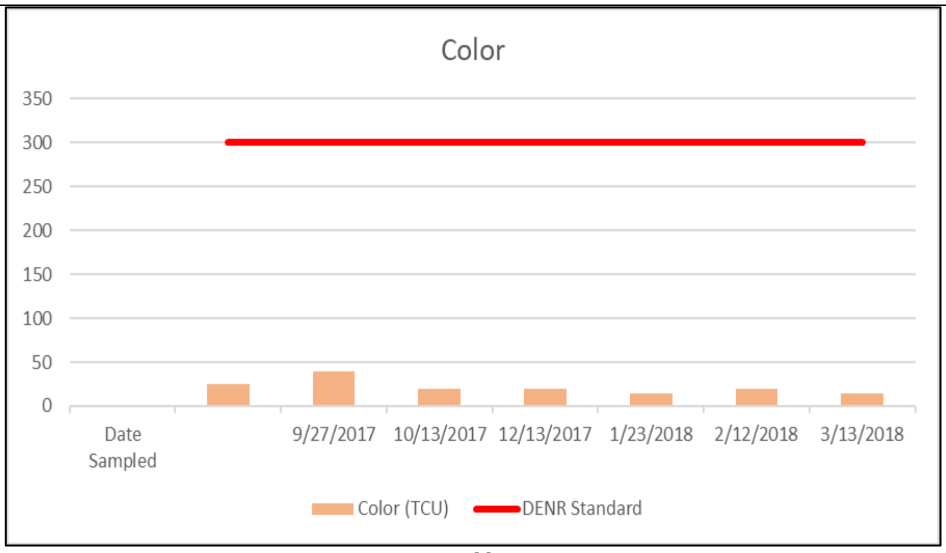
Oil and Grease

Water Quality Monitoring Results at Paniangan Talocao Creek 1

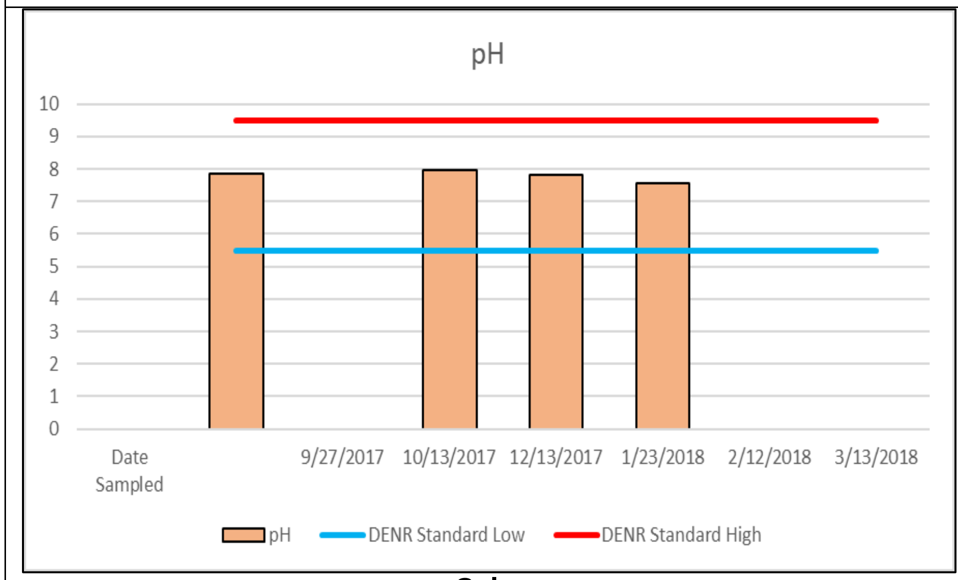
Graph 2.2-6. Water Quality Monitoring Results at Paniangan Talocao Creek 1



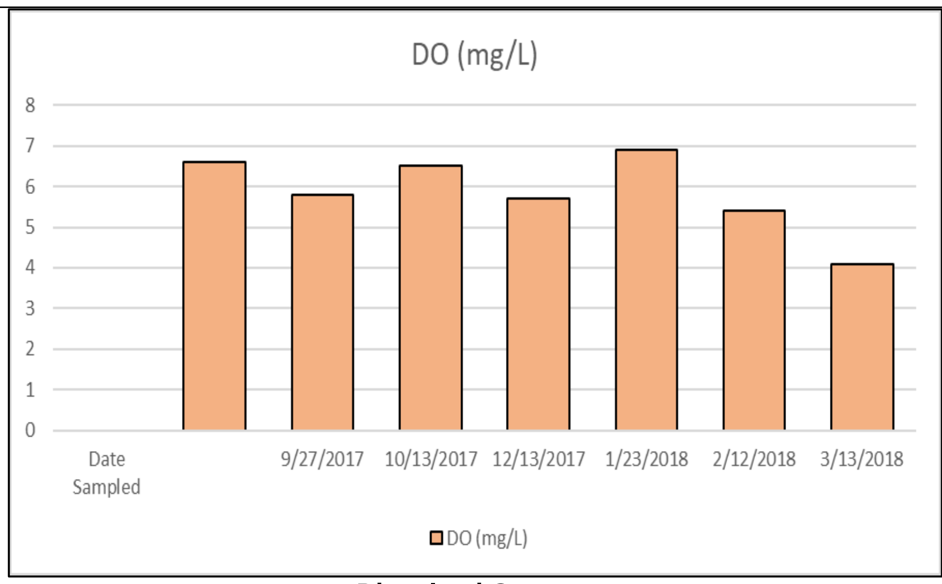
Temperature



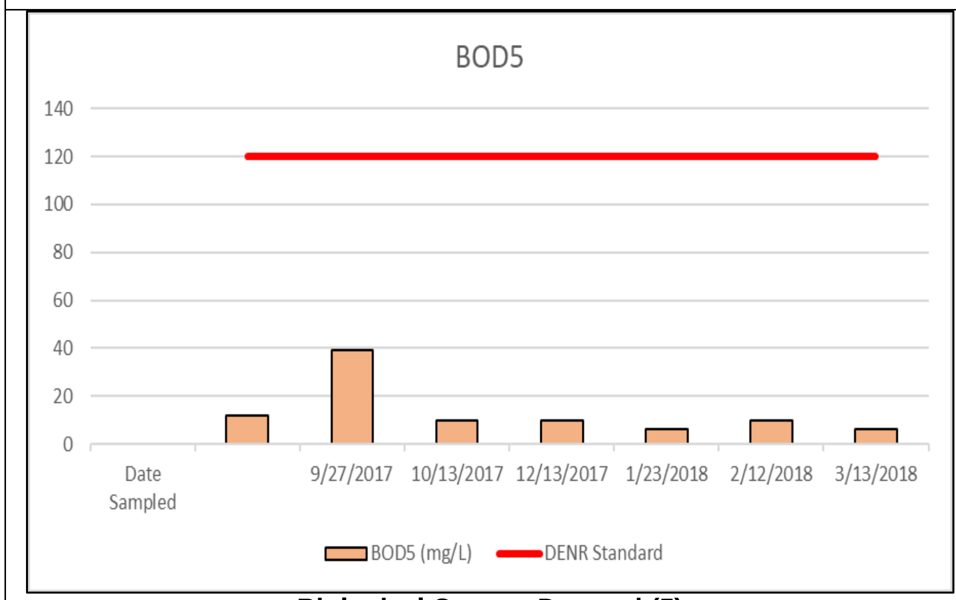
pH



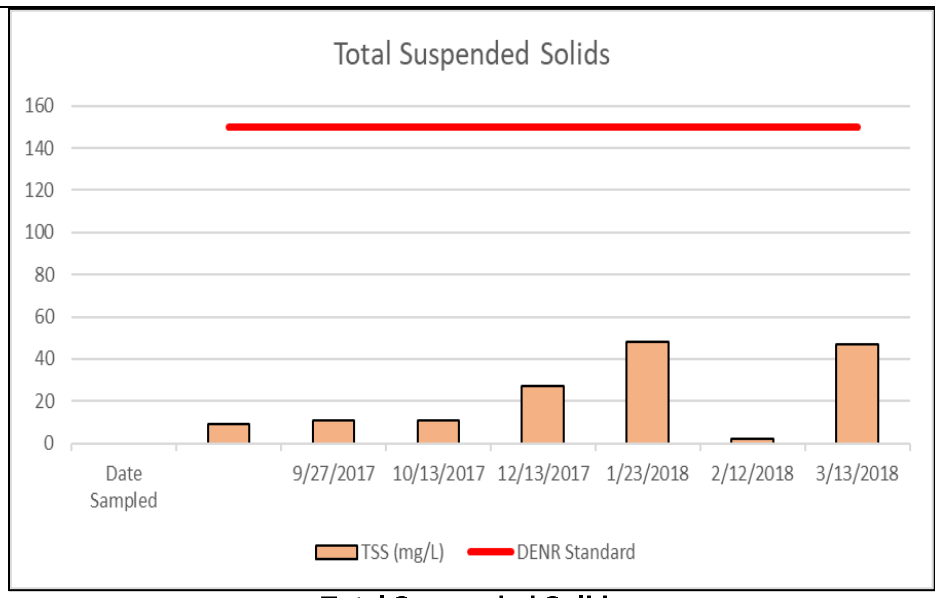
Color



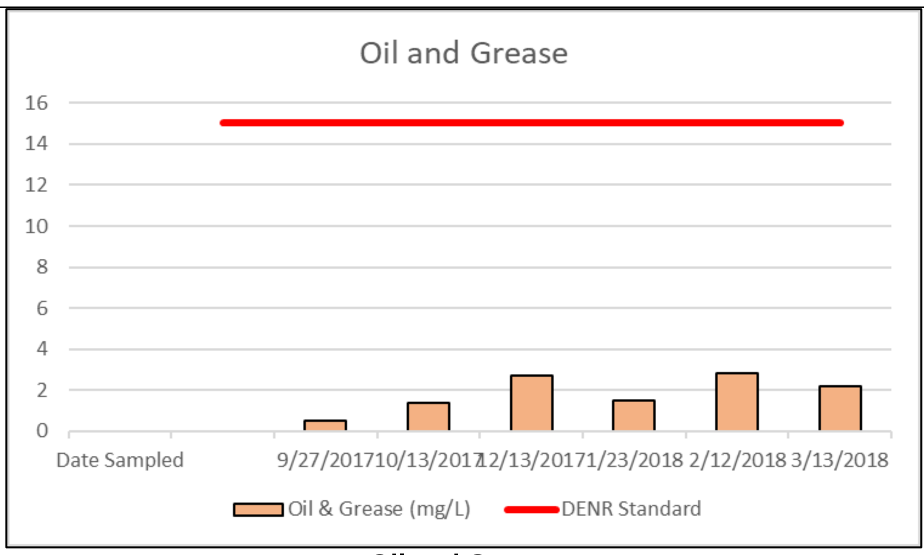
Dissolved Oxygen



Biological Oxygen Demand (5)



Total Suspended Solids



Oil and Grease

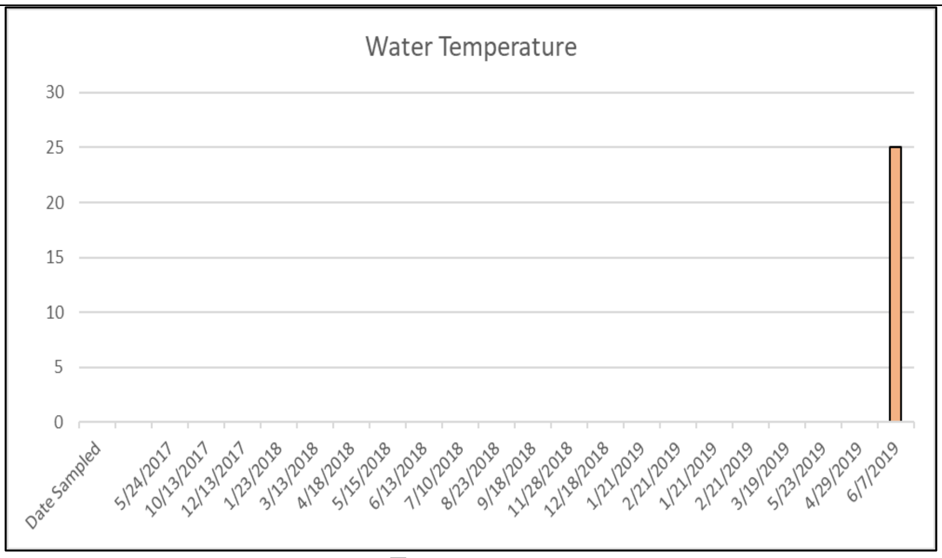
Water Quality Monitoring Results at EW 7: Silt Pond No. 2

Graph 2.2-7. Water Quality Monitoring Results at EW7: Silt Pond No. 2

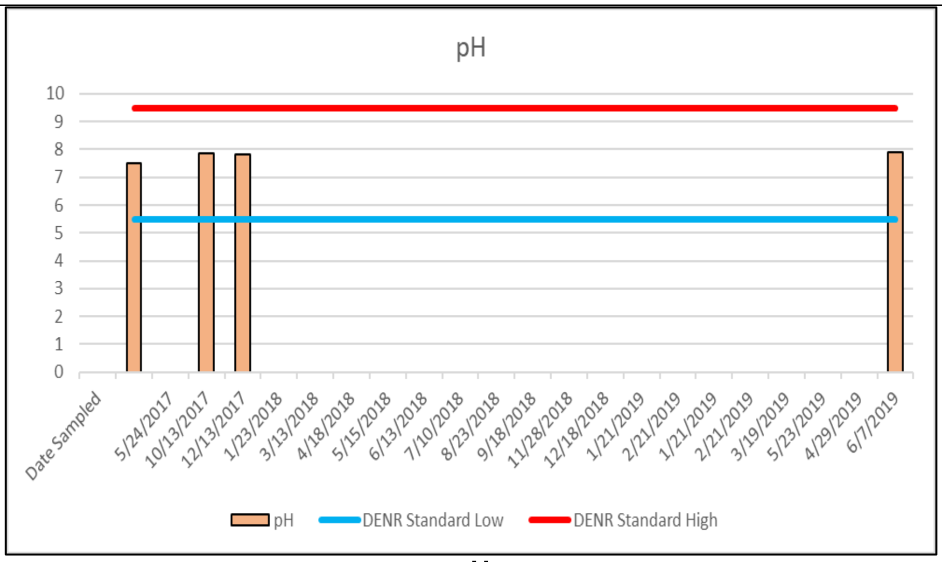
Table 2.2-14. Surface Water Quality Monitoring Results (EW5: Silt Pond No. 1)

Date Sampled	Location	Water Temperature	pH	Color (TCU)	DO (mg/L)	BOD5 (mg/L)	TSS (mg/L)	Oil & Grease (mg/L)
		DENR Standard	**6.5-9.5**	**75**	**N/A**	**100**	**80**	**3**
10/13/2017	RCMI Silt Pond 1	-	NS	25	6.2	36	1	0.5
12/13/2017	RCMI Silt Pond 1	-	7.88	20	4.8	11	10	1.1
1/23/2018	RCMI Silt Pond 1	NS	7.81	20	5	11	9	1.8
3/13/2018	RCMI Silt Pond 1	-	NS	20	5.1	7	8	2.1
4/18/2018	RCMI Silt Pond 1	NS	NS	5	5.8	7	27	1.8
5/15/2018	RCMI Silt Pond 1	NS	NS	5	7	19	10	1.4
6/13/2018	RCMI Silt Pond 1	NS	NS	5	7.3	13	24	3.3
7/10/2018	RCMI Silt Pond 1	NS	NS	10	6.9	6	16	1.3
8/23/2018	RCMI Silt Pond 1	NS	NS	10	6.7	4	13	1.2
9/18/2018	RCMI Silt Pond 1	NS	NS	15	6.2	9	28	1.1
11/28/2018	RCMI Silt Pond 1	NS	NS	5	5.1	5	3	1.8
12/18/2018	RCMI Silt Pond 1	NS	NS	5	5.4	15	41	2.3
1/21/2019	RCMI Silt Pond 1	NS	NS	5	6.3	4	70	2.1
2/21/2019	RCMI Silt Pond 1	NS	NS	5	8.8	4	27	3.3
1/21/2019	RCMI Silt Pond 1	NS	NS	5	6.3	4	70	2.1
2/21/2019	RCMI Silt Pond 1	NS	NS	5	8.8	4	27	3.3
3/19/2019	RCMI Silt Pond 1	NS	NS	5	6.1	6	5	3
5/23/2019	RCMI Silt Pond 1	NS	NS	5	6	2	3	<1
4/29/2019	RCMI Silt Pond 1	NS	NS	5	6.3	7	23	3.4
6/7/2019	RCMI Silt Pond 1	NS	NS	5	7	1	31	<1
10/8/2019	100m from settling pond	25	7.9	5	8	<1	25	<1

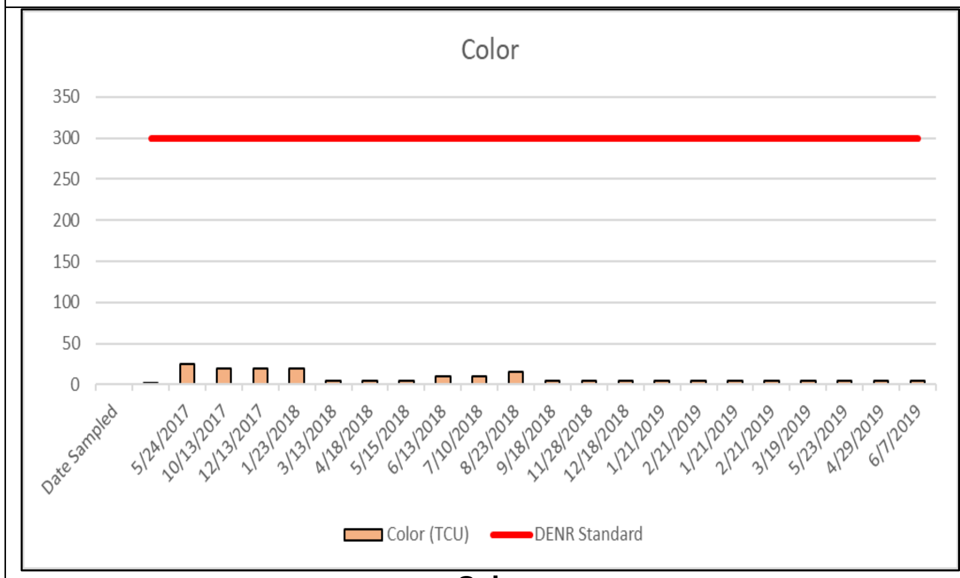
Its graphical representation is shown in **Graph 2.2-6**. Furthermore, the charts for all stations are shown in **Graph 2.2-7**.



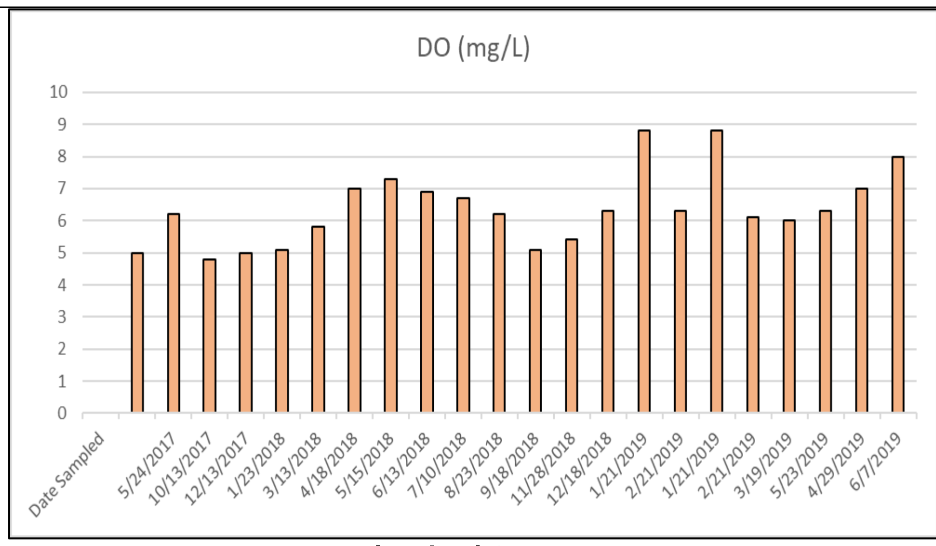
Temperature



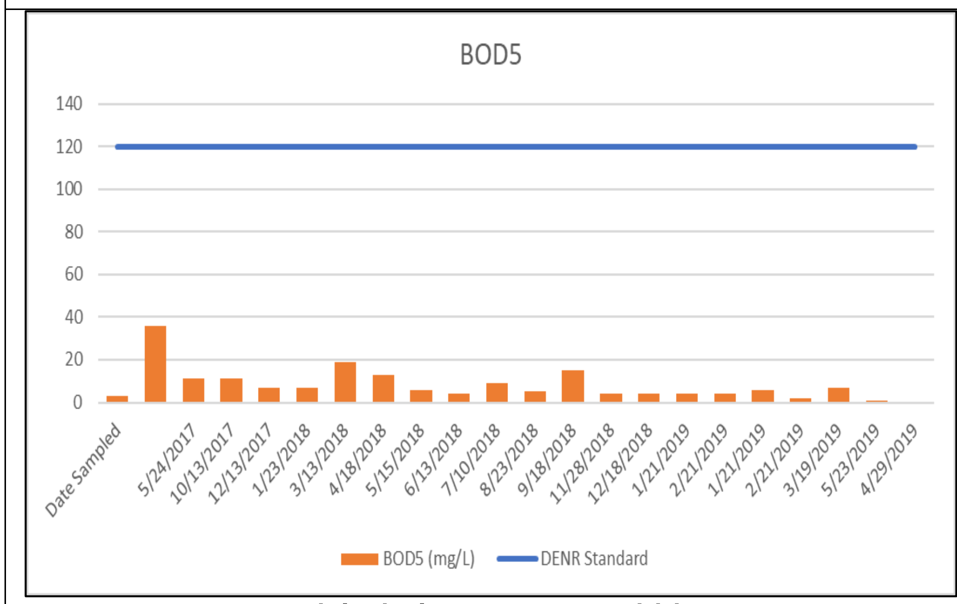
pH



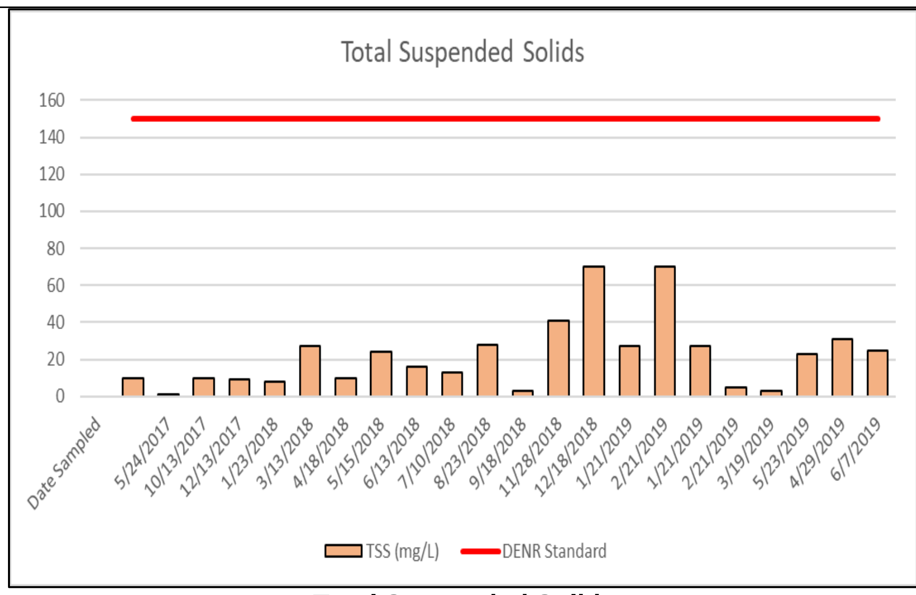
Color



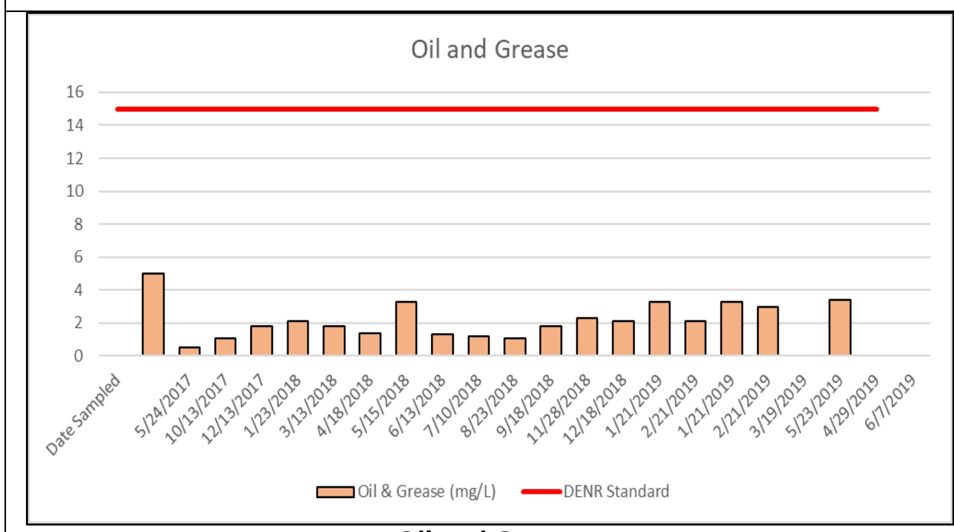
Dissolved Oxygen



Biological Oxygen Demand (5)



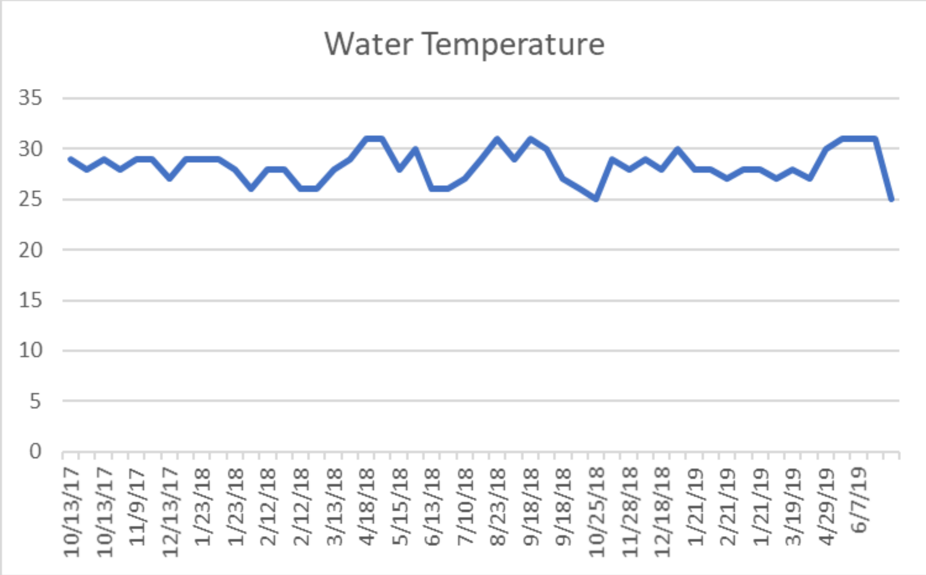
Total Suspended Solids



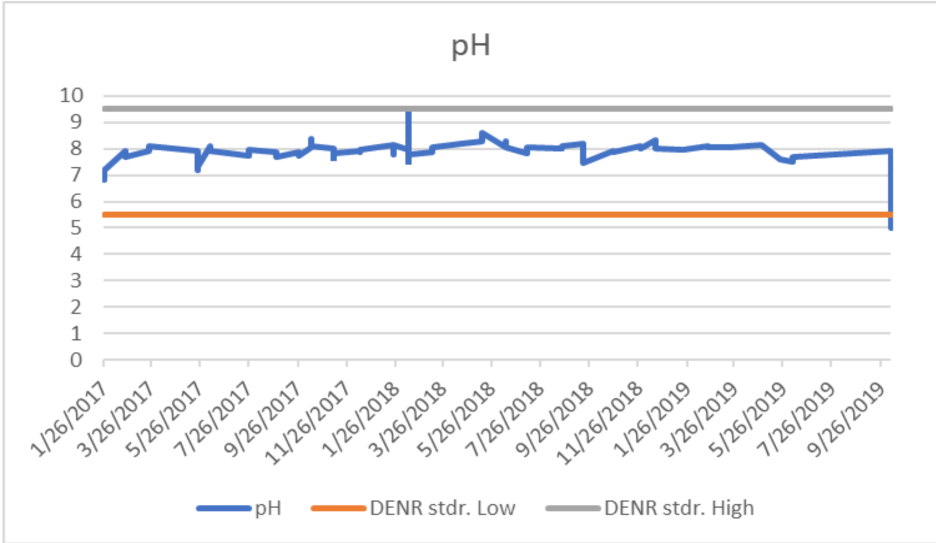
Oil and Grease

Water Quality Monitoring Results at EW5: Silt Pond No. 1

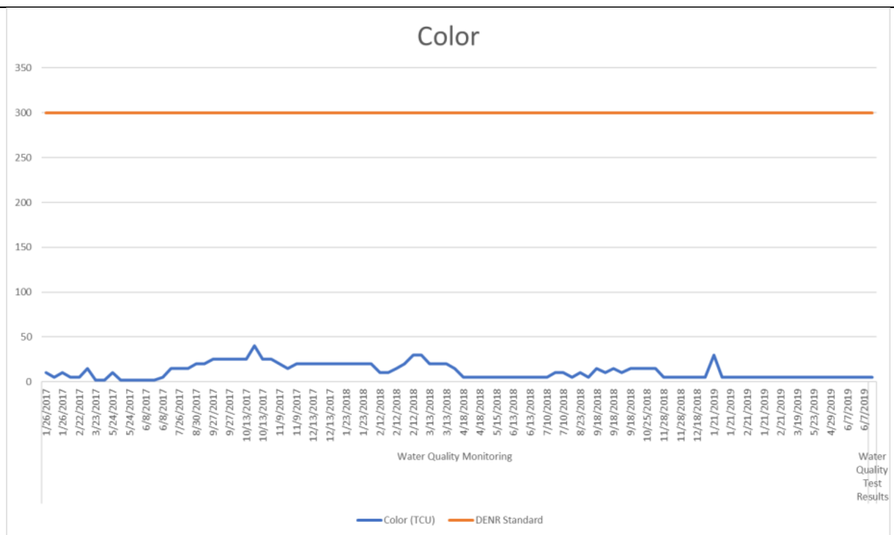
Graph 2.2-8. Water Quality Monitoring Results at EW5: Silt Pond No. 1



Temperature



pH



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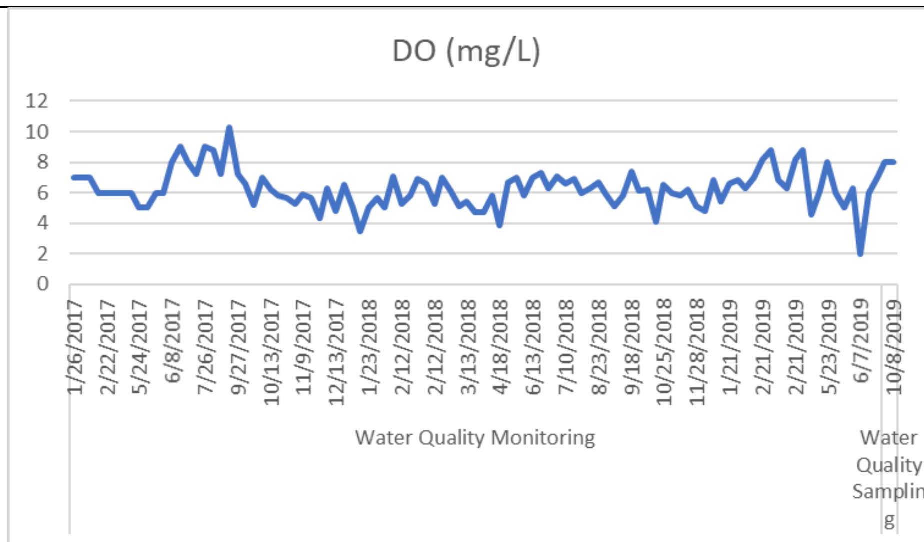
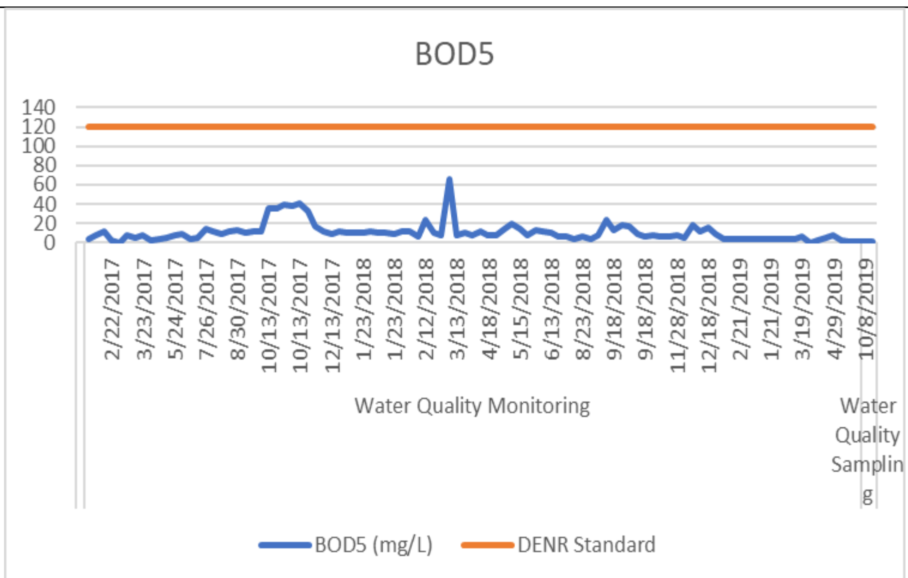


Dissolved Oxygen



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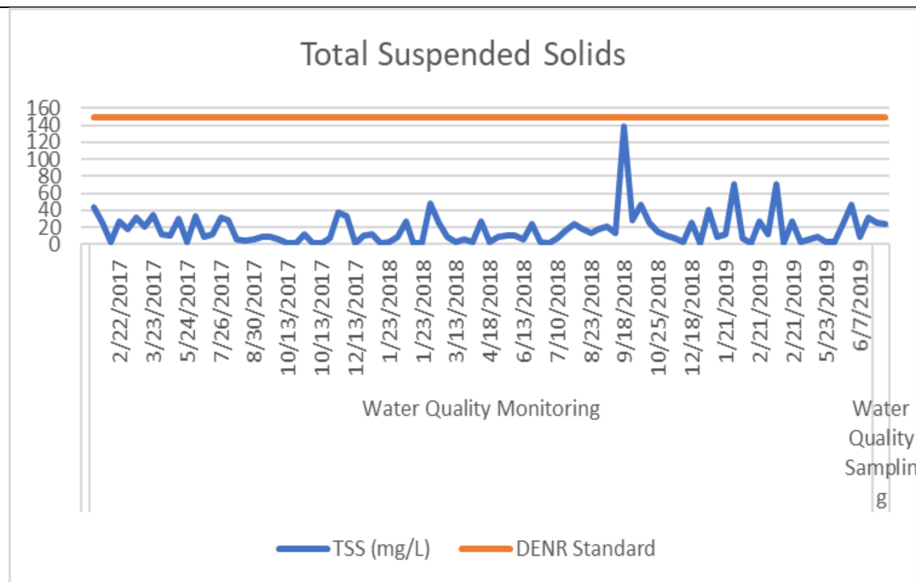
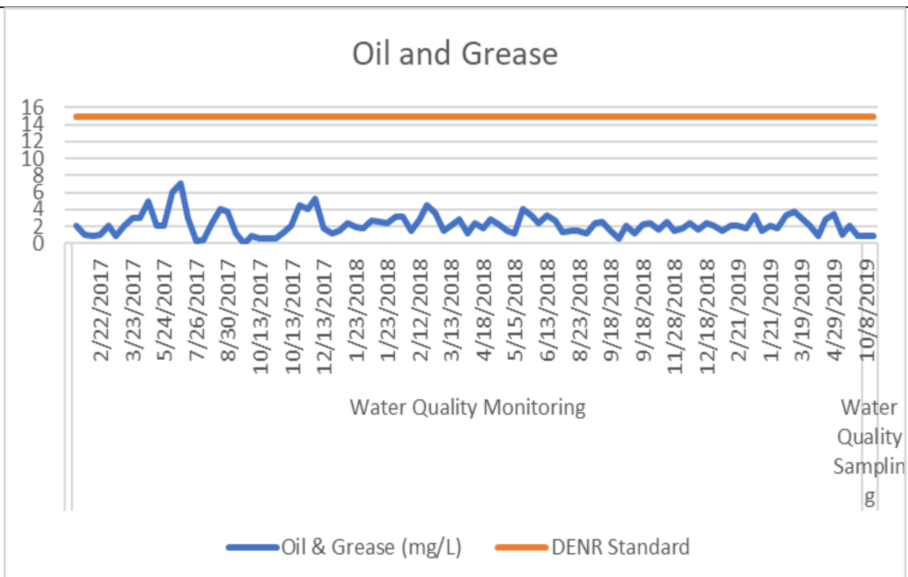


Total Suspended Solids



Oil and Grease

**Water Quality Monitoring Results
In All Effluents Stations (2017-2019)**

Graph 2.2-9. Water Quality Monitoring Results – All Effluents Stations (2017-2019)

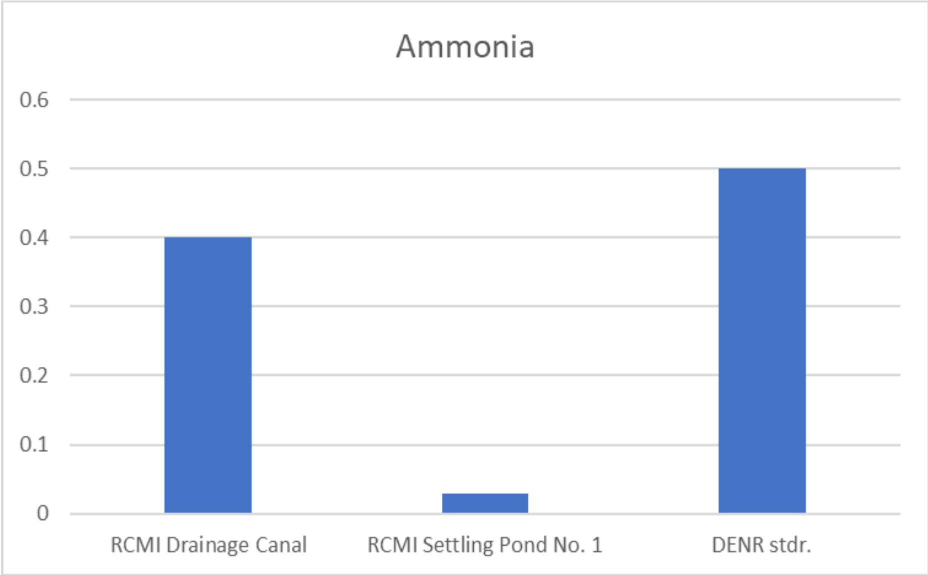
Metals and Nutrient Contents in Effluents

Based on the test results provided, there is no deemed significant effect of the project to the surface water quality in terms of metallic substances in the area near the Plant, it is supported by the graphical representation of each parameter that the water quality of the tested areas are lower than the DENR standard for metalic contamination.

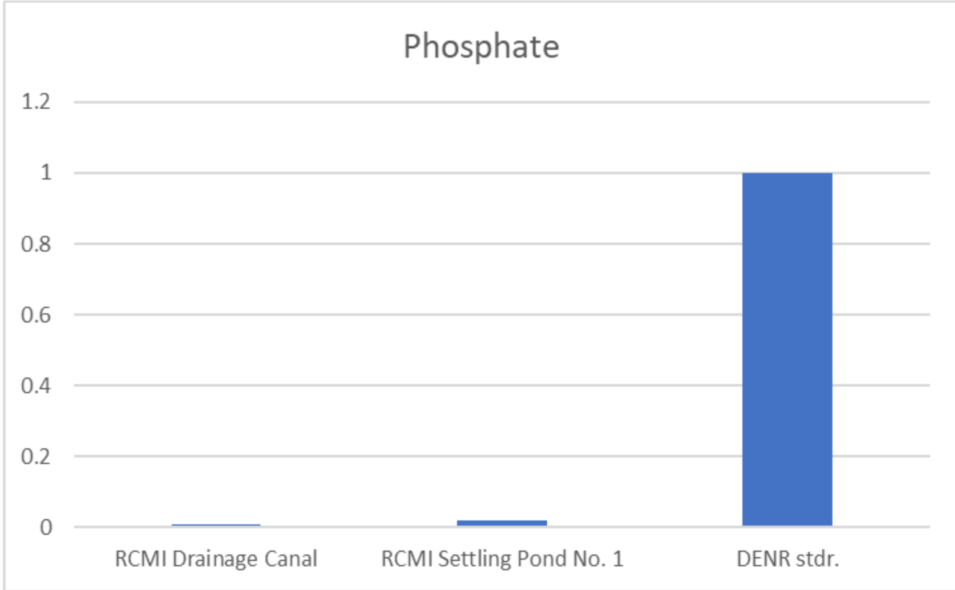
Table 2.2-15. Surface Water Quality Tests for Metallic Substances and Nutrients (October 2019)

Location	Hexavalent Chromium mg/L	Ammonia mg/L	Phosphate mg/L	Nitrate mg/L	Arsenic mg/L	Cadmium mg/L	Mercury mg/L	Lead mg/L
EW6: Drainage Canal	<0.02	0.4	<0.01	0.24	<0.001	<0.003	<0.0001	<0.01
EW5: Settling Pond No. 1	<0.01	<0.03	0.02	0.75	<0.001	<0.003	<0.0001	<0.01
DENR Standard	**0.02**	**0.5**	1	14	0.02	0.006	0.002	0.02

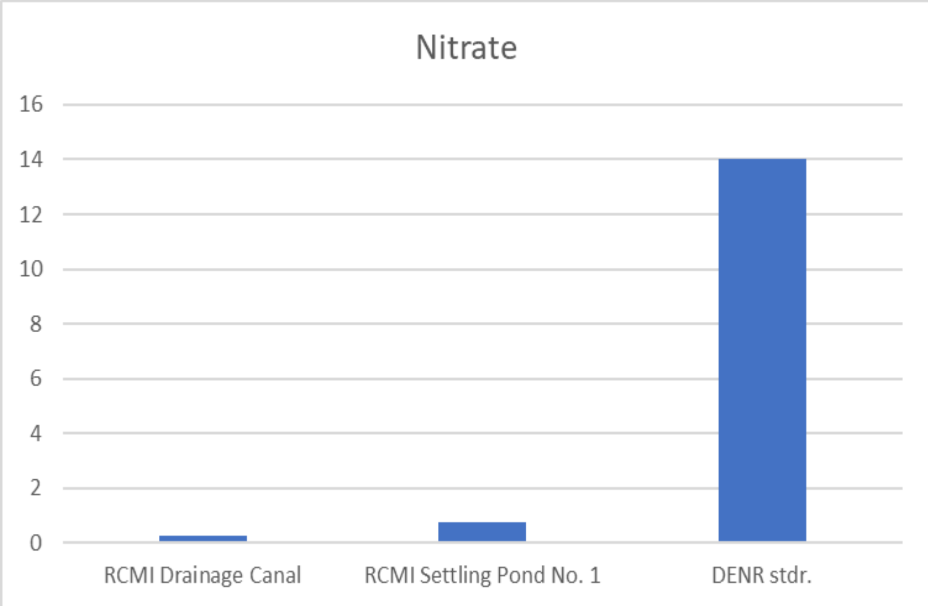
There will be no lake nor river to be affected by the project. The nearest surface water body is Iligan bay which is discussed already. **Figure 2.2-8** shows that the distance of the edge of the project site to the nearest river is approximately 2.25 km.



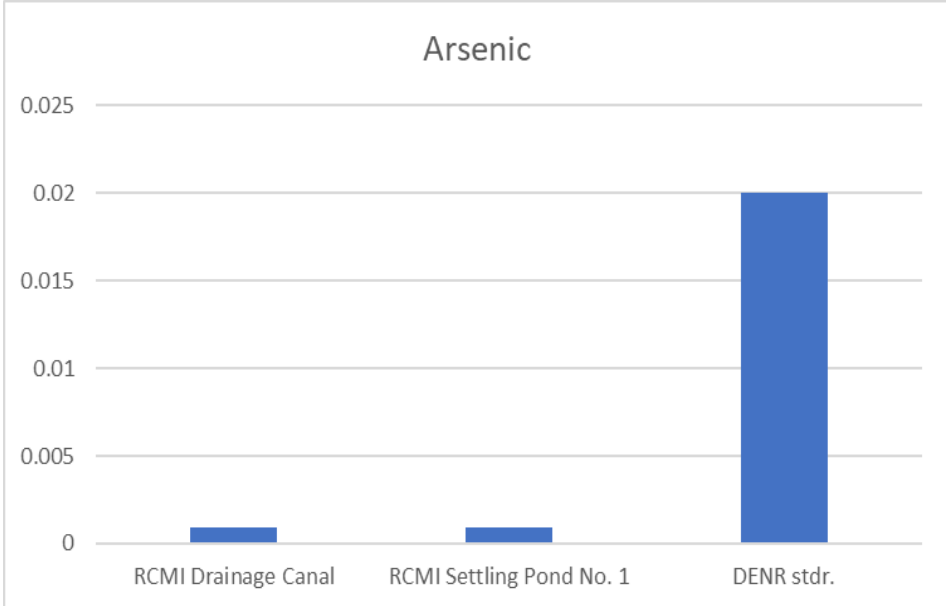
Ammonia



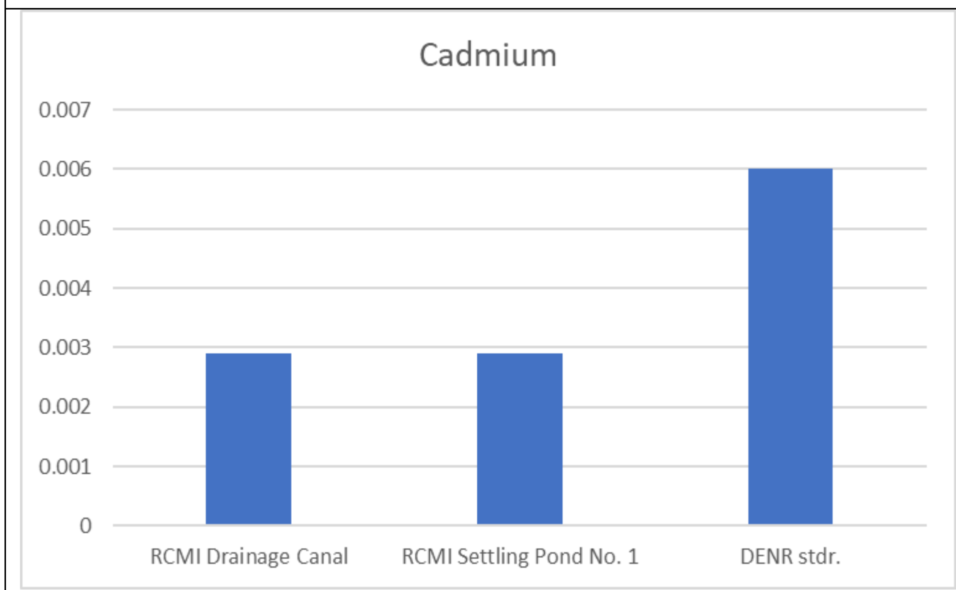
Phosphates



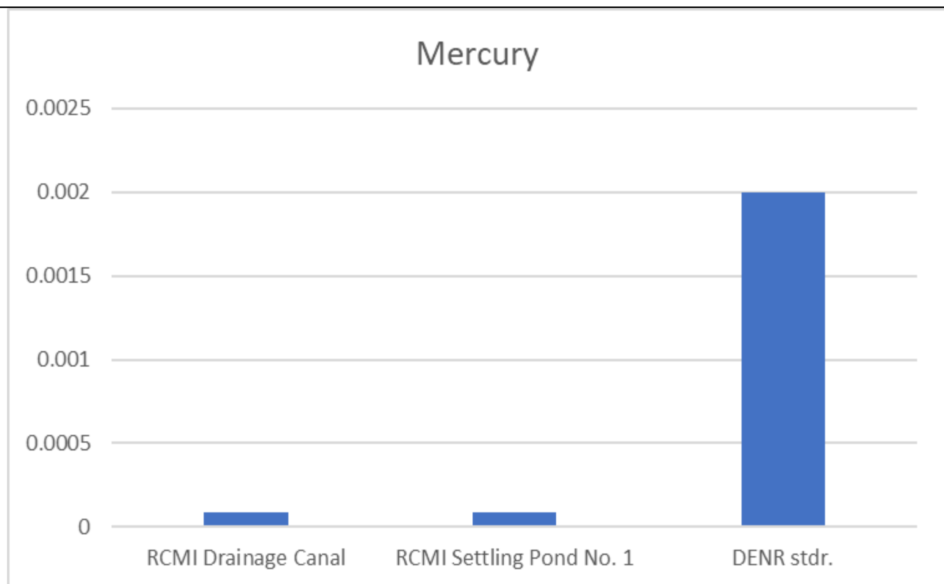
Nitrate



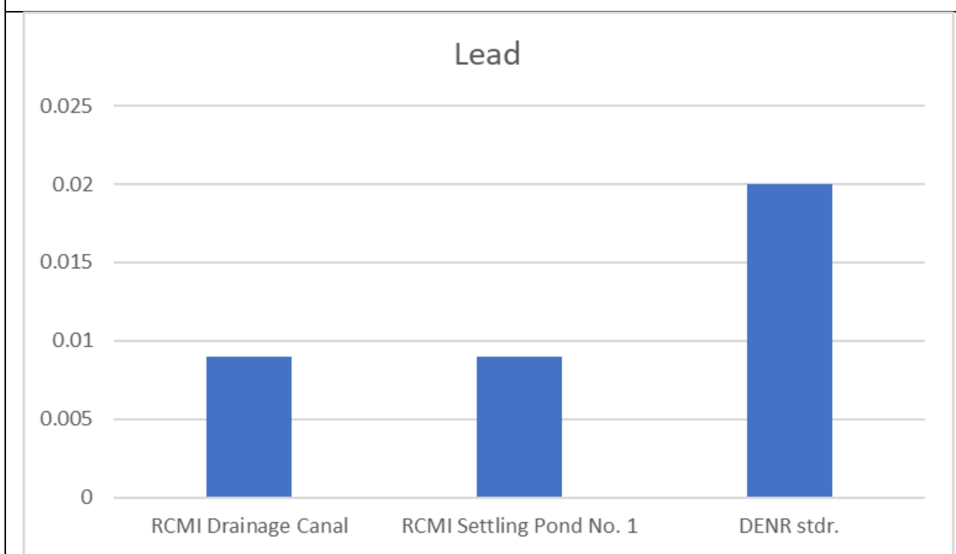
Arsenic



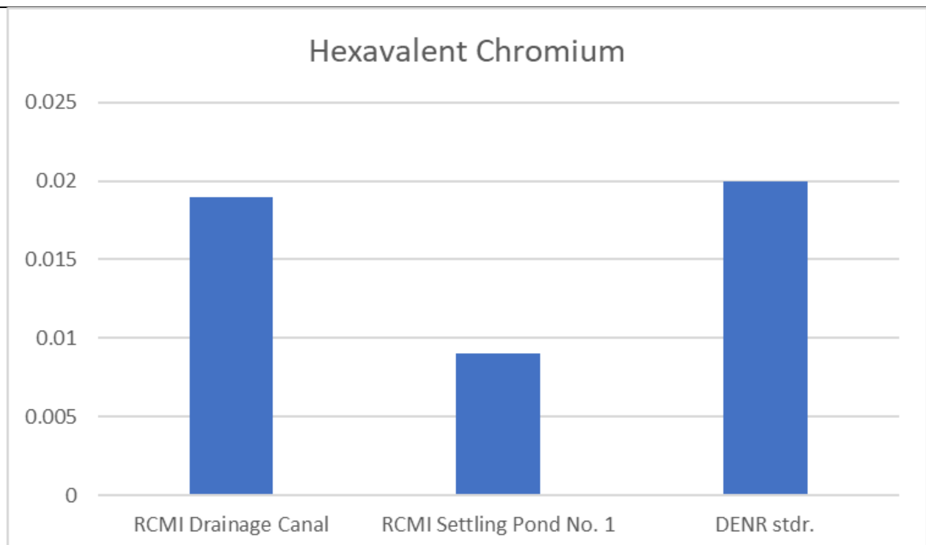
Cadmium



Mercury



Lead



Hexavalent Chromium

Graph 2.2-10. Marine Water Quality Monitoring Results for Metal and Nutrient Contents – All Stations

2.2.3.3 Degradation of Coastal/Marine Water Quality

Data for the historical conditions of marine water quality presented hereunder are taken from secondary sources (CLUP 2000) and RCMI's sampling in 2001.

Table 2.2-16. Physico-chemical Profile of Iligan Bay: Kiwalan-Dalipuga vicinities (1982-1998)

Location	Year	Turbidity (NTU)	pH	Salinity	DO (mg/L)	TSS (mg/L)
Iligan Pier	1982 - 1983		8.39	33.3	6.72	
Kiwalan	1982 - 1983		8.43	33.3		
Portland	1989					109
ICC	1989					266
Dalipuga	May 1995		8.21 - 8.24	20 - 36		
Dalipuga	Dec 1996					
Dalipuga	Jan 5, 1997					
Dalipuga	Jan 1997		7.9	20.26	1.08 - 5	
Dalipuga	Aug 1996	clear		31		14
Shallow	Aug 1996	clear		33.5		75
Deep	Aug 1996			33		87
Daipuga (s)	1996			30		113
Dalipuga (sh)	1996			31		161
Dalipuga (d)	1996			31		130
Dalipuga	1998			32.5		

Source: CLUP of Iligan City, 2000-2010

RCMIs 2001 sampling points were:

Sta D 150m from jetty, sampled July 10, 2001
Sta 6 150m from jetty, sampled Dec 8 & 11, 2001
Sta G 300m from jetty, sampled July 10, 2001 (composite sampling – 2 grabs 50m apart)

Exceedances were present in heavy metals such as lead (0.455 mg/L) and cadmium (0.033 mg/L) and were observed at fixed rates. The exceedances could be the result of the regular hauling/transporting of cement and other industrial products surrounding the coasts. The fixed levels indicate contamination diffusion over some parts of the bay. The bay is positive for coliform but within the allowed limits. The table below show the results.

Table 2.2-17. Marine Water Quality Test Results in Iligan Bay (2001)

Station	pH	Color (PCU)	Temp (deg C)	DO (mg/L)	BOD5 (mg/L)	TSS (mg/L)	TDS (mg/L)	Turbidity (NTU)	Total Coliform (MPN/ 100 ml)	Cd (mg/L)	Pb (mg/L)	O&G (mg/L)
Sta D	8.2	<5	29.2	6	1	4	5,641	0.9	2,400	0.033	0.455	<1
Sta G	8.1	<5	29.2	7	4	1	23,582	0.8	3,000	0.033	0.455	<1
Class SC Std	6.0 - 8.5		< 3 increase	min 5	max 7 (10)	< 30 increase	-	-	5,000	0.01	0.05	3

All physical parameters were within acceptable limits. While there is no standard for TDS, the increasing levels as one goes farther into the sea is perceived very high based on conventional standard set at 1,500 mg/L. Turbidity is minimal (<1 NTU) as well as TSS (1 to 4 mg/L) indicating very low to nil siltation in the area.

Oil and grease are maintained way below the limits. Acidity is within acceptable range. There is abundant supply of oxygen (6-7 mg/L). Further observation revealed the presence of abundant fish and other marine organisms within 300m distance from the jetty.

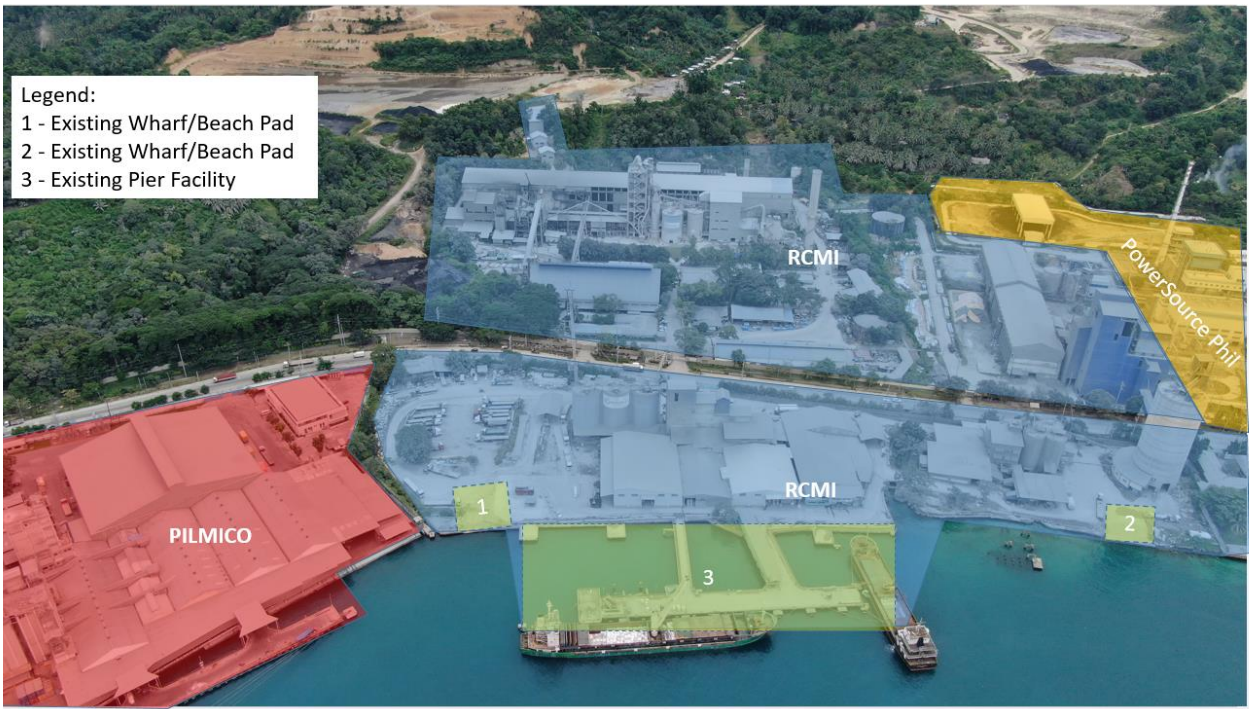
AFTER 2004/2006 ECC (EXISTING)

The historical trend of the marine water quality as recorded in the regular monitoring of the project is discussed below.

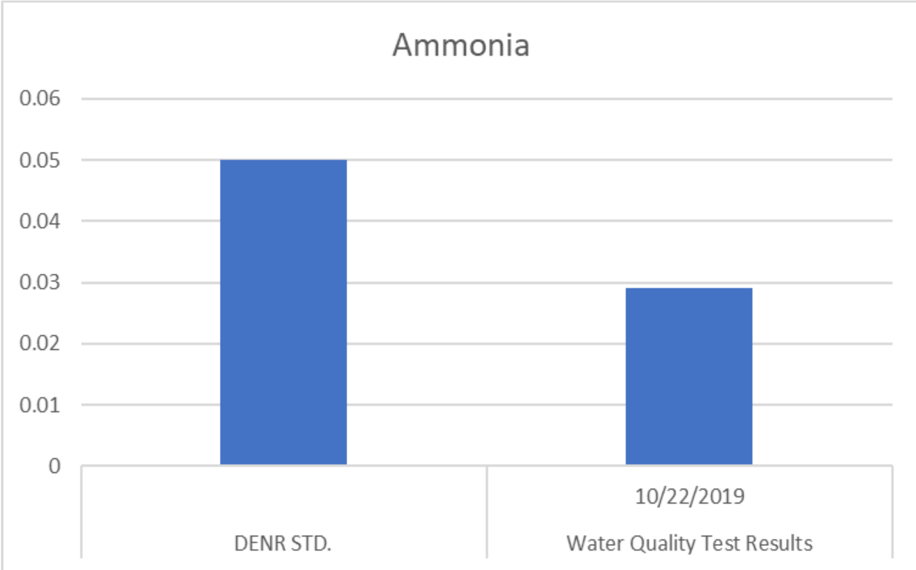
There is general compliance with the DENR standards and hence, it can be said that is no significant effect of the project to the marine water quality in the RCMI vicinity. Minor exceedance is observed for the temperature (32), which exceeded the DENR higher limit three times and once for the O & G limit (3.8 mg/L). This may be attributed to oil spills from sea crafts and not from the project. See graphical representation. This may be gleaned from the table below**.**

Table 2.2-18. Marine Water Monitoring Test Results at Station MW1

Parameters	Class SC Standard	7/10/2018	8/23/2018	9/18/2018	11/25/2018	11/28/2018	12/18/2018	1/21/2019	2/21/2019	3/19/2019	4/29/2019	5/23/2019	6/7/2019	10/22/2019
pH	6.5 8.5	7.94	8.21	8.13	8.17	7.85	7.96	7.65	8.21	8.5	7.9	8.5	8	8.3
COLOR	75	5	5	10	5	5	5	5	5	5	5	5	5	5
Temp	25-31	32	32	28	NS	NS	NS	27	30	27	31	31	32	25
TSS	80	34	23	47	40	34	37	13	18	4	23	32	13	33
Oil and Grease	3	1.7	1.1	0.9	1.1	1.3	1.5	1	3	3.8	2.8	0.9	1	<1
Hexavalent Chromium	0.05	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	<0.01
Ammonia	0.05	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	<0.03
Phosphate	0.5	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.02
Nitrate	10	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.06
Arsenic	0.02	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	<0.001
Cadmium	0.005	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	<0.0001
Mercury	0.002	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	<0.0001
Lead	0.05	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	<0.002



Based on the test results provided, there is no deemed significant effect of the project to the marine water quality in the area near the RCMI plant except the Water temperature which excedes the DENR high limit 31 three times and also exceeds the DENR limit of 3 in Oil and Grease two times, it is supported by the graphical representation of each parameter that the water quality of the tested areas are lower than the DENR standard for metalic contamination.



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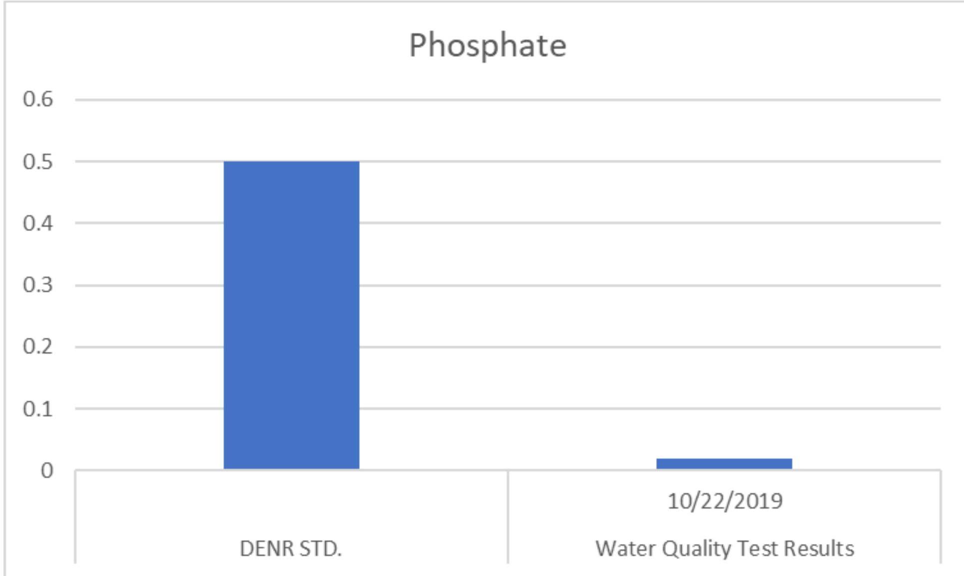
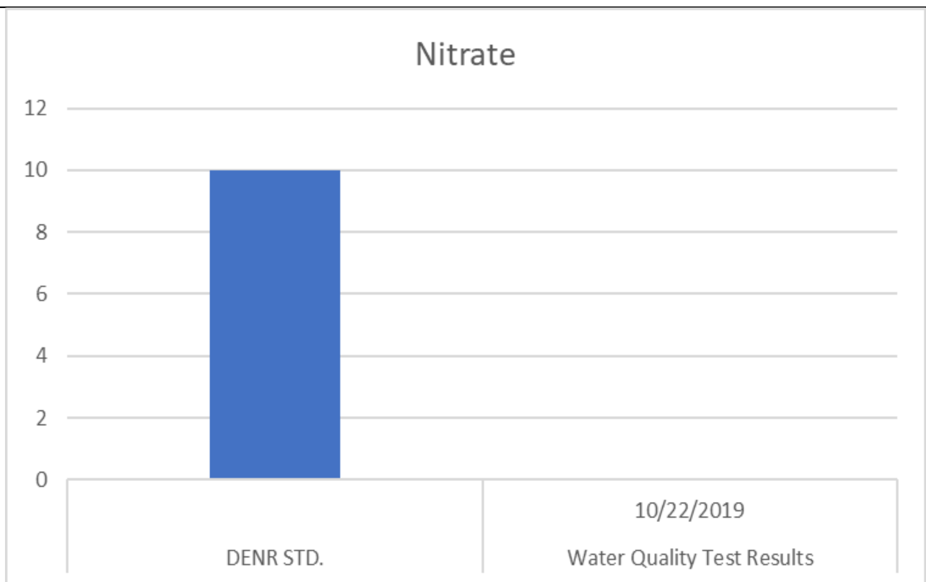
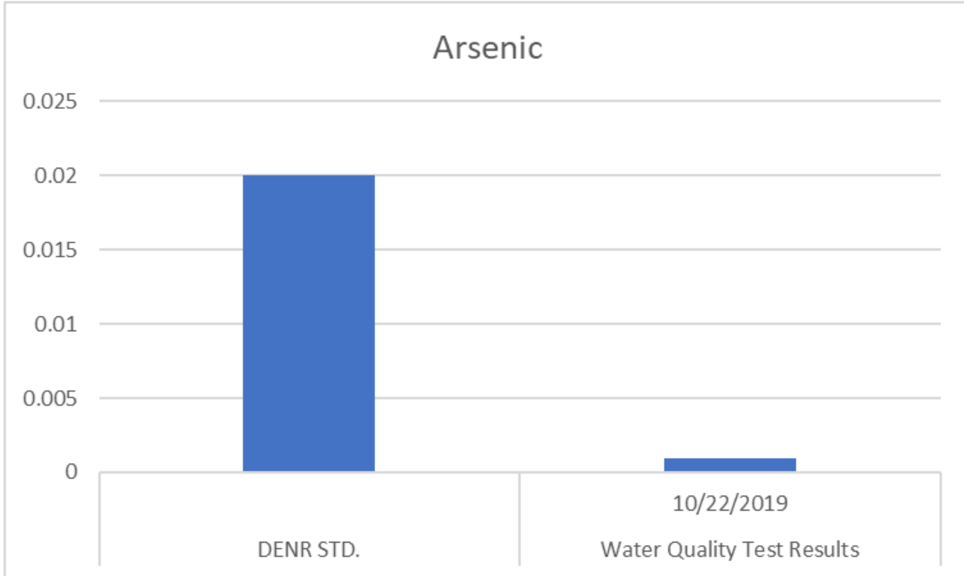


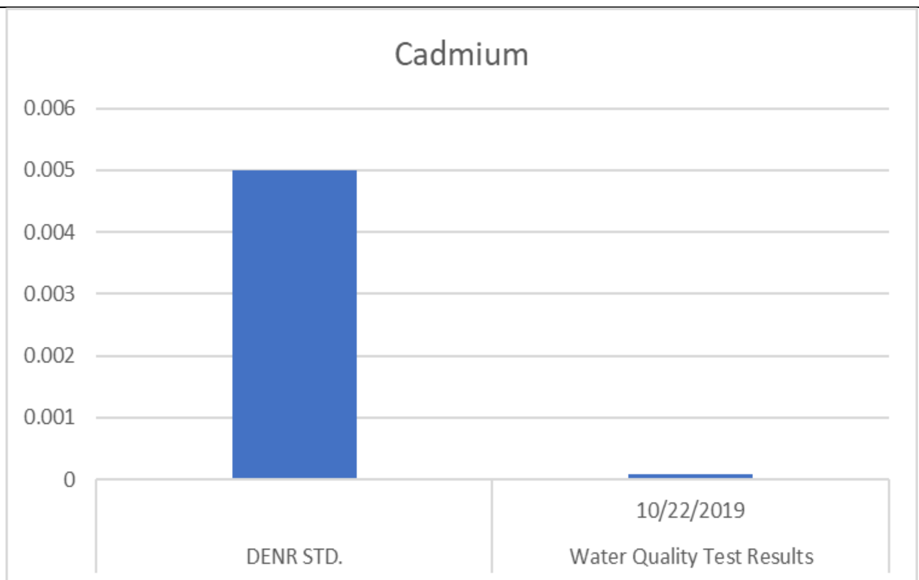
Phosphates



Nitrates



Arsenic



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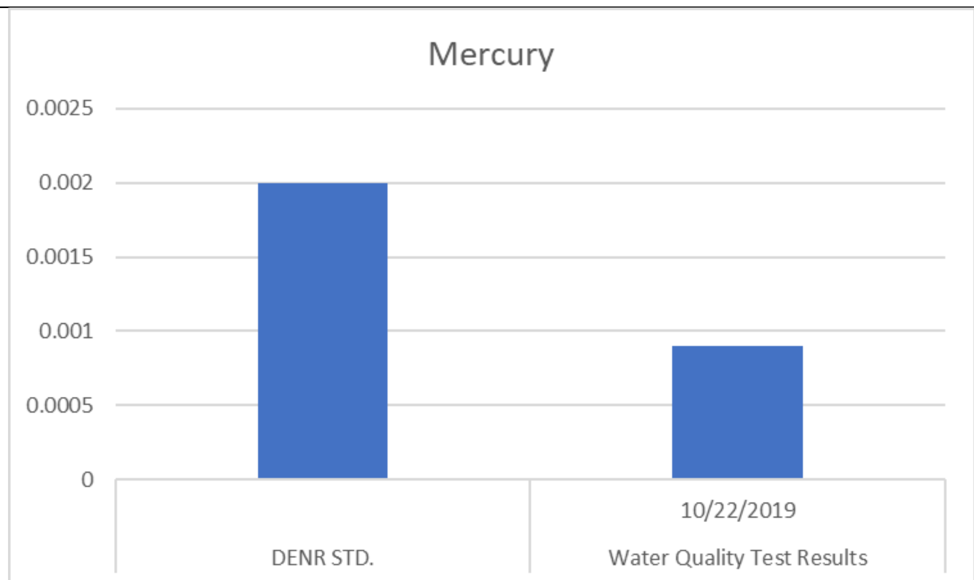

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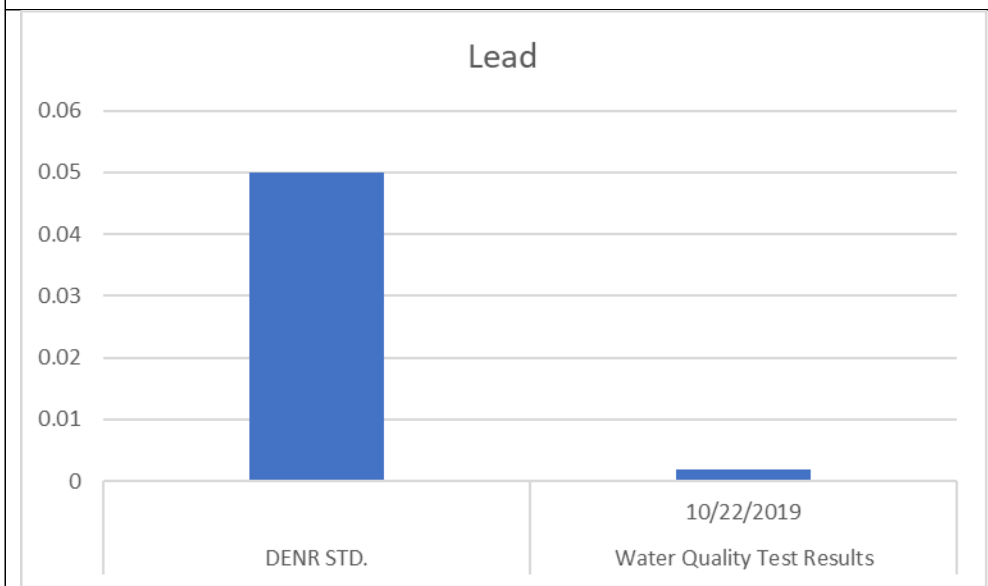


Lead

Marine Water Quality Monitoring Results (Metals & Nutrients) in All Stations

Graph 2.2-11. Marine Water Quality Monitoring Results for Metal and Nutrient Contents – Station MW1

The results of the water quality monitoring provided in **Section 2.2.3** demonstrate general compliance with the DENR standards. Isolated exceedances were noted for Temperature and Oil and Grease. See **Graph 2.2-9. These are attributable to discharges from other sources.**

These are, however, deemed as not of long-term concern because no notice(s) have been received by RCMI from the MMT nor from the EMB on these findings. Nonetheless, continuous monitoring's are being observed by RCMI and corrective measures accordingly made when applicable.

Other matters of interest:

There will be no additional wells or expanded extraction rates for the expansion project. There are no springs in the impact areas.

In case of abandonment of the project, the decommissioning plan will consider the effects on the households. The abandonment/decommissioning plans are envisaged for the future yet and not immediately after the securing of the ECC for the expansion project.

An in-depth assessment of the groundwater quantity and quality in the coastal plain particularly focusing on evaluation of saline intrusion and compliance with the PNSDW. This matter is well noted, however, compliance with the PNSDW may not be relevant because the groundwater which is under the permits of RCMI is not envisioned for use as Drinking Water.

The potential locations of the new coastal plain wells and the rationale for the site selection. This matter while significant is deemed not within the Scope of the EPRMP/ECC Amendment being applied for. The expansion project is focused on the existing wells within the plant site.

The pros and cons of the coastal water sources in terms of environment, water quality, technical, and social. Number of households expected to benefit from the location of the new coastal wells. Matter as to whether these wells strategically located in close proximity to communities that it will serve. If not, plan of the project to make water more accessible to communities.

Similarly, it is reiterated that the expansion project is focused on the existing wells within the project site and not on coastal under groundwater which are outside the impact areas.

2.2.4 Freshwater Ecology

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

Threat to existence and/or loss species of important and habitat is deemed not relevant to the discussion, **Figure 2.2-8 above** shows that the nearest freshwater body is 2.25 km away from the edge of the project site.

2.2.4.2 Threat to abundance, Frequency and distribution of Species

The above threats are not relevant to the project in the absence of adjacent fresh water bodies.

2.2.5 Marine Ecology

Methodology

Being an EPRMP the performance vis-à-vis marine ecology is discussed. Trends based on monitoring data when available are considered. However historical monitoring data are not available to enable good trending evaluation. Predicted impacts and mitigation thereof are presented.

Methodology is first discussed before data or results presentation. The methodology includes maps and coordinates of major sampling sites and photo documentation.

Benthic life forms- corals and associated coral-associated fauna.

The survey characterized coral reef morphology by estimating the cover of various coral life forms (the percentage cover of living corals as well as other benthic life forms, e.g., soft corals, sponges, etc) utilizing standard categories in one line intercept transect (LIT; English et al.,1994) in the inner water of the pier. The survey protocol involved the laying out of a 50-m transect parallel to the shoreline and following the reef contour. Data generated from line-intercept surveys for coral reef assessment provides more rigid data sets on percentage of live coral cover as well as species distribution that can be ultimately used for comparative evaluation if the same survey stations are monitored in the future. The categories utilized for classifying coral cover follow standard ratings used for live coral distribution, i.e., *76-100% live coral cover = Excellent; 51-75% coverage live coral cover = Good, 26-50% coverage live coral cover = Fair, and 0-25% coverage live coral cover = Poor coral cover (Gomez, et. al.,1981).*

A single line intercept transect was laid out in the inner sea beneath the Republic pier traversing up to the area which was already dredged and for which no further dredging activities would be undertaken.

The coordinates of the transect are N 08.286554°and E 124.261936°. The survey in this station was supplemented by spot dives to reinforce information on the extent of coral cover and record other relevant information. The overall characterization of coral life forms are described following standard categorization as follows (From Gomez, 1994):

Table 2.2-19. Standard categories employed in describing condition of coral cover

CRITERIA	CONDITION
Excellent	76-100% live coral cover
Good	51-75% live coral cover
Fair	26-50% live coral cover
Poor	0-25% live coral cover

Quantity of Coral Colonies

The number of coral colonies in the inner sea and the RMCI pier area was catalogued in consideration of the possibility that corals in the latter sector might be trans-located if such colonies are endangered by any future plans for dredging activity or by sediment clouds arising therefrom. No such dredging activities are confirmed as of this time.

Four divers conducted the enumeration of corals – two divers undertook counting of corals along the pier wall revetments while the other two catalogued corals across the inner rocky ledge, piles and walls beneath the pier access.

Corals in Kiwalan Cove

Separately, in the Kiwalan reef, a small fringing reef hugging part of the coastline in front of the separate adjacent power plant project of PowerSource Phils. Inc (PPEI) pump house hosts some of the most robust branching and massive corals in the entire coastline of Kiwalan and neighboring Barangays in Iligan City. This reef patch, which lies about 350 meters southeast of the RCMI pier, contains extensive staghorn and massive corals in both its crest and slope. In May 2016, a comprehensive assessment of corals in the vicinity of the PPEI's (a power plant project near the project site) intake and outfall pipes was undertaken (source: *Report of Results of Assessment of Coastal Habitats and Resources in the Coastal Impact Area of PPEI Outfall and Intake Pipes; May 2016*).

Two line intercept transects were laid out and investigated in the narrow fringing reef in the vicinity of coastal waters in front of the PPEI pump house. The two transects focused on a strip of coral reef traversing the proposed location of the intake pipe, with the reef slope in 8 to 12 meters of water.

Fish species richness and abundance.

Fish visual census was conducted along the line intercept transect fro corals in the inner sea behind the RCMI pier and other fish species were recorded during systematic snorkeling beside the pier walls.

Reef fish assemblages were catalogued using a modification of the standard Fish Visual Census (FVC) technique described by English et al. (1994). The conduct of FVC is aimed to document a fairly accurate picture of demersal fish species *richness, abundance and biomass* of fish assemblages within the 10-meter belt corridor following a 50-meter transect station. FVC surveys document mostly demersal, reef-associated species of fish that normally indicates the robustness of a coral reef ecosystem. High values for these indicators can indicate the overall ecological condition of a reef area and high species richness is normally associated with robust ecosystem functions. In healthy reefs, the fish species diversity may include both commercially important fish (e.g., Groupers, Snappers) and reef-dependent species of fish such as Angelfishes and Butterfly fishes. The estimation of fish biomass in the stations surveyed can subsequently be used to extrapolate the average fisheries productivity of the broader coastal area under normal circumstances, especially in view of the fact that demersal fish can supply about 30 percent of total food fish production in a locality. This productivity value is in fact one of the most important merits in protecting coral reefs. Collectively, the results of coral reef assessments and fish visual census are used as reference points for comparative monitoring of changes in spatial distribution and diversity of benthic life forms in periodic environmental impact monitoring and are used as vivid indicators of sediment intrusion in coastal waters as coral polyps are sensitive to sediment suffocation.

Fish species encountered in the FVC transects are categorized as target, major or indicator species based on categories recommended in *FishBase* (2004). Target species are economically important food fish that are normally sought by fishers for trade of for food. In reef areas, such demersal species may include high value groupers (*Ephinephalidae*), snappers (*Lutjanidae*), jacks (*Carangidae*) and some species of surgeons (*Acanthuridae*). Fish that belong to the major fish category are considered to be ecologically important because they occupy unique niches and sometimes symbiotic relationships in the coral reef ecosystem. Many of these species are represented by members of the prolific damselfishes (*Pomacentridae*) and wrasses (*Labridae*). Indicator species are coral-feeders whose presence, variety and abundance in a reef area may give an indication of the robustness and diversity of corals present in the reef.

Figure 2.2-9 is the map showing line intercept station for detailed coral and other life form distribution in the primary impact area

Fish visual census was undertaken in the same coral line intercept station **(Figure 2.2-10)**

Figure 2.2-9. Map showing line intercept station for detailed coral and other life form distribution in the primary impact area of the Project

Figure 2.2-10. Map showing the fish visual census station surveyed in the primary impact area of the RCMI PROJECT

During the marine observation/survey periods the fish population was largely confined to the RCMI pier area hence the rationale for the methodology of FVC conducted at this site.

The main survey pathway was laid out across the inner sea beneath the pier structure where a ledge of about five (5) meters comprised of concrete slabs, boulders and firm rubble has been colonized by coral colonies).

Outside of the waters ‘inside’ the pier, broad area rapid benthic assessment employing continuous manta tows and spot dives were undertaken in order to pinpoint other coral reefs or patches of coral life forms that may be linked to the ‘inner’ corals.

Seagrass meadows

The survey also involved identification of the location of seagrass meadows, if any, and determining species distribution. Sampling of plankton communities, macro-invertebrates and soft bottom fauna was undertaken; with plankton and soft bottom benthos sampling in four (4) stations, seagrass in one (1) station and opportunistic surveys to identify macro-invertebrates of significant commercial value along the revetments of the pier wall.

The survey stations and pathways were established employing GPS – referenced coordinates after preliminary analysis of maps showing the location of the pier and the area to be dredged.

Plate 2.2-1. The survey site in the rear side of the RCMI pier (left, with team member doing manta tow) and pier columns/pylons (right picture).

Figure 2.2-11. Survey area in the RCMI pier where marine ecology baseline assessment was focused on

Characterization of the nature of bottom substrate and seabed morphology in waters behind and near the RMCI pier (Lug-it area).

The nature of the seabed and benthic environment in the vicinity of the pier was surveyed and defined through manta tow surveys in continuous pathways, supplemented by spot dives with scuba. Primarily, manta tow is used to pinpoint the location and abundance of corals, seagrass and other benthic resources in a continuous stretch of the broader environment of the project area in order to generate a collective assessment of the diversity of coastal habitats that can be prone to anthropogenic disturbances. Observations on percentage distribution of corals and associated benthos perceived within the tow stations are recorded in accordance with standard categories to characterize the overall scenario and diversity in the broader primary impact area. In areas where significant coral reefs occur, results from a manta tow survey are used to pinpoint the locations of ideal stations where more detailed underwater coral reef characterization employing line intercept transects are undertaken.

The manta tow stations are displayed in **Table 2.2-17** and presented in **Figure 2.2-12.**

Table 2.2-20. Coordinates of manta tow stations surveyed during marine ecology baseline assessment in coastal waters around the pier area of RCMI

Tow Coverage	Coordinates/Location [DecDeg]
S00a	N 08.286626°; E 124.261891°
S00-T01	N 08.287226°; E 124.261073°
T01-T02	N 08.286881°; E 124.259671°
T02-T03	N 08.287111°; E 124.258290°
T03-T04	N 08.287496°; E 124.257098°
T04-T05	N 08.288659°; E 124.256955°
T05-T06	N 08.289667°; E 124.256228°
S00b	N 08.288344°; E 124.255720°
S00b-T07	N 08.286918°; E 124.256591°
T07-T08	N 08.286282°; E 124.258308°
T08-T09	N 08.285960°; E 124.260091°
T09-T10	N 08.285646°; E 124.261491°

Figure 2.2-12. Manta tow pathways investigated for benthic life form characterization

Mangroves

Visual surveys were employed for the mangroves communities for possible presence within the RCMI impact areas.

Seagrasses

Seagrass communities are 'true plants' of the sea and their roots enable firmer substrate that ultimately sequesters silt and sediments in the water column that ultimately reduces turbidity. The seagrass blades ("leaves") and rhizomes support a diverse array of marine animals, including marine turtles and the commercially important rabbitfishes or 'Dangit'.

The coordinates of the seagrass stations are listed in **Table 2.2-18** below:

Table 2.2-21. Coordinates of Survey Stations for Seagrass Diversity

WP Code	LATITUDE	LONGITUDE	REMARKS
SGR1	N 08.284639°	E 124.263444°	Recorded 4 species with an overall subtotal percentage cover of 16.5% where the dominant species was *Thalassia hemprichii* at 13.0%. Observed sediments from rivers, storm runoff, sewage or industrial discharges reduced water clarity in the survey site. The rest of the substrate is sand/mud at 79.0% with associated biota *Padina* sp. @ 4.0% and *Sargassum* sp. @ 0.5%
SGR2	N 08.283444°	E 124.264056°	Recorded 5 species with an overall subtotal percentage cover of 33.5% where the dominant species was *Thalassia hemprichii* at 16.5%.Sediment-saturated seawater was again observed in the survey site which can physically smother the seagrass or cause water turbidity that may impair photosynthesis. The rest of the substrate is sand/mud at 62.5% with associated biota of algal assemblages @ 2.0%, coralline algae @ 1.0%, and *Halimeda* sp. @ 1.0%.
SGR3	N 08.282694°	E 124.264139°	Recorded 4 species with an overall subtotal percentage cover of 43.0% where the dominant species was *Syringodium isoetifolium* at 19.0%. The seagrass bed is highly disturbed as evidenced by the presence of uprooted rhizomes observed along the transect line, since the survey site is exposed to high wave action during the monsoon seasons. The rest of the substrate is sand/mud at 57.0% with clusters of sea urchins also observed.

Plankton and benthos

Plankton communities and the primary productivity that they nurture constitute the lower base of the marine food chain and sustain the life cycle of many fish and crustaceans. Composition, abundance and density of phytoplankton communities was determined using standard plankton vertical net surveys, and bio-assessment metrics that includes Shannon-Weaver

Diversity/Evenness Indices and Pielou Index of Evenness.

In conjunction with plankton community sampling, sediment samples were obtained in the same stations for assessment of sand and soft bottom macro-benthos. Soft bottom animals, including enchinoderms, mollusks and other invertebrates are significant indicators of ecosystem health and marine pollution. Filter feeders and detritus feeders like clams and gastropods are normally susceptible to sediment disturbance. Mussels, in particular, are used as monitors for bio-toxin levels in such bivalves particularly during plankton blooms. Plankton composition was analyzed in the laboratory of the UP Marine Science Center in Diliman, Quezon City while analysis of benthos organisms in the samples was undertaken in the laboratory of the National Museum in Manila.

A total of four plankton and benthos sampling stations were investigated, shown in **Figure 2.2-13** and **Table 2.2-19.**

Table 2.2-22. Coordinates of plankton community sampling stations

WP Code	LATITUDE	LONGITUDE	REMARKS
PLK1	N 08.286600°	E 124.261820°	“inner waters” behind Pier; depth at 3.8 meters
PLK2	N 08.287080°	E 124.261380°	Behind pier; Dredging area; Depth 5 m
PLK3	N 08.286170°	E 124.260260°	Outside pier going towards Pilmico; Depth 23.6 m
PLK4	N 08.285780°	E 124.261340°	Front side of republic pier; Depth 21.2 m

Figure 2.2-13. Map showing the plankton community sampling stations surveyed in the primary impact area of the RCMI Project

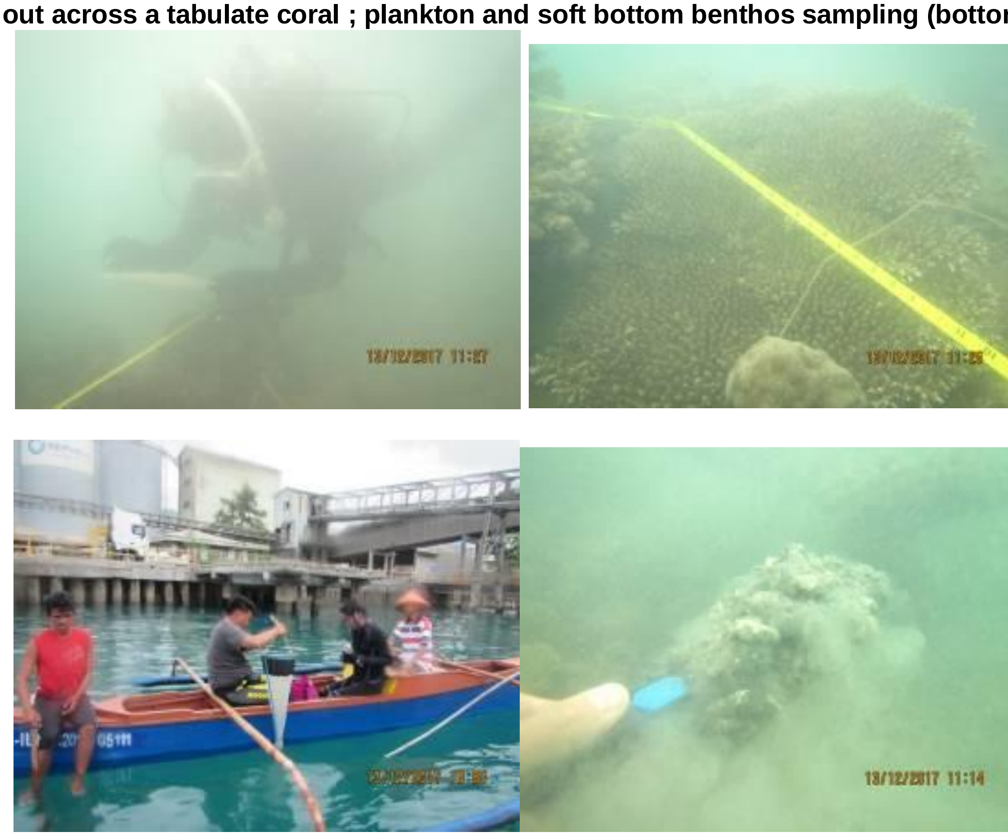
Macro-invertebrates*.*

Bivalves, gastropods and echinoderms are important marine animals that provide livelihoods to many fishers, specifically women in fisheries. Opportunistic survey of benthic and epi-benthic macro-invertebrates of commercial importance for food and trade (Echinoderms, Molluscs, and Crustaceans) was undertaken along the pier wall behind the Republic Cement jetty during the coral survey. The coordinates of the macro-invertebrate survey site are N 8.286965° and E 124.261786°.

Fisheries Documentations

Documentation of actual fishing operations and key informant (KI) interviews was conducted to determine (i) dominant fisheries resource practices, (ii) catch composition and indicative productivity of fishing gears, (iii) issues confronting the fisheries sector and how issues potentially generated by the Project can affect fisheries and fishing practices.

Plate 2.2-2. Survey team doing broad area benthic profiling through manta tow and detailed coral assessment through line intercept transect method (upper photos with the line transect laid out across a tabulate coral ; plankton and soft bottom benthos sampling (bottom photos).



Survey results

Corals and associated life forms
Broad area benthic characterization through manta tows

A total of ten (10) manta tow benthic observations pathways, one line intercept transect and four (4) spot dives were completed on 12-13 December 2017. Two (2) of the tows and spot dives were located inside the pier area; five (5) tows and two (2) other spot dives were conducted in a northerly direction towards the Philmico jetty while three tows were conducted past the Pilmico jetty. In addition, systematic snorkeling was conducted in shallow waters south of the RCMI pier in the vicinity of the reef in Kiwalan cove (front of PPEI pump house). In ten tows, only three (3) pathways hosted corals while the rest were deep water where the benthic environment is presumably comprised of sandy substrate. The first two tows where corals were encountered were inside the Republic pier while outside of the port complex, the lone tow station where corals were encountered is in the vicinity of the Philmico jetty. Corals in the area of the pier under the jetty piles are located in boulders in the squat shelf beneath the pier, in pylons and concrete posts along the jetty structure, and in the concrete revetments along the wall of the pier. Coral colonies in the "inner sea" beneath the jetty are more dispersed and profuse – in pier walls, piles and in the seabed where rocks and concrete blocks are spread out. In the dredging area, the seabed is dominated by mud and silt and corals have settled only in the backside, along pier walls and pylons. In this area, corals were only seen at the start of the tow pathway, in jetty piles and pier walls; in the seabed in most of the tow, , corals were completely absent.

The corals are comprised mostly of recruits of massive *Porites*, branching *Acropora* (e.g., *A. palmata*), foliose and encrusting corals **(Plate 2.2-3).** In two manta tow observation pathways across the ledge along the pier wall, coral distribution was estimated at an average of only 15.0% live hard coral cover (LHC), 10% dead coral with algae and the rest comprised of silt-encrusted concrete, sand and muddy substrate. Coral cover in the 'inner' sea was vividly higher and more diverse than coral communities in the area to be dredged, with Tow station number 1 exhibiting an average of 25% live hard coral cover, 10% dead corals with algae and soft corals less than 5% across the survey belt. Manta tow and spot dive surveys in the dredge sector indicate 5% live hard coral cover, mostly attached to the pier wall and concrete slabs underneath, 10 % dead corals and 85% mud and silt (**Table 2.2-20**) Even as live coral cover is relatively low, it should be noted that the walls and slabs in 'inner' sea vividly serve as settlement area for coral planulae and the presence of recruits indicate vigorous recruitment that can continue in the future, eventually resulting to increasing coral cover.

In the Pilmico jetty, hard coral cover was cataloged at 5%, along with 10% dead corals, 15% rocks/boulders. The rest of the substrate was comprised of sand. This coral patch is about 800 meters from the Republic pier. Towards the south, dense coral colonies were encountered through spot dives were undertaken in the area because manta tows were not possible due to the presence of two barges blocking the tow pathways. Spot dives indicate live coral cover ranging from 40% to 60% in this reef, which is above average. No seagrass communities were encountered in the area of the Republic and Philmico piers but were encountered extensively in shallow waters fronting the PPEI pump house.

Results of the manta tows are mapped in **Figure 2.2-14** tabulated results of the manta tow survey pathways is presented in **Table 2.2.20.**

Table 2.2-23. Manta Tow Results for Reef and Substrate Composition

Site name:	Offshore waters across the Republic Cement Plant Site in Kiwalan, Iligan City	**Survey Team:**
Time / Date:	1508H-1540H, 13 December 2017	1. Benjamin Francisco 2. Michael Chester Francisco
Tow Speed:	3.0 kmh (ave)	
Visibility:	Varying from 1m to 5m due to mixing of waves and sand	
Weather:	Overcast with drizzles	
Wave:	Flat to slight rolling waves	
Current:	None to very mild	
Tide:	Lowering from 0.49m to 0.43m as ref from Iligan Bay:Iligan Tidal Station [WXTIDE32 App]	
Water Temp:	Varying from approx. ± 30°C	
Wind:	Beaufort Scale #2	

Cloud Cover:		Nimbus Clouds						
Tow Coverage	**Location [DecDeg]**	**LHC**	**SC**	**DC**	**DCA**	**CR**	**S**	**Remarks**
S00a	N 08.286626° E 124.261891°	-	-	-	-	-	-	Start of Tow R1
S00-T01	N 08.287226° E 124.261073°	25	5	0	10	20	40	Behind pier @ inner inlet to area planned for dredging; crown-of thorns starfish observed feeding on corals.
T01-T02	N 08.286881° E 124.259671°	5	0	0	10	0	85	Bottom substrate mostly sand and mud; seawater is saturated with silt
T02-T03	N 08.287111° E 124.258290°	0	0	0	0	0	0	Deep water; approx ± 400m NW offshore from RCC Pier
T03-T04	N 08.287496° E 124.257098°	0	0	0	0	0	0	Deep water; approx 500+m NW offshore from RCC Pier
T04-T05	N 08.288659° E 124.256955°	5	0	0	10	15	70	Approaching Pilmico jetty; few clusters of corals observed
T05-T06	N 08.289667° E 124.256228°	0	0	0	0	0	0	Deep water across Pilmico jetty; end of Tow R1
S00b	N 08.288344° E 124.255720°	-	-	-	-	-	-	Start of Tow R2
S00b-T07	N 08.286918° E 124.256591°	0	0	0	0	0	0	Deep water; approx 550+m SW offshore from Philmico jetty
T07-T08	N 08.286282° E 124.258308°	0	0	0	0	0	100	Deep water but KI confirms sand/mud bottom substrate
T08-T09	N 08.285960° E 124.260091°	0	0	0	0	0	100	Deep water but KI confirms sand/mud bottom substrate
T09-T10	N 08.285646° E 124.261491°	0	0	0	0	0	0	Deep water; approx ± 100m from RCC Pier; end of Tow R2
Average Reef and Substrate Composition		**7**	**1**	**0**	**6**	**7**	**79**	

- Tow area coverage are expressed in Decimal Degrees WCS notation in reference to WGS84 Map Datum
- Red-shaded rows denote deep water along the pathway and substrate cannot be discerned;
- Reef and Substrate composition are expressed in (%) and described as follows:

Live hard coral (LHC) - coverage of stony or hard corals on the bottom or part of the bottom
Live soft coral - (SC) - coverage of soft corals attached to the bottom
Dead coral (DC) - recently dead coral still attached and recognizable at the bottom in original upright position, color usually white with no living tissue
Dead coral with algae (DCA) - corallites still visible, skeletal structure can still be seen but algae dominate the structure (often appears greenish to brownish)
Coral rubble/rock (CR) - loose broken fragments of stony corals, consolidated hard bottom or large blocks of hard reef materials not attached or easily moved around
Sand/silt (S)

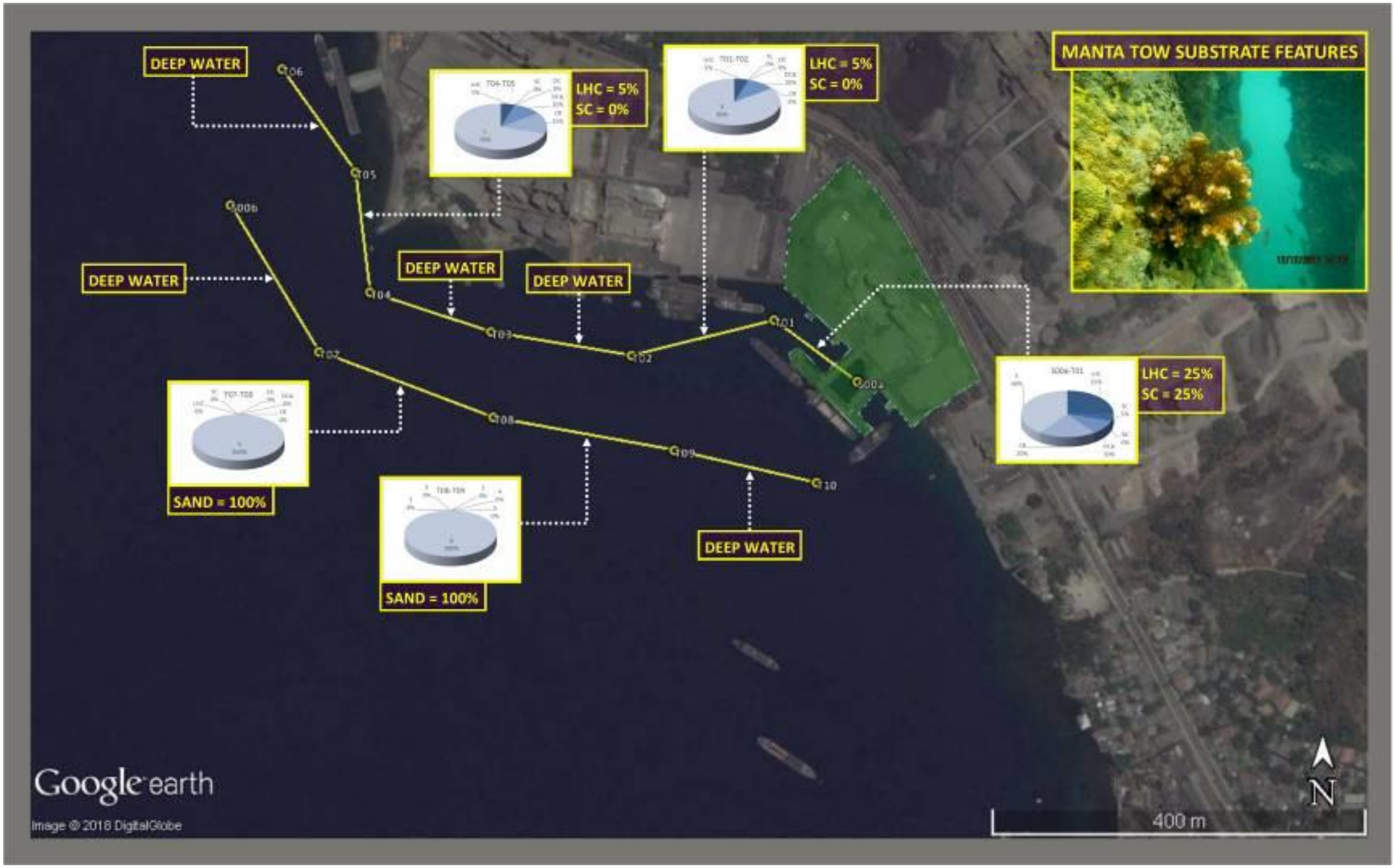


Figure 2.2-14. Results of ten manta tow pathways investigated for coral life form distribution and substrate characterization

Plate 2.2-3. Corals under the Republic pier complex, located mostly in the 'inner' shelf beneath the jetty structure, are comprised of a variety of coral life forms, e.g. massive Porites spp, branching Acropora, fire coral Millepora sp, and encrusting Montipora sp.

Detailed coral assessment through line intercept transect (LIT)

Across the 50-meter transect, the average live coral cover was registered at 39.4%, rated as "Fair" in standard coral cover grading. In such a small area, survey impressions indicate an impressive coral diversity. There were eight (8) varieties of corals, with massive *Porites* spp corals dominating the community, accounting for 17.20% of all live coral cover (**Table 2.2.5-6** and **Figure 2.2.5-6**). Patches of Acropora branching, sub-massive, encrusting and tabulate corals comprised 20.6 % of the community, consisting mostly of *Montipora* sp, *Acropora formosa* and *Acropora indonesia*, and a scattering of the fire coral *Millepora* sp. Non-acropora and foliose corals combined accounted for another 8% of the population, mostly attached to concrete piles. Dead coral with algae was registered at 22%, with mortality mostly attributed to sediment suffocation; while sand, rocks and rubble accounted for 37.4 % of the surveyed area (**Figure 2.2.5-11**).

All in all, there were forty-one (41) species of corals catalogued in the pier area, dominated by *Porites* spp, *Montipora* and *Acropora* varieties (**Table 2.2.5-7, Plate 2.2-4**). Many of the coral colonies are new recruits and the diversity is impressive. The corals in the 'inner' section hosts a great degree of higher and more diverse live coral cover than the area where dredging is proposed to be undertaken. The former was catalogued with at least eleven dominant species while the 'dredging' area hosted mostly massive and encrusting varieties almost exclusively attached to the pier walls. Coral recruits were numerous in both sections but no corals were seen in the sandy-silt substrate. Soft corals, mostly represented by the species *Sarcophyton crassocaule,* were also encountered. However, mortality of coral polyps was also observed to be high, most of which were caused by suffocation from silt, algal encrustation due to loss of polyps, and predation by crown-of-thorns (COT) starfish (Plate 5). If uncontrolled, outbreaks of the COT can decimate one square meter of coral cover per day.

Table 2.2-24. Average percentage cover of the different lifeform categories across 2 LIT transects located within the baseline assessment study site

Name of Site: Republic Cement Pier, Barangay Kiwalan, Iligan City, Lanao del Norte
Date: December 12 - 14, 2017
Observers: Victor L. Pantaleon & Ronald T. Pocon
Station Coordinates: Start: 124.26193^0 E, 08.28655^0 N; End: 124.26181^0 E, 08.28694^0 N
Depth at time of survey 2-4 meters

Coral Life Form Categories		*Code*	% Distribution
Acropora	*Branching*	*ACB*	3.60
	Digitate	*ACD*	0.20
	Encrusting	*ACE*	3.00
	Sub-Massive	*ACS*	3.00
	Tabulate	*ACT*	4.00
Non-Acropora	*Branching*	*CB*	7.00
	Encrusting	*CE*	
	Foliose	*CF*	1.00
	Massive	*CM*	17.20
	Sub-Massive	*CS*	
	Mushroom Coral	*CMR*	0.40
AVERAGE % LIVE HARD CORAL COVER			***39.40 (Fair)***
Dead Coral		*DC*	
Dead Coral with Algae		*DCA*	22.00
Other Fauna	*Soft Coral*	*SC*	0.60
	Sponge	*SP*	0.60
Abiotic	*Sand*	*S*	19.80
	Rubble	*R*	4.80
	Rock	*RCK*	12.80

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

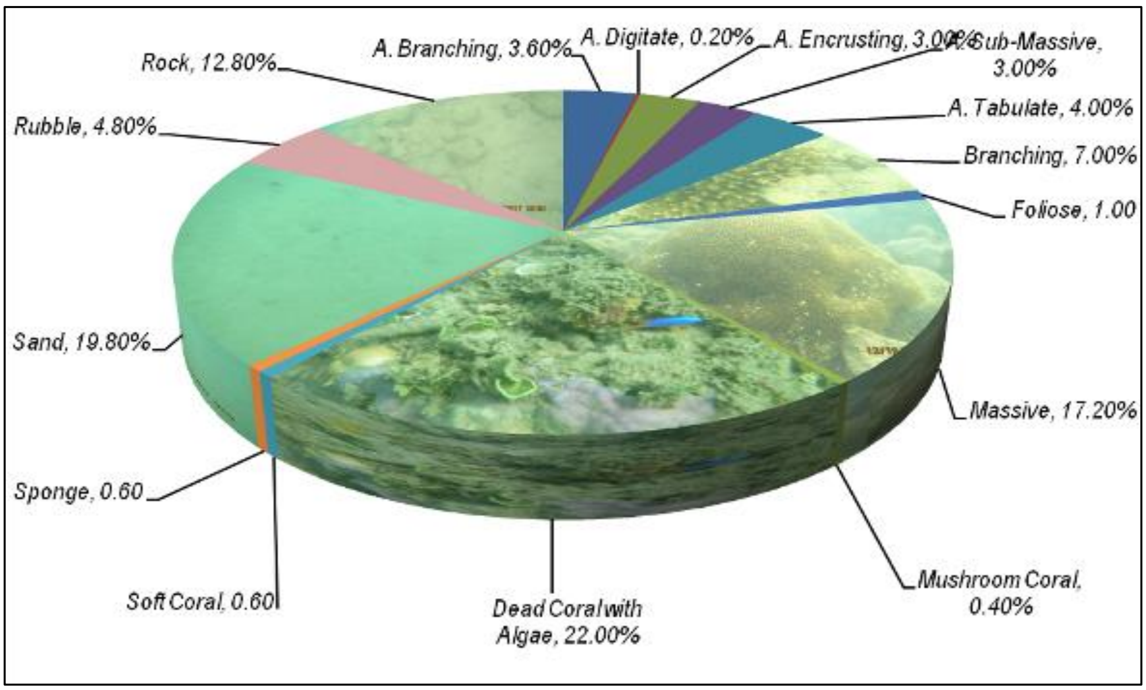


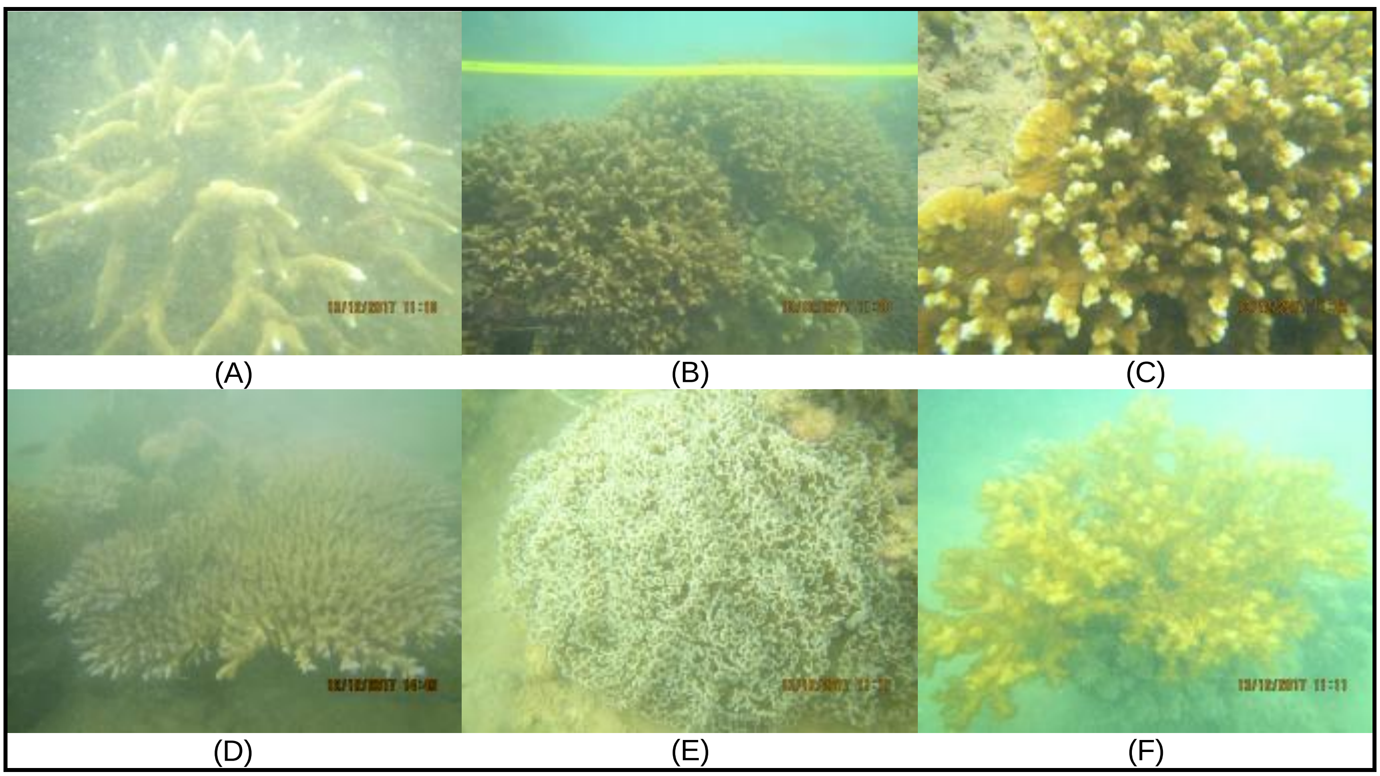
Figure 2.2-15. Distribution of coral life form categories in the LIT station surveyed inside the Republic Pier complex in Barangay Kiwalan, Iligan City

Table 2.2-25. Some coral species encountered in two (2) LIT stations observed during the marine ecology baseline assessment in coastal waters around the RCMI pier area

Massive	Branching	Digitate, Encrusting, Foliose, Tabulate, Sub-Massive, Mushroom, &

		Other Fauna
Favia veroni	*Acropora formosa (staghorn)*	*Acropora humulus*
Favites vasta	*Acropora palifera*	*Acropora digitifera*
Favites flexuosa	*Acropora indonesia*	*Montipora turtlensis*
Goniastrea edwardsi	*Acropora loripes*	*Montipora florida*
Goniastrea retiformis	*Anacropora pillai*	*Montipora foliosa*
Leptoria species	*Anacropora reticulata*	*Montipora spongiosa*
Lobophyllia hemprichii	*Goniastrea ramosa*	*Goniastrea minuta*
Platygyra crosslandi	*Montipora digitata*	*Fungia granulosa*
Porites astreoides	*Montipora samarensis*	*Millepora platyphylla*
Porites lobata	*Montipora hirsuta*	*Millepora alcicornis*
Porites species	*Montipora porites*	*Plerogyra sinuosa*
Symphyllia agarica	*Pocillopora elegans*	*Sarcophyton crassocaule*
Symphyllia radians	*Porites nigrescens*	*Clavularia viridis*
		Dysidea species
		Plurella species

Plate 2.2-4. L-R: Velvet branch corals i.e., Montipora samarensis (A) & Montipora hirsute (B); Velvet coral, Montipora turtlensis (C); Table-like coral, Acropora donae (D); Branching anchor coral, Euphyllia paradivisa (E); Velvet coral, Montipora setosa (F); Brain corals i.e., Symphyllia agarica (G) & Symphyllia radians (H); Pineapple coral, Favia veroni (I); Pagoda coral, Turbinaria mesenterina; a distinctive soft coral with anvil-like heads (J), Sarcophyton crassocaule (K); and, Soft little sponge, Dysidea sp.(L).



(G)

(H)

(I)

(J)

(K)

(L)

The bottom of the coastal shelf in the northeastern side of the pier does not have coral colonies owing to the fact that the bottom substrate is comprised of soft mud and silt which is inhospitable for coral planulae attachment. The absence of a firm substrate – except in the inner pier wall revetments – renders the area unsuitable for settlement of coral colonies and it is unlikely that recruits will settle in the area (Plate 5). Isolated coral colonies have settled in the concrete slabs and revetments in the extreme inner side of the port complex, growing in piles and in the vertical concrete walls.

Plate 2.2-5. Mud and silt substrate dominate the seabed in the proposed dredging area, rendering it unsuitable for coral settlement.

Figure 2.2-16. Highlights of detailed coral assessment beneath the RCMI pier area

Quantity of Coral colonies

A total of 1405 coral colonies consisting of massive, branching *Acropora* and encrusting corals were catalogued in both the inner sea and backwalls of the RCMI pier (**Table 2.2.5- 8**). Corals were more numerous in the 'inner' section, comprising 68% of the total community across the surveyed area. The massive corals mostly belong to the genus Porites, mostly *Porites lobata* and *Lobophylla sp*, encrusting and foliose corals that were mostly represented by *Montipora spp;* while Acropora branching corals were comprised of several species, dominated by *Acropora palmata, Acropora formosa (staghorn coral), Acropora cylindrica* and digitate *Acropora digita*. Among coral species, the Acropora branching varieties (e.g. staghorn) are the most fragile as they easily break and are among the slowest to recover. Old growths of tabulate *Acropora indonesia* were also encountered, as well as the fire coral *Millepora sp* (Plate 6). Survey impressions indicate a diverse coral community, albeit vividly stressed by sediment intrusion, algal encrustation and blanketing of what appears to be caused by recent sediment disturbance. It was observed that sediment intrusion is currently blanketing small massive coral colonies and some have been lost. No marks of destructive fishing gears or anchor damage were seen.

Along the revetments, large sea urchins, consisting exclusively of the banded sea urchin *Echinotrix calamari* were encountered. More importantly, at least three coral-eating Crown-of-Thorns starfish were also seen. Outbreaks of this predator starfish is considered one of the most serious natural cause of coral mortality and in areas where they occur, the COT are often removed by diver volunteers in order to halt coral polyp predation. A single voracious COT can consume about 1 square meter of coral colony in a day.

Past the revetments and piles, the seabed is comprised of mud and silt with depths in two bathymetry points measuring 3.0 meters (inner waters) and 5.2 meters (dredging area). No corals occur in the seabed across the area proposed to be dredged as the soft, unstable muddy substrate is not a viable substrate for coral settlement. Neither were there any other benthic macro-algae detected in spot dives.

Table 2.2-26. Number of coral colonies catalogued in the RCMI pier area

Coral Lifeform Categories	Number of colonies and other life forms	
	Inner Pier waters	Dredging Area Waters
Branching	270	204
Massive	229	104
Encrusting	327	64
Soft corals	1	12
Mushroom	35	17
Fire corals	3	12
Table corals	52	18
Foliose	36	21
Total coral colonies	953	452
Other life forms		
Sponge	10	5
Crown of thorns	2	1
Diadema	9	0

Plate 2.2-6. More coral species encountered in the Republic Cement inner pier area during marine ecology baseline assessment, December 12-14, 2017. Upper photos – branching Acropora palmata, foliose Montipora sp., digitate Acropora digita with Cypraea sp; 2nd row photos – Lobophylla sp (brain coral), fire coral Millepora sp., and tabulate Acropora; 3rd row: Non-acropora digitate coral beside a brain coral, corals along piles, and rocks and silt in the seabed

Corals in Kiwalan Cove

The detailed coral survey in two transects revealed modest to good coral growths along the stretch of reef of about 150 meters length, averaging 64.8% across the two stations (**Table 2.2.5-9**). The rest of the abiotic components include 21 % dead corals, 11.8 % rubble and 1.4 % dead coral with algae (**Figure 2.2.5-8**). The dense branching corals in the reef have colonized the slope and little sandy substrates were observed. Branching corals of the non-*Acropora* varieties dominated the slope, averaging 25.6% across the two stations. *Acropora* branching coral species dominated by the species *Acropora formosa*, comprised 23.6% of the coral reef.

Table 2.2-27. Average percentage cover of the different life form categories across two (2) LIT transects located within the proposed outfall and intake pipes of the PPEI project

LIFEFORM CATEGOTES		CODE	AVERAGE PERCENTAGE COVER *(in %)*
Acropora	*Branching*	*ACB*	**23.60**
	Digitate	*ACD*	**1.20**
	Encrusting	*ACE*	**1.80**
	Sub-massive	*ACS*	**0.60**
Non-Acropora	*Coral Branching*	*CB*	**25.60**
	Encrusting	*CE*	**2.30**

LIFEFORM CATEGOTES		CODE	AVERAGE PERCENTAGE COVER (in %)
	Foliose	*CF*	**0.60**
	Massive	*CM*	**7.10**
	Sub-massive	*CS*	**1.80**
	Mushroom Coral	*CMR*	**0.20**
AVERAGE PERCENT LIVE HARD CORAL (LHC) COVER			***64.80 - Good Condition***
Dead Coral		*DC*	**20.90**
Dead Coral with Algae		*DCA*	**1.40**
Other Fauna	*Sponge*	*SP*	**0.60**
Abiotic	*Sand*	*S*	**0.50**
	Rubble	*R*	**11.80**

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

The coral patch in Kiwalan cove fronting the PPEI pump house represents one of the most fragile ecological niche in the area and corals in both the reef flat and slope are currently vividly stressed due to silted waters. Some broken branching coral colonies observed during the Republic survey also indicate damage caused by boat or fishing gear scraping. This narrow patch of extremely “good” coral cover (at the time of the 2016) survey) is about 350 meters from the Republic pier and is unlikely to be affected significantly by improvement in port operations but can be susceptible to sediment plumes or inadvertent marine pollution emanating from accidental oils spills or shipboard wastes. This patch of corals appears to be a significant source of coral propagules and juvenile fish.

In the 2016 marine ecology baseline assessment the species richness in the ‘Kiwalan reef’ was represented by twenty-seven (27) species belonging to eleven (11) families (**Figure 2.2.5-9**). Relatively, the level of species richness is diverse given the small coral reef in the area and the turbid coastal waters. Target fishes belonged to seven (7) species, among them Rabbitfish (Danggit/Samaral), Trevallies (Matangbaka), Surgeonfishes (Labahita/Suran), Lizardfishes and Parrotfishes. Most of the target species were found in the deeper portions of transect 2 while the rabbitfishes were encountered near patches of seagrass beds in Station 1. Indicator species were represented by two species of the butterfly fish and one species of angelfish – the magnificently colored *Vermiculated angelfish.*

The corals encountered in the ‘Kiwalan Reef’ transect survey stations in 2016 are dominated by branching *Acropora formosa, Porites cylindrica,* massive *Porites sp*, encrusting *Acropora crateriformis, Acropora irregularis, Coeloseris mayeri*, the fire coral *Millepora sp*, among others. There were very few A*cropora donei and Acropora divaricata,* mostly represented by recruits*.* Soft corals were isolated, represented by *Tubipora sp*. Non-scleractinian corals of the species *Fungia granulosa* were also catalogued. The coral recruits that have settled in the inner pier of Republic Cement could have most likely come from the robust reef in Kiwalan.

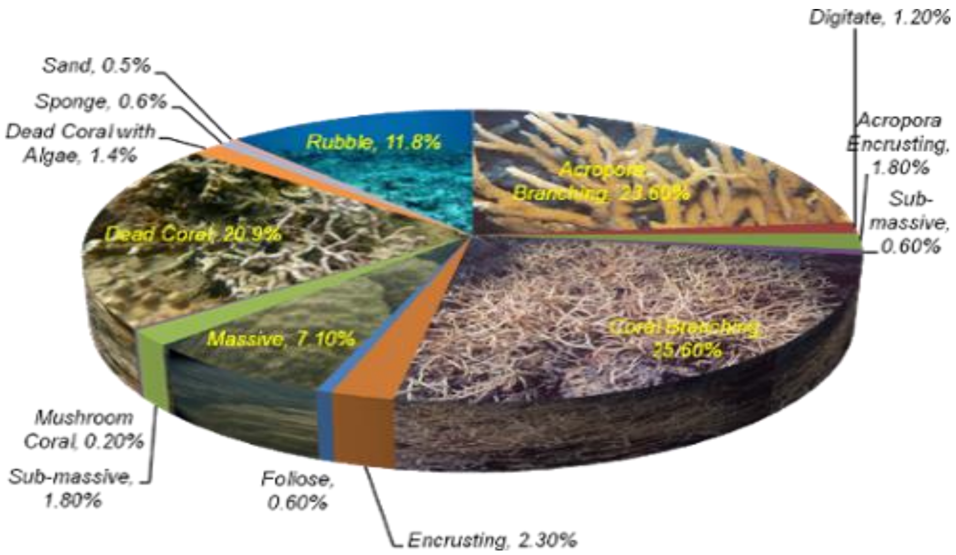


Figure 2.2-17. Average distribution of coral life forms and other benthic substrate categories across two line intercept transects surveyed in the vicinity of the proposed intake and outfall pipes of PPEI in Barangay Kiwalan, Iligan City; (surveyed on 06 May 2016).

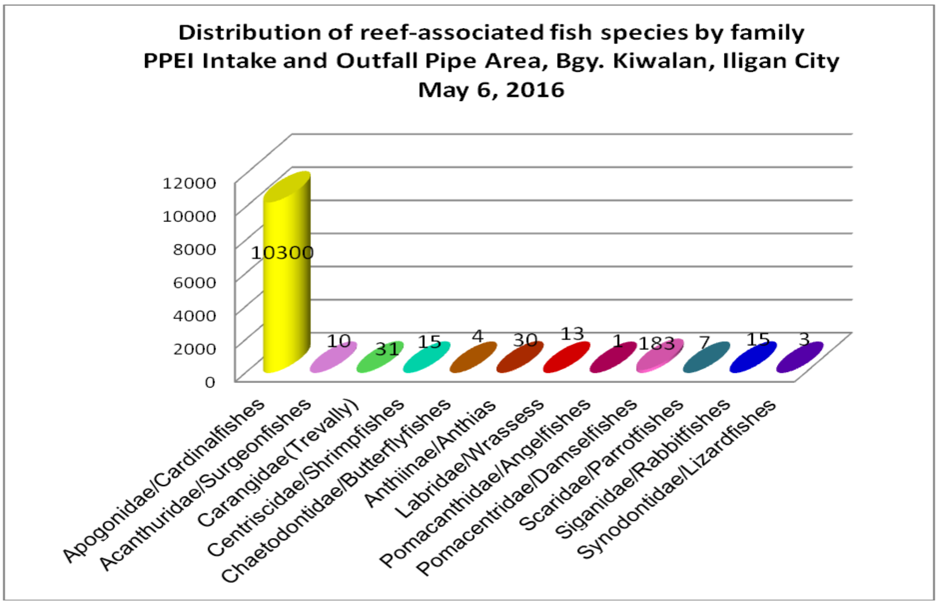


Figure 2.2-18. Fish species richness catalogued during the 2016 marine ecology baseline assessment in the "Kiwalan Reef" southeast of the Republic Cement pier.

Presidential Decree No. 1219 providing for the exploration, exploitation, utilisation and conservation of coral resources is duly noted especially on the matter of "conservation of coral resources". Further, REPUBLIC ACT NO. 8550 "AN ACT PROVIDING FOR THE DEVELOPMENT, MANAGEMENT AND CONSERVATION OF THE FISHERIES AND AQUATIC RESOURCES, INTEGRATING ALL LAWS PERTINENT THERETO, AND FOR OTHER PURPOSES SECTION" otherwise known as "The Philippine Fisheries Code of 1998" is also duly recognized.

It is deemed that the RCMI expansion project does not and will not in any way run contrary nor adverses to the intent of the PD and the RA. The project is not involved in fishery activities but the impacts thereof on the marine ecology are the focus of attention. The main stressors to potential impacts are discharges of waste water to the Iligan Bay for which mitigating measures are adequately provided.

Macro-invertebrates

Few macro-invertebrates were encountered in the survey in the pier area, mostly in the revetments of the pier wall. Large sizes of the Philippine leaf oyster *Dendostrea folium* dominated the columns and revetments almost exclusively (Plate 2.2.5-7). Isolated specimens of the ark shell *Scapharca sp* were seen and coral scallops *Pedum spondyloideum* were encrusted in massive corals. Empty *Cypraea* (cowry) shells were also seen. A lone sea cucumber specimen was distinguished in sandy substrate and crown-of thorns starfish were observed preying on several coral colonies. Two clumps of *squid eggs* were observed, indicating that the rocky seawall is a favored spawning area for cephalopods. Survey impressions indicate low diversity of macro-invertebrates. The absence of gastropods was noted.

Plate 2.2-7. Macro-invertebrates encountered in the pier area of Republic Cement during marine ecology baseline assessment, 12-14 December 2017; left to right – leaf oyster and sea cucumber. The former species are comprised of dense colonies of mature oysters.

Fish abundance and species richness in the Republic Cement survey site

In such a small area, the species richness documented in the survey in the inner pier is impressive. A total of nineteen (19) species belonging to twelve (12) families were catalogued, among them target species of breams (Siri/Kanuping) and rabbitfishes (Danggit/Kitong); Fish density across the transect corridor was recorded at .46 per square meter, with 'other' species comprising of damsels, labrids, and cardinalfish as the most abundant in the community. Outside of the transect, aggregations of the lucrative mangrove snapper (*Lutjanus ehrenbergii; Bla spot snapper;* Mangagat) and sweeper (*Pempheris sp*) were present, which indicates that the area could be a spawning site for these species. Indeed, the survey also noted schools of fry in crevices in the pier wall.

Seven (7) target species comprising 12 % of total abundance were catalogued, although most of the species, except the rabbitfish, are second class. Mean fish biomass for target fishes was estimated at .39 kg per 500m2, indicating small size individuals (**Figure 2.2.5-10**). The dominant species are the damselfishes (Pomacentridae), numbering 144 individuals or 59% of total abundance (Figure 10). Among the damsels, the pale-tail chromis (Palata) was the most abundant, hovering above coral colonies in the inner section. Two species of "indicator fish" comprised of seven (7) individuals of the butterflyfish was likewise recorded. The Moorish idol, an indicator species associated with relatively good coral cover were also seen in significant numbers, most of which were outside of the transect. Both species of butterflyfish and moorish idol included mature individuals.

It should be noted that the fish community encountered during the survey were only those that were found in the transect corridor. It is anticipated that the pier wall's crevices can host many other cryptic species, perhaps including high value Groupers (Serranidae; Lapu-lapo), that are normally elusive during fish visual census.

Plate 2.2-8. Mature black spot snapper, mature labrids along the pier's concrete piles (top row); a school of cardinalfish and mature Moorish Idol species (Bottom row) are among the species of fish that have sheltered in the piles and revetments of RCMI pier.

Table 2.2-28. Summary of species richness by category of fish catalogued in the inner sea beneath the RCMI Pier

	Species Richness	Density/m2	Biomass (Kg)/500 m2
Target	7	0.15	0.39674
Indicator	3	0.036	0.08778
Other	8	0.304	0.49719

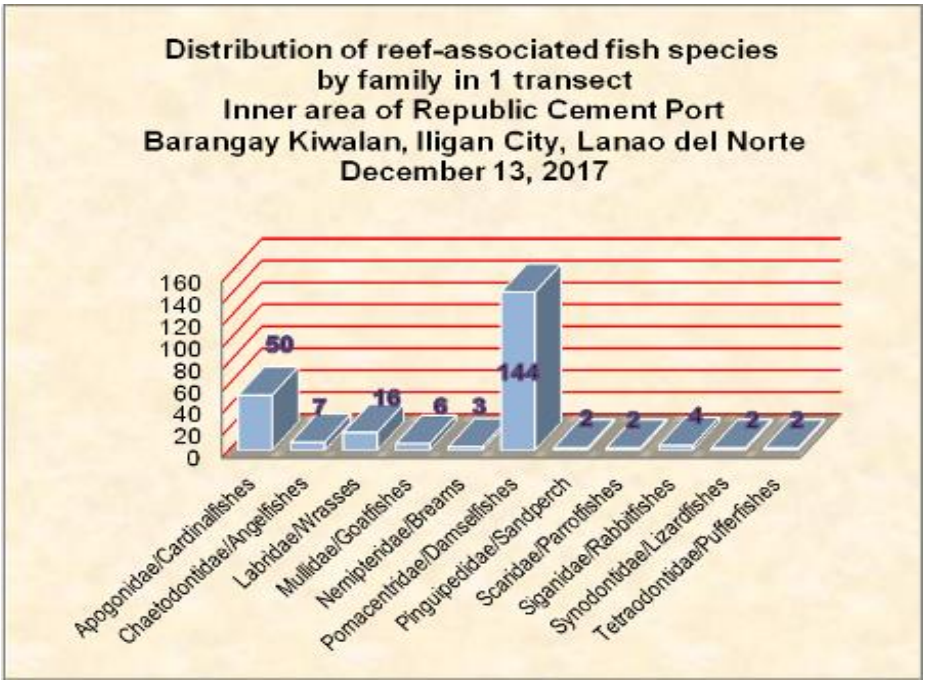


Figure 2.2-19. Total number of fish families catalogued in the inner sea beneath the RCMI Pier

Table 2.2-29. Fish Abundance Data Form

Site Name: Inner area of Republic Cement Pier, Barangay Kiwalan
Date: December 13, 2017
Time: 1003H-1032H
Station No. 1-(Start) N 08.286554⁰ E 124.261936⁰ (End) N 08.286940⁰ E 124.261810⁰

Municipality & Province: Iligan City, Lanao del Norte
Observer: Rowena R. Quimpo
Depth(m): 3-5 meters

FAMILY	SCIENTIFIC NAME	COMMON NAME	LOCAL NAME	Station 1		Total # of individuals
				# of ind	Size (cm)	
Apogonidae	*Apogon cookii*	Cook's cardinalfish	Dangat	50	4	**50**
Chaetodontidae	*Chaetodon baronessa*	Eastern triangular butterflyfish	Alibangbang	2	8	**2**
Chaetodontidae	*Chaetodon octofasciatus*	Eight-banded butterflyfish	Alibangbang	2	10	**2**
Chaetodontidae	*Chaetodon octofasciatus*	Eight-banded butterflyfish	Alibangbang	3	4	**3**
Labridae	*Thalassoma lunare*	Moon wrasse	Labayan	4	10	**4**
Labridae	*Thalassoma lunare*	Moon wrasse	Labayan	2	6	**2**
Labridae	*Thalassoma hardwicke*	Six barred wrasse	Labayan	4	8	**4**
Labridae	*Bodianus mesothorax*	Blackbelt hogfish	Labayan	2	12	**2**
Labridae	*Bodianus mesothorax*	Blackbelt hogfish	Labayan	4	8	**4**
Mullidae	*Parupeneus macronemua*	Longbarbel goatfish	Timbungan	6	4	**6**
Nemipteridae	*Scolopsis ciliatus*	Whitestreak monocle bream	Siri	3	10	**3**
Pinguipedidae	*Parapercis nebulosa*	Barred sandperch	Banghutin	2	6	**2**
Pomacentridae	*Dacyllus aruanus*	Whitetail dascyllus	Palata;Bika-bika	10	4	**10**
Pomacentridae	*Chromis viridis*	Blue green damselfish	Palata	15	3	**15**
Pomacentridae	*Chromis xanthura*	Pale-tail chromis	Palata	100	3	**100**
Pomacentridae	*Pomacentrus mollucensis*	Lemon damsel	Palata	15	4	**15**
Pomacentridae	*Dischistodos fasciatus*	Banded damsel	Palata	4	10	**4**
Scaridae	*Scarus niger*	Dusky parrotfish	Loro; mulmol	2	6	**2**
Siganidae	*Siganus javus*	Java rabbitfish	Kitong	4	15	**4**
Synodontidae	*Synodus binotatus*	Twospot lizardfish	Tiki-tiki	2	10	**2**
Tetraodontidae	*Canthigaster amboinensis*	Spider-eye puffer	Butete	2	8	**2**
Zanclidae	*Zanclus cornutus*	Moorish Idol	Kalaykalay;kalmin-kalmin	4	12	**4**
Zanclidae	*Zanclus cornutus*	Moorish Idol	Kalaykalay;kalmin-kalmin	2	6	**2**
Total # of individuals per transect (500m²)				**244**		**244**

Total number of fish families	**12**
Total number of target species▪	**7**
Total number of indicators	**3**
Total number of other species	**9**
Total number of species	**19**

Impacts Assessment and Mitigation Measure

Threats to existence and/or loss of important local species and habitat

Potential environmental Impacts of the proposed project in the marine environment

Findings from the present survey mission denote few coral colonies along a silted column of water behind the RCMI pier complex. In spite of this, the small area hosts surprisingly diverse coral colonies rated in "Fair" condition. Coral mortality is occurring, due to suffocation from silt and predation by crown-of-thorns starfish. Siltation and sedimentation is further imposing stress to other coral colonies in both the inner and 'dredging' sections. Coral recruits are numerous which indicate that settlement is occurring actively, even in turbid waters, due to the presence of firm concrete blocks along the inner side of the pier area.

Extensive branching coral colonies and seagrass meadows occur in the fringing reef in coastal waters in front of the PPEI pump house but these resources are outside of the management area of RCMI. However, both are significant ecological niches. The corals in Kiwalan are probably the source of planulae that has provided recruits in the Republic pier area; the seagrasses, on the other hand, are the true plants in the sea that can help sequester sediments through their roots and rhizomes. Both the corals and seagrass meadows provide shelter to many species of fish and invertebrates and increasing the cover and the diversity of both corals and seagrass beds in the area can be a contributing factor to the recruitment and settlement of mollusks, small cephalopods, crustaceans, fish and associated epiphytes. However, the intense siltation in the water column is already causing stress to corals and the seagrass beds and this condition can lead to further loss of resources in the future if sediment loading intensifies. Turbid waters will have negative impacts not only on the seagrass beds but on the various species of fish feeding and sheltering in the meadows as well as in the corals beneath the Republic pier complex.

Fishers are beset with extremely poor catch rates and diversity, and this fact has rendered fisheries largely unprofitable. The absence of significant schools of juvenile fish species in seagrass meadows has rendered the situation even more disappointing. However, recent catch rates has improved according to some fishers, most likely due to improving coral cover in the reef slope across the Kiwalan reef.

Recovery of these principal ecological niches should be the principal aim of environmental impact mitigation measures associated with project establishment and operations, by any institution along the shores of Barangay Kiwalan, reinforced by a broader local government effort to restore critical habitats, notably coral reefs and its associated fisheries resources. Even as a significant portion of the coral reef resources present in the surveyed area in Republic consist of impaired colonies, the presence of a significant quantity of live coral colonies in the 'inner' section represents an important factor that needs to be protected and regenerated in order to improve coral ecosystem health. These patches of few coral areas should be protected from further anthropogenic degradation and stressor pathways, notably physical disturbance and the reduction in sediment and silt intrusion.

There are minimal and manageable stressors to these ecological niches. There are no structures to be built at sea nor activities cited ih the project description that are sea based and which could therefore adversely impacts on the ecology. The major main stressors are waste water discharges from the operation of the facilities for which mitigating measures have been identified and more importantly will be implemented.

Threat to abundance, frequency and distribution

Possible Threats to the Benthic Community

The variability of macrobenthic organisms are generally affected by abiotic factors such as substrate types, salinity, water temperature, and dissolved oxygen. Biotic factors like recruitment, predation, and natural mortality could also result to changes in macrobenthic community. Other disturbances on the habitat, either anthropogenic or natural in origin like water pollution and displacement of bottom sediments, may cause severe depletion of their population. Of particular importance are bivalve veligers (significantly oysters) which appear to be offspring of the large population of oysters along the pier walls and columns.

The overall impression for the macrobenthic diversity assessment in the survey area is moderately good as indicated by the presence of some economically-important bivalves. However, the low diversity as analyzed is indicative of an introduced localized disturbance which may be natural or anthropogenic.

Potential impacts arising from climate change scenarios

Climate change projections of the PAGASA indicate that mean temperatures in all areas in the Philippines are expected to rise by 0.9 °C to 1.1 °C in 2020 and by 1.8 °C to 2.2 °C in 2050, with the largest seasonal temperature increase anticipated to occur during the summer season (PAGASA, 2011). The diverse coral community in the inner pier area can be affected by climate-induced seawater surface temperature rise. Seawater temperatures that breach an increase of 3 degrees Celsius may decimate the remaining coral colonies. In times of El Nino episodes, such a possibility can happen if the situation is exacerbated by climate-induced seawater temperature rise and unusually warm coastal water discharges from power plants and factories. Juvenile fish, on the other hand, will have lower survival rates; feeding regimens can be altered as fish feeding will be abnormally affected, and oxygen supply can be lowered. If hyper-nutrient loading in warm waters become intensified – either from domestic wastewaters or from point sources in the land-sea interface, the risk of oxygen depletion and fish kills over a broad area can be possible.
One fundamental mitigating measure currently accepted is to ensure that mangrove resources are enhanced with progressive mangrove reforestation and rehabilitation, as mangrove forests are effective carbon sinks.

Recommendations and mitigation measures

Wastewater management

Appropriate and sufficient sanitation facilities and disposal systems will be installed. The use of 3-chambered septic tanks shall be adopted in all project facilities where wastewaters and other effluents are generated both during pier-related construction and operations phase. Waste minimization should be practiced in all aspects of project operation. The objective is to ensure that pollution-causing effluents that can be potentially carried downstream are treated at the source. All wastewater treatment needs to conform with DENR DAO 35 Effluent Standard for Class SC waters and as such are not expected to cause degradation of marine waters.

Oil and grease containment

Potential risks of small oil spills should be addressed through strict fuel and oil dispersal protocols backed-up by an oil/fuel spill contingency plan. An oil and grease recovery and treatment system will be adopted, together with strict policies against indiscriminate disposal of oily waste and marine vessel bilge. Equipment and vehicle repair and maintenance areas will be sufficiently cemented and fit with oil and grease clean up facilities to prevent oil spillages from reaching coastal waters. More specifically among the measures that will be observed are:

1.0 Immediate shut off of sources of oil spills. Plant shutdown if necessary would be observed.
2.0 Collection of the oil spills.
3.0 If the oil is spilled in the drainage system, collection of this at the discharge end.
4.0 Drumming of the oil spills.
5.0 Temporary storage of the drummed spills at a designated place which is segregated from other materials.
6.0 Collection by an accredited 3rd party TSH entity for transport and treatment outside of the RCMI facilities.
7.0 Reporting to the EMB Region 10.
8.0 Post incident action plan.

Replacement of pipes, valves, fittings and/or other devices/appurtenances that will provide pathways for discharge of oil spills.

Outright maintenance and operational procedures to prevent accidental oil spills.

Enhancing seagrass growth

Seagrass growth can also be enhanced if sediment loading can be reduced in pilot areas where seagrass communities will be maintained. The Project can assist the Barangay Government to enhance protection of the seagrass meadows in front of the project site by supporting seagrass recolonization employing best practices.

Eradication of the crown-of-thorns starfish (COT)

The COT (*Acanthaster planci*), which preys on coral polyps, is a natural occurrence but their outbreak in localized areas is largely unexplained. In recent years, the appearance of ‘swarms’ of this echinoderm has been associated with unusually warm waters brought about by El Niño episodes. One factor that has led to the proliferation of the COT is the disappearance of its natural predator – the Triton gastropod in coastal waters. The COT is known to consume about six (6) sqm of corals per year. In areas where they occur in the hundreds, the COT’s impact on the reefs can be devastating, with large areas of bleached corals unlikely to recover. At least three COTs were seen in the corals behind the Republic Cement pier and some corals have already bleached presumably due to predation.

In view of the smallness of the area in the pier where corals have grown, it is recommended that the COTs be removed manually. Care should however be observed in removing the animals as their thorns can inject toxins into the collector’s hands and these can be extremely painful. The COT should be taken out using long forked spears and disposed of inland, buried in pits

SECTION 2.3 AIR

2.3.1 Meteorology/Climatology

2.3.1.1 Change in the Local Climate, e.g. local temperature

Climate" refers to weather conditions prevailing in an area over a long period.

The baseline data for climate are reckoned from key parameters such as rainfall, temperature and wind rose diagrams. These are provided in **Table 2.3-4** Climatological Normals, **Table 2.3-5** Climatological Extremes and in the Wind rose diagrams **Figures 2.3-2** and **2.3-3.**

Elements of climate/micro or local climate

The elements of climate may be gleaned from **Tables 2.3.1** to **2.3-3** and are the following:

- Rainfall
- Temperature
    - Wet Bulb
    - Dry Bulb
    - Dew Point
- Vapor Pressure
- Relative Humidity
- Wind Velocities and Directions

Local climate (Micro climate) refers to the climatological characteristics in a particular site, i.e. the Project Site.

2.3.1.1.1 Change in/Effects of Project on Microclimate

Rainfall

Rainfall patterns are generally recognized to be the result of global climate change phenomena which (climate change) is generally held to be caused by GHG emissions. In view of the largely insignificant contribution of the Philippines and of the Project to global GHG inventory it may be safely concluded that the Project will not influence the rainfall patterns at the microclimate level.

Temperature

Likewise, the global climate change is being generally accepted as the cause of temperature rises and thus similarly the Project will not influence changes in local temperatures.

Large bodies of water such as the Iligan Bay tends to stabilize the temperature at the lands adjacent to the water. Evapotranspiration from trees and vegetation will tend to create a cooling effect on local temperatures. Radiation from the sun has the greatest influence on temperatures and thus the site location relative to the sun is an influencing factor.

Inasmuch as the above-cited influencing factors to local temperature will remain unchanged, the Project **by itself** will therefore not exert effects on local temperature.

Wind

Wind is also an influencing factor on temperature due to its cooling effect. Site characteristics which can influence wind patterns are (a) **Topography**. Air velocity is lower near the ground surface because of friction. Topography (or contour) influences the air movement patterns as evidenced by higher wind velocities at elevated places (b) **Physical obstructions**. Air will tend to flow around objects or obstructions rather than reflecting off these obstructions (c) **Convection**. The temperature and density of the air at specific sites will influence wind velocities and direction (d) **Atmospheric**

Pressure. This is illustrated in the case of Low Pressure Areas (LPAs) causing typhoons/storms which in turn affect wind circulation.

The configuration of the project will not in any way affect the factors which influence wind characteristics.

In summary, the Project will not cause changes in microclimate.

2.3.1.1.2 Effects/Influence of Microclimate on the Project

On the other hand, significant changes in microclimate may affect the performance of the power plant. It is basic knowledge that the design of power plant facilities need to assume certain ambient climate conditions such as temperature values. In the design of the cooling water system, temperature rise has to be reckoned from the assumed ambient temperature.

The wind characteristics as reflected in the Windrose Diagram **(Figure 2.3-1)** will influence air dispersion and thus the plume of the discharged pollutants resulting from the combustion process.

In summary, microclimate may in principle affect the design and performance of the power plant. However, engineering judgment ("design philosophy") will factor in the variations in these ambient conditions. In case severe variations are encountered during the operations of the power plant in the future, field engineering may be resorted to at that time. Thus if the ambient temperature of the sea water should change significantly, adjustments may be made to maintain the thermal rise from the return cooling water such as by increasing the amount of the water or providing diffusers.

2.3.1.1.3 Consideration of the PAG-ASA climate change projections for 2020 and 2050

For some understanding although admittedly still limited, of the climate change phenomena, PAGASA has adopted the **"PRECIS"** (Providing Regional Climates for Impacts Studies) system which was developed at the Met Office Hadley Centre to provide a tool for predictions. It is made widely available to developing countries more as an **adaptation tool.**

Referring to **Tables 2.3-1** to **2.3-3** following observations are made:

- Maximum rainfall increase of 2.9 % by SON, 2020 emissions scenario
- Maximum rainfall decrease of -17.8 by MAM, 2050 emissions scenario
- Maximum temperature increase of by 2.4 deg C by JJA, 2050 emissions scenario

Implications of the above projections on the effect of and by the Project:

Further evaluation of the thermal effects of the cooling water return to Iligan Bay in consideration of the predicted 2.4ºC rise, 2050 emission scenario. This reevaluation will also have to consider that the already unhealthy marine life at the area of the outfall may further deteriorate because of temperature rise.

The drainage plan of the project may need to be reevaluated unless the engineering design at this time (prior to project implementation) already considered the increased rainfall scenario.

Table 2.3-1. Seasonal temperature increases (in °C) in 2020 and 2050 under medium-range emission scenario in Region 10

	OBSERVED BASELINE (1971-2000)				CHANGE in 2020 (2006-2035)				CHANGE in 2050 (2036-2065)			
	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON
Region 10												
Bukidnon	25.1	26.5	25.8	25.7	1.0	1.2	1.2	1.0	1.9	2.3	2.4	2.1
Lanao del Norte	**24.4**	**25.5**	**25.4**	**25.2**	**1.0**	**1.1**	**1.0**	**1.0**	**1.9**	**2.2**	**2.1**	**1.9**
Misamis Occidental	25.6	26.7	26.6	26.4	1.0	1.1	1.1	1.0	1.9	2.2	2.2	1.9
Misamis Oriental	25.4	26.8	26.9	26.5	1.0	1.2	1.2	1.0	1.9	2.3	2.4	2.0

Source: "Climate Change in the Philippines. February 2011" by PAGASA and others)

Table 2.3-2. Seasonal rainfall change (in %) in 2020 and 2050 under medium-range emission scenario in Region 10

	OBSERVED BASELINE (1971-2000)				CHANGE in 2020 (2006-2035)				CHANGE in 2050 (2036-2065)			
	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON
Region 10												
Bukidnon	329.7	335.6	653.8	559.5	2.9	-10.3	-4.4	-0.3	-5.1	-13.0	-9.7	-5.8
Lanao del Norte	**337.5**	**350.3**	**662.5**	**621.1**	**9.6**	**-0.6**	**-2.2**	**6.9**	**2.5**	**-1.9**	**1.4**	**7.1**
Misamis Occidental	392.1	323.4	633.1	728.3	9.1	1.4	-6.1	6.1	5.2	0.3	-5.1	4.6
Misamis Oriental	442.5	296.0	615.7	581.1	4.6	-10.4	-3.7	2.9	1.8	-17.8	-5.2	-0.1

Table 2.3-3. Frequency of extreme events in 2020 and 2050 under medium-range emission scenario in Region 10

Provinces	Stations	No. of Days w/ T max > 35°C			No. of Dry Days			No. of Days w/Rainfall > 150mm		
		OBS (1971-2000)	2020	2050	OBS	2020	2050	OBS	2020	2050
Bukidnon	Malaybalay	26	477	1441	6537	3977	4461	4	9	9
Lanao del Norte	Dipolog	217	2155	4004	7481	5384	5470	3	6	1
	Cagayan de Oro	**383**	**4539**	**6180**	**8251**	**6413**	**7060**	**10**	**13**	**9**
Misamis Oriental	Lumbia	106	2012	3759	6495	6290	6580	3	6	1

Note:
For western portion of Misamis Occidental, use values of Dipolog City

2.3.1.1.4 Monthly average rainfall and temperature of the area; Climatological normals/extremes; Wind rose diagrams; Frequency of Tropical cyclones

Table 2.3-4. Climatological Normals

Station Name: LUMBIA AIRPORT, MISAMIS ORIENTAL Latitude: 08°24'12"N Elevation: 182.0 m
Period: 1981-2010 Longitude: 124°33'18 E

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16a)	(16b)
MONTH	RAINFALL		TEMPERATURE						VAPOR PRESS. (mbs)	RH (%)	MSLP (mbs)	WIND		CLOUD AMT. (okta)	NO. OF DAYS W/	
	AMOUNT (mm)	NO. OF RD	MAX (°C)	MIN (°C)	MEAN (°C)	DRY BULB (°C)	WET BULB (°C)	DEW POINT (°C)				DIR (16pt)	SPD (mps)		TSTM	LTNG
JAN	98.9	12	29.6	21.6	25.6	25.0	23.0	22.2	26.7	84	1010.7	N	2	5	2	2
FEB	68.0	8	30.2	21.4	25.8	25.2	22.9	22.0	26.3	82	1011.0	N	2	5	2	1
MAR	49.8	6	31.3	21.6	26.5	25.9	23.3	22.3	26.8	80	1010.7	N	2	4	4	2
APR	52.6	5	32.5	22.4	27.5	26.9	23.8	22.6	27.3	77	1009.8	N	2	4	7	4
MAY	125.0	12	32.9	23.2	28.0	27.3	24.3	23.2	28.3	78	1009.2	N	2	5	17	12
JUN	212.7	17	32.0	22.8	27.4	26.5	24.0	23.1	28.1	81	1009.4	S	2	6	18	11
JUL	245.6	18	31.6	22.4	27.0	26.1	23.8	22.9	27.9	83	1009.5	S	2	6	17	10
AUG	195.8	15	32.1	22.5	27.3	26.4	23.8	22.8	27.7	80	1009.4	S	2	6	13	9
SEP	219.7	16	31.8	22.3	27.1	26.1	23.7	22.8	27.6	82	1009.8	S	2	6	17	10
OCT	185.9	16	31.4	22.3	26.9	26.1	23.8	22.9	27.9	83	1009.5	S	2	5	16	13
NOV	136.0	12	30.9	22.1	26.5	25.9	23.7	22.9	27.8	83	1009.3	S	2	5	10	8
DEC	113.2	11	30.1	21.8	26.0	25.5	23.4	22.6	27.3	84	1010.0	N	2	5	5	4
ANNUAL	**1703.3**	**148**	**31.4**	**22.2**	**26.8**	**26.1**	**23.6**	**22.7**	**27.5**	**81**	**1009.9**	**N**	**2**	**5**	**128**	**86**

Table 2.3-5. Climatological Extremes

YEAR: AS OF 2011

MONTH	TEMPERATURE (°C)				GRATEST DAILY RAINFALL (mm)		STRONGEST WINDS (mps)			SEA LEVEL PRESSURES (mbs)			
	HIGH	DATE	LOW	DATE	AMOUNT	DATE	SPD	DIR	DATE	HIGH	DATE	LOW	DATE
JAN	35.0	01-26-1988	16.1	01-03-1991	104.4	01-13-2009	12	NE	01-30-1984	1018.1	01-27-1983	982.8	01-21-1989
FEB	36.0	02-14-2003	17.1	02-05-1980	107.8	02-05-1999	14	N	02-02-1993	1017.8	02-28-1981	1001.6	02-24-1980
MAR	37.6	03-28-1998	17.1	03-10-1992	84.2	03-19-1982	13	NNW	03-19-1982	1018.9	03-07-1981	1002.0	03-19-1982
APR	37.0	04-11-1998	18.0	04-13-1983	58.0	04-23-2000	20	NNW	04-29-1983	1017.3	04-14-1993	1002.8	04-01-2000
MAY	38.2	05-07-1998	20.7	05-28-1984	94.3	05-21-1990	18	W	05-27-1998	1015.5	05-20-1979	1003.3	05-05-2002
JUNE	38.4	06-06-2009	20.0	06-11-1992	96.0	06-01-1995	18	WNW	06-10-1997	1015.6	06-20-1982	1002.4	06-17-2007
JULY	36.2	07-11-2002	20.0	07-17-1994	142.0	07-13-1999	22	W	07-31-1999	1014.8	07-01-1987	1001.0	07-03-2001
AUG	37.8	08-28-1990	19.4	08-26-1995	129.3	08-21-1998	22	W	08-05-1999	1015.6	08-11-1997	1002.9	08-17-1990
SEP	36.7	09-02-1992	19.0	09-23-1991	92.8	09-10-1995	24	NNW	09-23-1996	1016.1	09-26-1982	983.8	09-16-1988
OCT	39.0	10-31-1991	19.0	10-31-1982	114.1	10-20-1980	17	W	10-24-1988	1017.0	10-07-1987	1001.4	10-29-1995
NOV	34.7	11-30-2006	18.0	11-25-1992	237.1	11-24-2009	18	NNW	11-11-1990	1016.3	11-17-1982	1000.7	11-06-1996
DEC	34.4	12-08-1996	17.8	12-31-1990	180.9	12-16-2011	14	S	12-21-1996	1016.8	12-27-2001	1002.2	12-16-2011
ANNUAL	**39.0**	**10-31-1991**	**16.1**	**01-03-1991**	**1809.0**	**12-16-2011**	**24**	**NNW**	**09-23-1996**	**1018.9**	**03-07-1981**	**982.8**	**01-21-1989**
Period of Record	**1979-2011**				**1977-2011**		**1979-2011**			**1979-2011**			

Prepared by: 2016 CADS/CAD/PAGASA

The Wind rose diagrams are depicted **in Figure 2.3-1** and **Figure 2.3-2,** the latter showing that wind direction and wind speed blowing predominantly towards the Northern and Southern directions

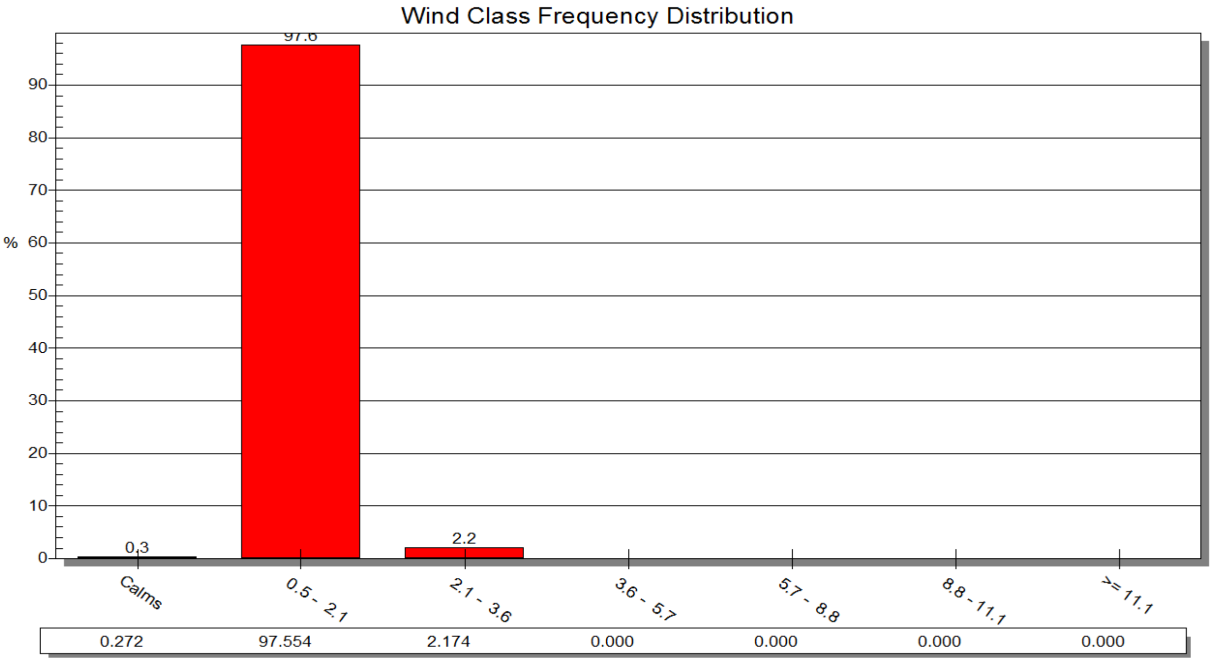


Figure 2.3-1. Wind Direction Frequency Diagram, Lumbia, Cagayan De Oro (WRplot ver. 5.9)

Note to the above diagram:

Windrose diagram generated using WRPlot view Version 5.8 software, which utilizes SCRAM (.DAT) files. Wind direction was oriented in "Blowing from" configuration. In Figure No. 2.3.2 wind rose diagram shows frequency distribution of wind direction and wind speed blowing predominantly towards the Northern and Southern directions.

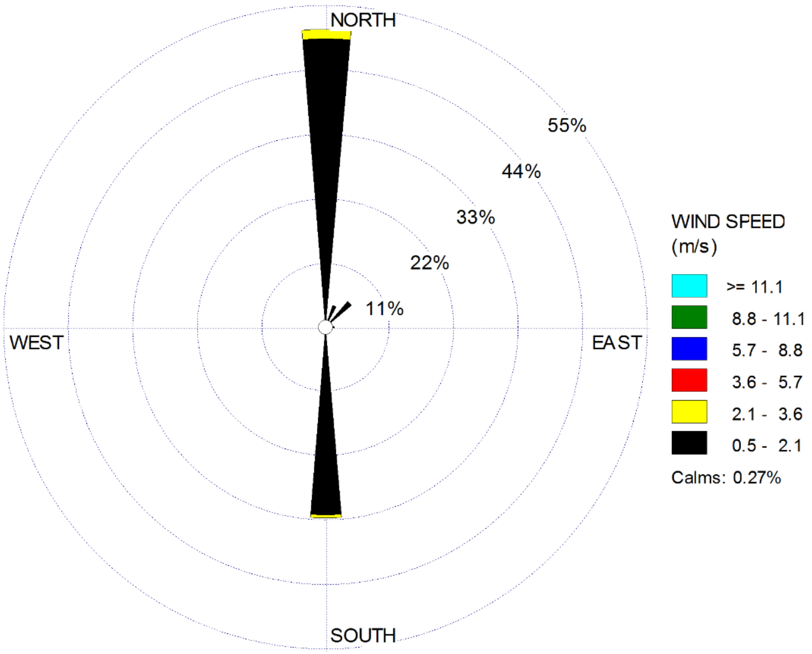


Figure 2.3-2. Wind Rose Diagram, Lumbia, PAGASA CDO Station 747 (1951-2007)

The monthly wind rose diagrams are shown in **Figures 2.3-3**.

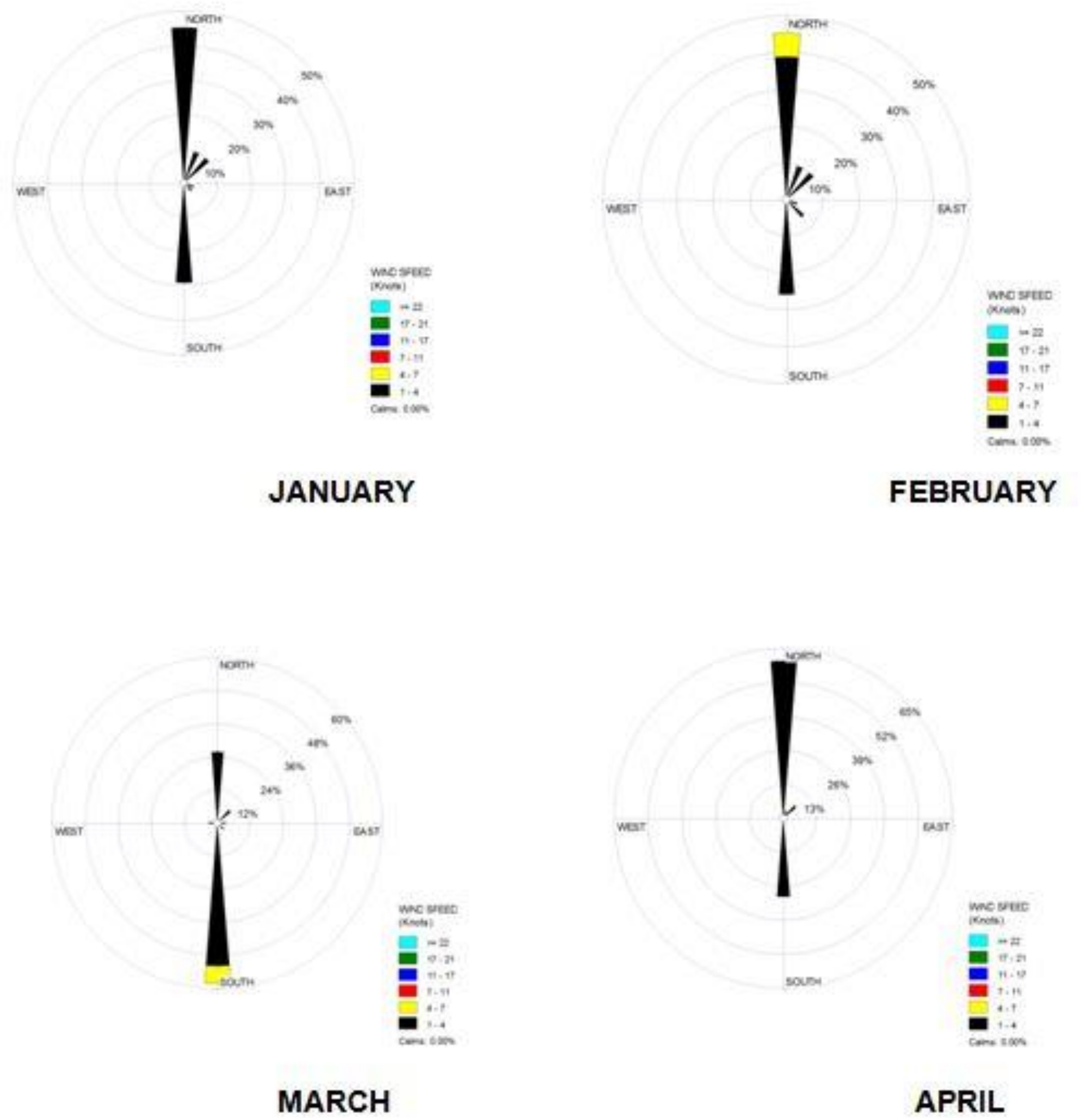


Figure 2.3-3. Monthly Wind Rose Diagram (January to April)

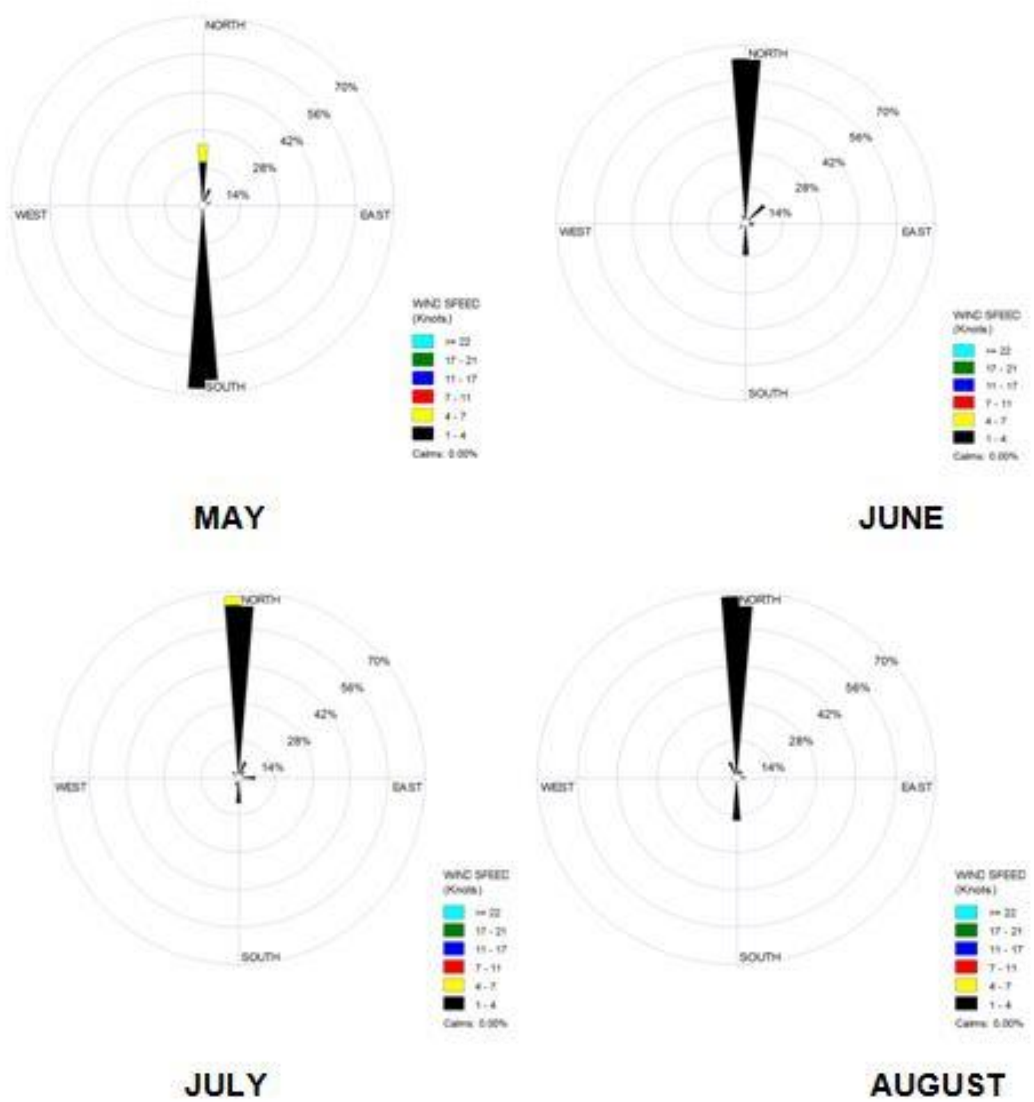


Figure 2.3-4. Monthly Wind Rose Diagram (May to August)

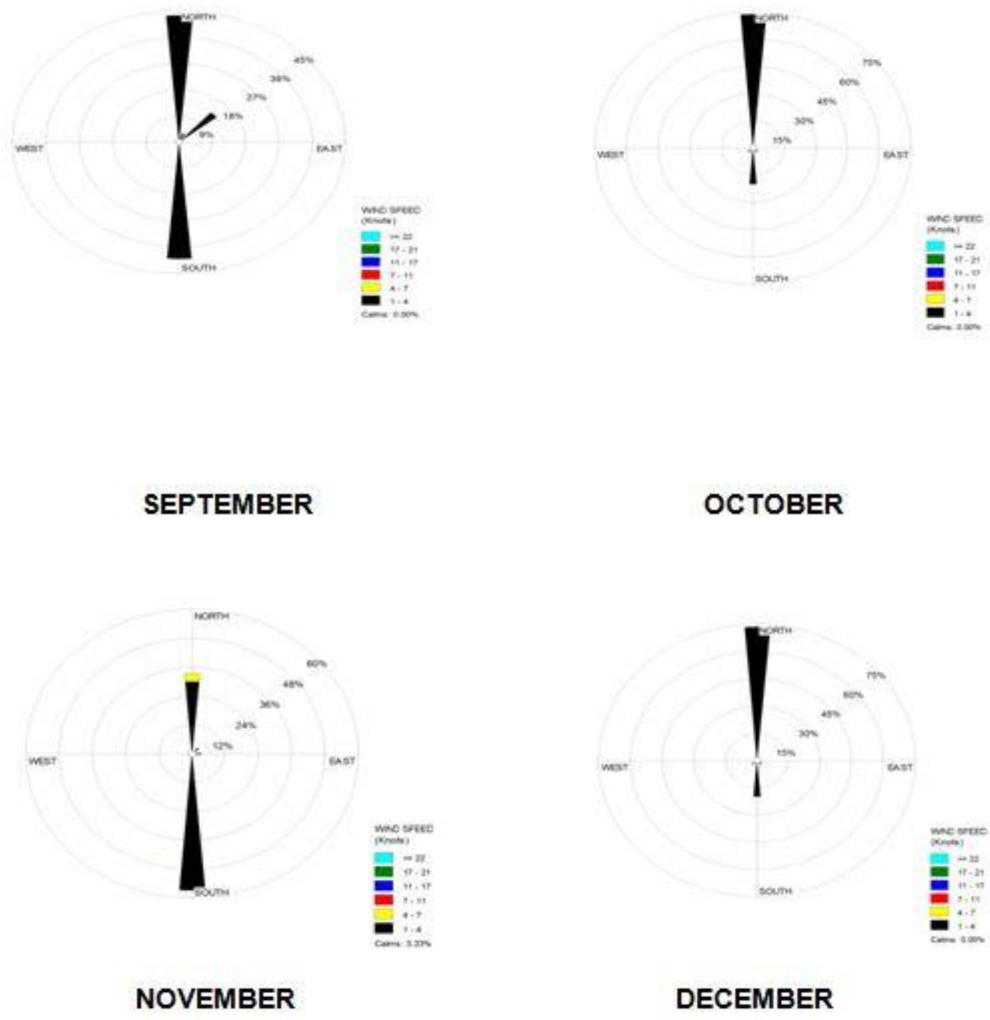


Figure 2.3-5. Monthly Wind Rose Diagram (September to December)

2.3.1.2 Contribution in Terms of Greenhouse Gas Emissions

Data on Greenhouse gasses (i.e., carbon dioxide, nitrous oxide); Calculation of projected GHG emission
Discussion of the project's contribution in terms of greenhouse gas emissions

Greenhouse Gas (GHG) Emissions

The GHG emissions were calculated in terms of CO_2 emissions using the Cement CO_2 and Energy Protocol of the World Business Council for Sustainable Development. By nature of its plant and quarry operations nitrous oxide is deemed not significantly emitted.

The following were the basis of the calculated emissions:

a) Total direct CO2 - all fossil CO2 sources
   - from raw materials
   - from kiln fuels including drying of fuels and raw materials
   - from non-kiln fuels
b) Total indirect CO2
   - CO2 from external power generation
   - CO2 from net inbound and outbound clinker
c) CO2 from combustion of biomass (kiln and, non-kiln fuels, biomass content of mixed fuels)

The project's contribution in terms of GHG emissions is reckoned from the global inventory and given the fact that since the overall Philippine GHG inventory is deemed insignificant compared to the global that Project's emissions are therefore largely insignificant compared with the global.

The Project's Annual GHG inventory estimate is shown in **Table 2.3-6**.

Table 2.3-6. The Project's Annual GHG Emissions

IPPU Categories	Input Data Estimates	2017	2018	2019
		Tons (t)	Tons (t)	Tons (t)
a. Based on Clinker Production	Individual Type of Clinker Produced	443,429.38	436,880	231,435
	Mass of Individual Type of Cement Produced			
	i. Type 1	736,802.94	596,635	191,573
	ii. Type 1-P	211,315.34	364,588	229,837
b. Based on Cement Production	Clinker Fraction in Cement			
	i. Type 1	672,764.57	542,428	173,511
	ii. Type 1-P	151,549.64	260,296	160,345
	Imports for Consumption of Clinker	377,245.57	368,295	128,002
	Exports of Clinker	0	0	0

Climate change projections

Climate change projections on rainfall and temperatures in 2020 and 2050 at the site was based on the paper *"Climate Change in the Philippines, 2011"* published by the PAGASA. The projections were based on the medium-range emission scenario (A1B) defined by the IPCC as:

> *A1: The A1 storyline and scenario family describe a future world of very rapid economic growth, a global population that peaks mid-century and declines thereafter, and a rapid introduction of new and more efficient technologies. Major underlying themes are convergence among regions, capacity building, and increased cultural and social interactions, with a substantial reduction in regional differences in per capita income. The A1 scenario family is further developed into three groups that describe alternative directions of technological change in the energy system. The three A1 groups are distinguished by their technological emphasis: fossil-intensive (A1FI), non-fossil energy sources (A1T), or balanced across all sources (A1B) (where balanced is defined as not relying too heavily on one particular energy source, on the assumption that similar improvement rates apply to all energy supply and end use technologies).*

There are no plant nor quarry operations and activities that will influence rainfall and temperature changes in Misamis Oriental (the study area of the PRECIS GHG projections), the latter reiterated hereunder:

- *Maximum rainfall increase of 2.9 % by SON, 2020 emissions scenario*
- *Maximum temperature increase of by 2.4 deg C by JJA, 2050 emissions scenario*

Carbon Dioxide Reduction Initiatives

The Plant has CO_2 reduction programs which focus on the following levels:

- Alternative fuels such as Biomass (Rice Husk) instead of or in mixture with coal
- Improvement on Specific Heat and Power
- The National Greening Program and
- Mine Forest Program/Reforestation for carbon sequestration.

Shown in Table 2.3-7 below is the summary of accomplishments on the reforestation and NGP programs.

Table 2.3-7. Summary of Reforestation/NGP Accomplishments

Programs	Area Planted (ha)	Seedlings Planted (Number)	Survival Rates (range in %)
Mine Forest Program	18.95	12,312	86.04-89.4
National Greening Program	226.905	298,206	90.37-90.59
Total	245,855	310,518	

Reference: latest MFP and NGP Report 2nd Half 2019

2.3.2 Air Quality (and Noise)
2.3.2.1 Degradation of Air Quality

Air Quality is reckoned from the NAAQGV shown in **Table 2.3-8**; the sampling stations for ambient air monitoring are provided in **Tables 2.3-9** and **2.3-10** and in **Figure 2.3-6.**

Table 2.3-8. The National Ambient Air Quality Guideline Values (NAAQGV) from RA 8749

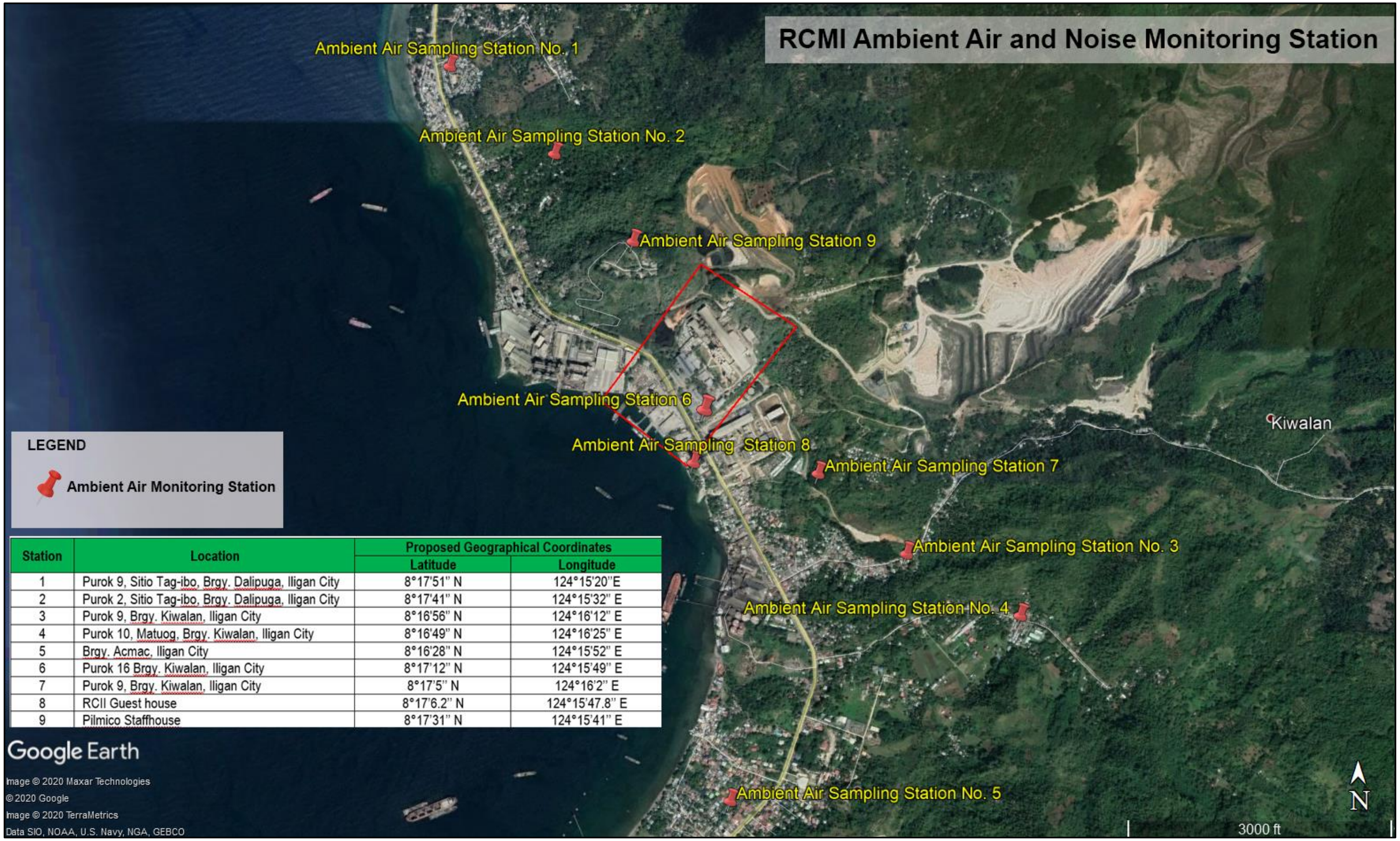
Parameter	Averaging Time	NAAQGV (µg/NCM)
TSP	Annual	90
	24-hour	230
PM_{10}	Annual	60
	24-hour	150
$PM_{2.5}$	Annual	35 (until 31 Dec, 2015) 25 (By 1 January, 2016)
	24-hour	75 (until 31 Dec, 2015) 50(By 1 January, 2016)
Sulfur Dioxide (SO_2)	Annual	80
	24-hour	180
Nitrogen Dioxide (NO_2)	Annual	-
	1-hour	-
	24-hour	150
Ozone (O_3)	8-hour	60
	1-hour	140
Carbon Monoxide (CO)	8-hour	10
	1-hour	35
Lead (Pb)	Annual	1
	3 months	1.5

Table 2.3-9. Previous Ambient Air Monitoring (2001)

Station	Location	Date	SO2 (µg/Ncm)	NO2 (µg/Ncm)	TSP (µg/Ncm)
Sta 1	Kabacsanan Elem School, 8°16.880N/ 124°18.417E	Aug 26-27, 2001	5.73	14.03	60.35
Sta 2	Datu Memorial School, 8°16.138N/ 124°17.448E	Aug 24-25, 2001	6.18	11.75	59.15
Sta 3	Iligan City East High School, Brgy Sta Filomena, 8°16.139N/ 124°16.616E	Aug 23-24, 2001	2.05	7.30	351.28
Sta 4	Kalubihon Elem School, Brgy. Dalipuga, 8°16.073N/ 124 deg16.431E	Aug 25-28, 2001	5.25	17.18	67.20
			4.8	**12.56**	**134**

Table 2.3-10. Ambient Air and Noise Sampling Geographic Coordinates (Regular Monitoring)

Station	Location	Proposed Geographical Coordinates	
		Latitude	Longitude
1	Purok 9, Sitio Tag-ibo, Brgy. Dalipuga, Iligan City	8°17'51" N	124°15'20"E
2	Purok 2, Sitio Tag-ibo, Brgy. Dalipuga, Iligan City	8°17'41" N	124°15'32" E
3	Purok 9, Brgy. Kiwalan, Iligan City	8°16'56" N	124°16'12" E
4	Purok 10, Matuog, Brgy. Kiwalan, Iligan City	8°16'49" N	124°16'25" E
5	Brgy. Acmac, Iligan City	8°16'28" N	124°15'52" E
6	Purok 16 Brgy. Kiwalan, Iligan City	8°17'12" N	124°15'49" E
7	Purok 9, Brgy. Kiwalan, Iligan City	8°17'5" N	124°16'2" E
8	RCII Guest house	8°17'6.2" N	124°15'47.8" E
9	Pilmico Staffhouse	8°17'31" N	124°15'41" E



Station	Location	Proposed Geographical Coordinates	
		Latitude	Longitude
1	Purok 9, Sitio Tag-ibo, Brgy. Dalipuga, Iligan City	8°17'51" N	124°15'20"E
2	Purok 2, Sitio Tag-ibo, Brgy. Dalipuga, Iligan City	8°17'41" N	124°15'32" E
3	Purok 9, Brgy. Kiwalan, Iligan City	8°16'56" N	124°16'12" E
4	Purok 10, Matuog, Brgy. Kiwalan, Iligan City	8°16'49" N	124°16'25" E
5	Brgy. Acmac, Iligan City	8°16'28" N	124°15'52" E
6	Purok 16 Brgy. Kiwalan, Iligan City	8°17'12" N	124°15'49" E
7	Purok 9, Brgy. Kiwalan, Iligan City	8°17'5" N	124°16'2" E
8	RCII Guest house	8°17'6.2" N	124°15'47.8" E
9	Pilmico Staffhouse	8°17'31" N	124°15'41" E

Figure 2.3-6. Ambient Air and Noise Sampling Locations

The data obtained from the SMRs are provided in the table below and illustrated in the corresponding Graphs.

Table 2.3-11. Results of Ambient Air Quality Monitoring

Date Sampled	Location	PM-10 (µg/Ncm)	TSP (µg/Ncm)	SO_2 (µg/Ncm)	NO_2 (µg/Ncm)
	DENR STANDARDS	150	300	340	260
02/19/2020	Purok 9, Tag-ibo, Brgy. Dalipuga	NS	9	15	9
07/01/2020	Purok 9, Tag-ibo, Brgy. Dalipuga	NS	20	17	4
09/01/2019	Purok 9, Tag-ibo, Brgy. Dalipuga	NS	20	15	7
09/05/2019	Purok 9, Tag-ibo, Brgy. Dalipuga	NS	20	15	7
11/27/2019	Purok 9, Tag-ibo, Brgy. Dalipuga	NS	20	<7	10
11/23/2020	Purok 9, Tag-ibo, Brgy. Dalipuga	NS	23	<7	27
09/30/2020	Purok 9, Tag-ibo, Brgy. Dalipuga	NS	23	<7	4
09/02/2019	Purok 2, Tag-ibo, Brgy. Dalipuga	NS	19	14	3
09/05/2019	Purok 2, Tag-ibo, Brgy. Dalipuga	NS	19	14	3
11/27/2019	Purok 2, Tag-ibo, Brgy. Dalipuga	NS	19	<7	10
02/19/2020	Purok 2, Tag-ibo, Brgy. Dalipuga	NS	8	9	10
07/01/2020	Purok 2, Tag-ibo, Brgy. Dalipuga	NS	17	12	3
09/30/2020	Purok 2, Tag-ibo, Brgy. Dalipuga	NS	20	<7	8
11/23/2020	Purok 2, Tag-ibo, Brgy. Dalipuga	NS	29	<7	10
09/03/2019	Purok 9, Brgy. Kiwalan	NS	16	15	10
09/05/2019	Purok 9, Brgy. Kiwalan	NS	16	15	10
11/27/2019	Purok 9, Brgy. Kiwalan	NS	26	<7	11
02/19/2020	Purok 9, Brgy. Kiwalan	NS	9	17	7
07/01/2020	Purok 9, Brgy. Kiwalan	NS	22	<7	3
09/30/2020	Purok 9, Brgy. Kiwalan	NS	25	9	8
11/23/2020	Purok 9, Brgy. Kiwalan	NS	9	<7	11
09/04/2019	Purok 10, Matu-og, Kiwalan	NS	17	7	7
09/05/2019	Purok 10, Matu-og, Kiwalan	NS	17	<7	7
11/27/2019	Purok 10, Matu-og, Kiwalan	NS	17	<7	10
02/19/2020	Purok 10, Matu-og, Kiwalan	NS	9	15	6
07/01/2020	Purok 10, Matu-og, Kiwalan	NS	20	20	19
09/30/2020	Purok 10, Matu-og, Kiwalan	NS	22	9	10
11/23/2020	Purok 10, Matu-og, Kiwalan	NS	19	<7	15
09/05/2019	Brgy. Acmac	NS	19	21	7
09/05/2019	Brgy. Acmac	NS	19	21	7
11/27/2019	Brgy. Acmac	NS	16	<7	4
02/19/2020	Brgy. Acmac	NS	17	18	8
07/01/2020	Brgy. Acmac	NS	17	17	3
09/30/2020	Brgy. Acmac	NS	9	9	7
11/23/2020	Brgy. Acmac	NS	19	<7	10
05/28/2015	Purok 16, near Dryer	NS	5	7	1
09/12/2018	Purok 16, near Dryer	NS	39	NS	NS

Date Sampled	Location	PM-10 (µg/Ncm)	TSP (µg/Ncm)	SO_2 (µg/Ncm)	NO_2 (µg/Ncm)
05/01/2019	Purok 16, near Dryer	NS	24	15	14
05/28/2015	Purok 9, near Circle Post	NS	6	7	1
04/12/2018	Purok 9, near Circle Post	NS	181.1	34.4	17.2
09/12/2018	Purok 9, near Circle Post	NS	19	NS	NS
05/01/2019	Purok 9, near Circle Post	NS	27	20	15
4/13/2018	Purok 16, near Dryer	NS	377	ND	ND
04/13/2018	Guest House	NS	19.9	ND	ND
09/12/2018	Guest House	NS	23	NS	NS
05/01/2019	Guest House	NS	19	18	39
04/12/2018	Pilmico Staffhouse	NS	44.4	ND	ND
05/01/2019	Pilmico Staffhouse	NS	17	16	15
05/28/2015	Loyalty Park - National Highway	NS	9	59	1
05/28/2015	MPCC Warehouse	NS	5	7	1
08/09/2018	Paniangan - Revira Residence	NS	12	56	<1
11/09/2018	Paniangan - Revira Residence	NS	18	NS	NS
09/05/2019	Paniangan - Revira Residence	NS	18	7	1
08/09/2018	Paniangan - Sayson Residence	NS	11	24	<1
11/09/2018	Paniangan - Sayson Residence	NS	20	NS	NS
09/05/2019	Paniangan - Sayson Residence	NS	20	7	5

Note: The TSP exceedance recorded in 4/13/2018 is due to kiln upset/unstable condition and is an isolated case.

For PM10 following test results have been recently obtained (**Table 2.3-9**)

Table 2.3-9. Results of Ambient Air for PM10

Station	Results	DENR National Ambient Air Guideline Values (NAAGV) PM10 µg/Nm³
Sampling Date: 11 December 2020		
Purok 9 Bgy Dalipuga	19 µg/NcM	**150**
Purok 2	16 µg/NcM	
Purok 9 Bgy Kiwalan	20 µg/NcM	
Purok 10, Bgy Matuog	13 µg/NcM	
Bgy Acmac Iligan City	8 µg/NcM	

Based on the above, it is clearly evident that PM10 is well within the limits of the Philippine Clean Air Act Standard of 200 µg/NcM.

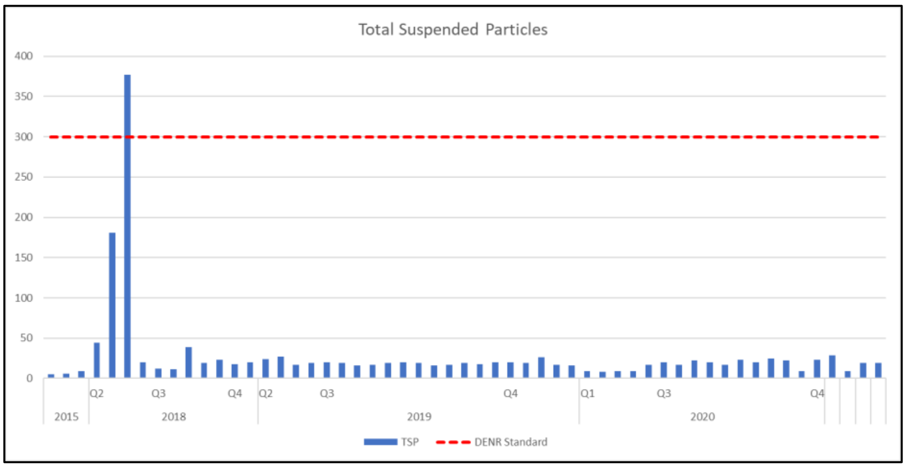


Figure 2.3-7. Ambient Air Monitoring Results for Total Suspended Particles

The TSP exceedance is due kiln upset/unstable condition and is an isolated case.
(Note: As per MMT Chairman Mr. Lao which was cited in MMT minutes "that there's no need to conduct re-sampling instead he suggested to write EMB Region 10 regarding the abnormalities of the operation during the air sampling".)

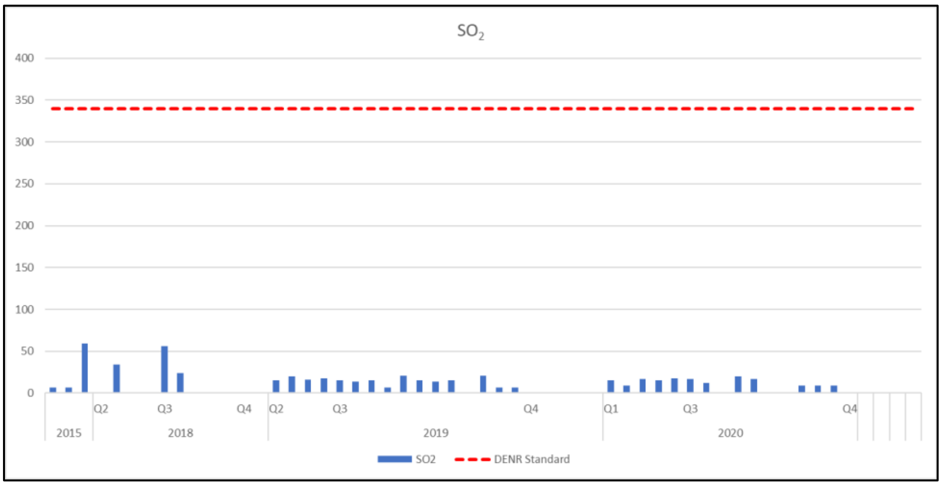


Figure 2.3-8. Ambient Air Monitoring Results for SO_2 (ug/NcM)

The SO_2 Monitoring Results show that the project did not exceed the DENR standards for SO_2 and does not have any major contribution on the increase of SO_2 particles in the vicinity covered by project.

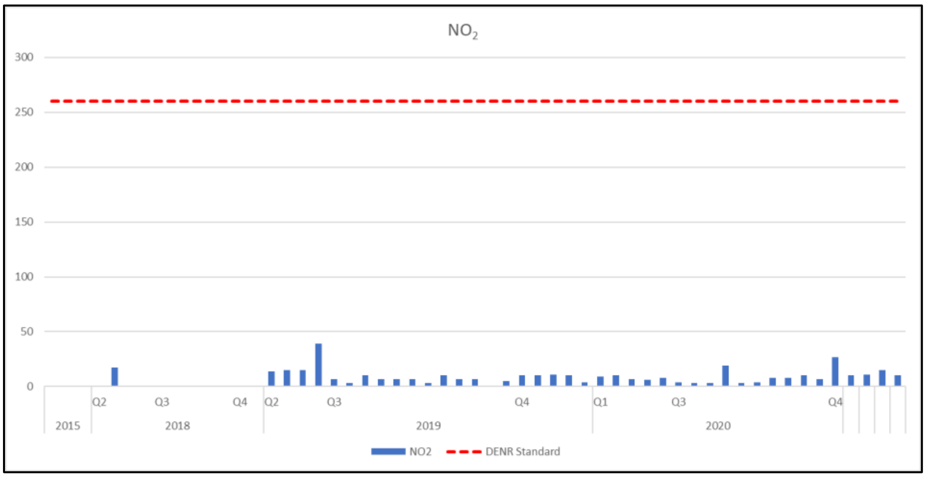


Figure 2.3-9. Ambient Air Monitoring Results for NO_2 (ug/NcM)

The NO_2 Monitoring Results shows that the emissions did not exceed the DENR standards for NO_2 and does not have any major contribution on the increase of NO_2 particles in the vicinity covered by plant.

Table 2.3-12. Geographical Coordinates of Source Emission Sampling Stations

Location	Latitude	Longitude
Kiln Main Stack	8°17'16.42'' N	124°15'52.46'' E
Dryer Stack	8°17'16.49'' N	124°15'54.31'' E
AQC Stack	8°17'23.12'' N	124°15'48.89'' E
Coal Mill	8°17'21.84'' N	124°15'48.26'' E
FM1 Stack	8°17'23.35'' N	124°15'48.05'' E
FM2 Stack (PG Stack)	8°17'8.97'' N	124°15'50.94'' E
PHSE 1 Exhaust	8°17'13.72'' N	124°15'44.41'' E
PHSE 2 Stack	8°17'9.98'' N	124°15'47.55'' E

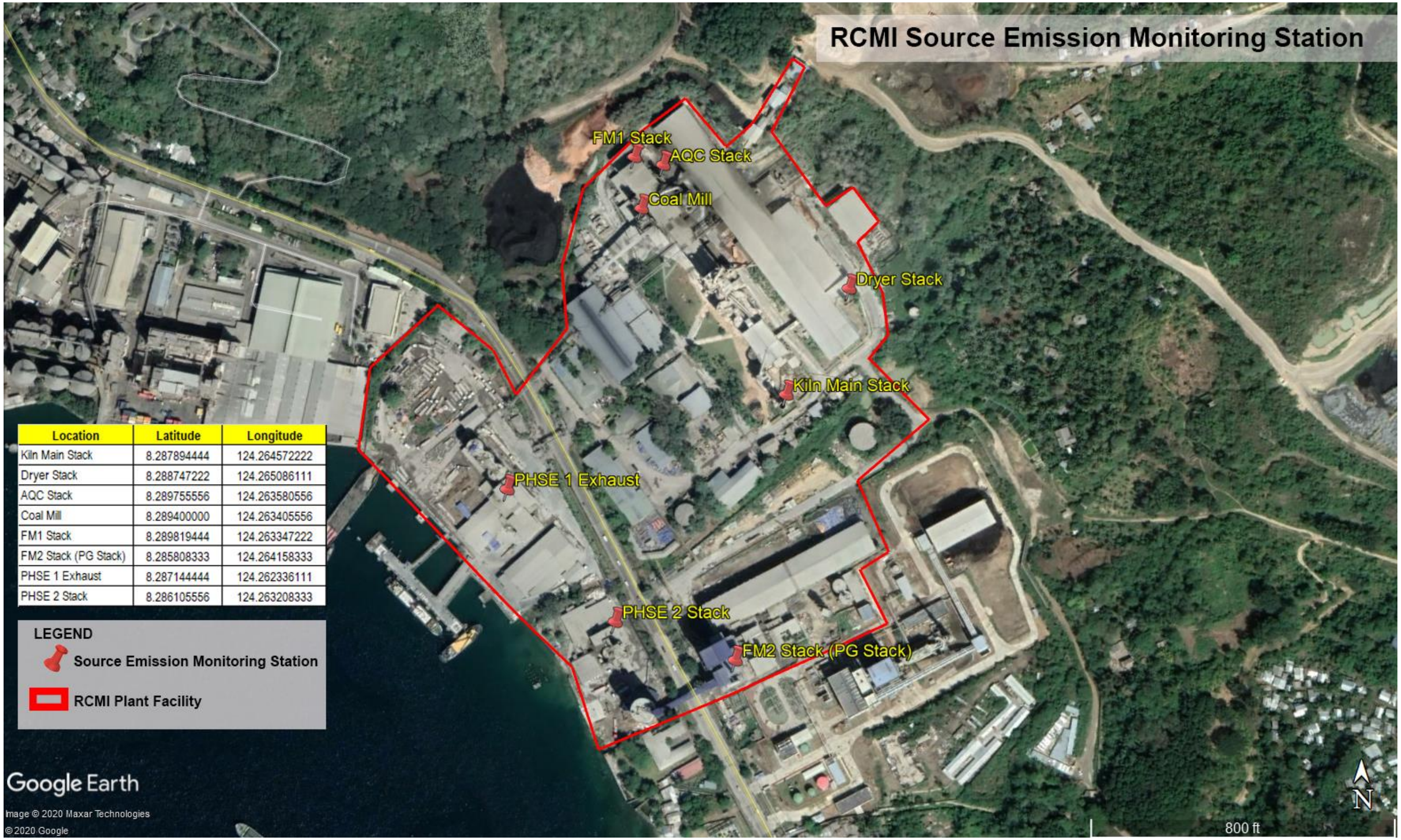


Figure 2.3-10. Source Emission Sampling Stations

Table 2.3-13. Source Emission Sampling Results

Date Sampled	Location	Particulates (µg/Ncm)	SO_2 (µg/Ncm)	NO_2 (µg/Ncm)	CO (µg/Ncm)
	DENR STANDARDS	150	1500	1000	500
7/28/2015	AQC	12.83	2.33	2.22	0.1
12/22/2016	AQC	4.8	NS	NS	NS
3/20/2017	AQC	14	NS	NS	NS
11/08/2017	AQC	4	3	<2	<0.01
4/13/2018	AQC	21	NS	NS	NS
4/15/2018	AQC	65	ND	129	88
09/10/2018	AQC	5	3	14	1
6/26/2019	AQC	12.7	1	22	0.9
12/16/2019	AQC	9	2	36	2
5/14/2020	AQC	41	3	39	234
3/22/2017	Coal Mill	39	7	122	3
11/10/2017	Coal Mill	NS	6	106	77
6/28/2019	Coal Mill	50.8	4	62	102.8
12/18/2019	Coal Mill	13	1	115	18
5/13/2020	Coal Mill	39	3	53	228
7/31/2015	Dryer	98.8	3	58.44	63
12/21/2016	Dryer	35.2	<1	15	43.6
3/21/2017	Dryer	20	<1	68	<0.1
11/08/2017	Dryer	4	3	62	89
04/12/2018	Dryer	31	ND	116	205
09/12/2018	Dryer	10	3	69	28
6/25/2019	Dryer	4.4	<1	51	56.9
12/17/2019	Dryer	12	3	34	2
5/13/2020	Dryer	18	3	55	254
3/20/2017	FM1	47	NS	NS	NS
11/07/2017	FM1	NS	NS	NS	<0.1
4/16/2018	FM1	12	NS	NS	NS
9/13/2018	FM1	5	NS	NS	NS
6/26/2019	FM1	21.7	NS	NS	NS
12/16/2019	FM1	34	3	23	4
5/16/2020	FM1	32	3	118	229
7/27/2015	FM2	7.87	NS	NS	0.1
12/22/2016	FM2	1.8	NS	NS	NS
3/22/2017	FM2	11	NS	NS	NS
11/06/2017	FM2	NS	NS	NS	<0.1
04/11/2018	FM2	3	NS	NS	NS
09/11/2018	FM2	5	NS	NS	NS
6/25/2019	FM2	13.8	NS	NS	NS
12/16/2019	FM2	10	3	27	5
5/16/2020	FM2	82	3	86	243

Date Sampled	Location	Particulates (µg/Ncm)	SO_2 (µg/Ncm)	NO_2 (µg/Ncm)	CO (µg/Ncm)
12/22/2016	Generator Set	NS	5	74	5
4/19/2018	Generator Set	NS	NS	110	317
6/29/2019	Generator Set	NS	NS	61	332.7
7/29/2015	Kiln Main Stack	13.53	2.8	147.11	193.4
12/20/2016	Kiln Main Stack	14.8	3	74	6.5
04/05/2017	Kiln Main Stack	13	<0.02	109	156
11/09/2017	Kiln Main Stack	2	2	205	128
4/15/2018	Kiln Main Stack	5	<0.02	106	160
09/06/2018	Kiln Main Stack	8	3	115	30
6/24/2019	Kiln Main Stack	14.7	1	181	75.3
12/18/2019	Kiln Main Stack	18	4	116	26
05/12/2020	Kiln Main Stack	42	3	68	252
12/20/2016	Packhouse 1	18.2	NS	NS	NS
3/21/2017	Packhouse 1	27	NS	NS	NS
11/07/2017	Packhouse 1	NS	NS	NS	<0.2
12/17/2019	Packhouse 1	39	2	24	3
5/15/2020	Packhouse 1	55	2	37	252
12/20/2016	Packhouse 2	1.8	NS	NS	NS
3/22/2017	Packhouse 2	1	NS	NS	NS
11/06/2017	Packhouse 2	NS	NS	NS	<0.3
6/27/2019	Packhouse 2	5	NS	NS	NS
12/17/2019	Packhouse 2	11	3	42	3
5/15/2020	Packhouse 2	56	5	39	241
7/30/2015	PHSE1	7.07	NS	NS	0.1
4/18/2018	PHSE1	56	NS	NS	NS
9/14/2018	PHSE1	11	NS	NS	NS
7/27/2015	PHSE2	0.65	NS	NS	1.3
4/17/2018	PHSE2	6	NS	NS	NS
9/13/2018	PHSE2	5	NS	NS	NS

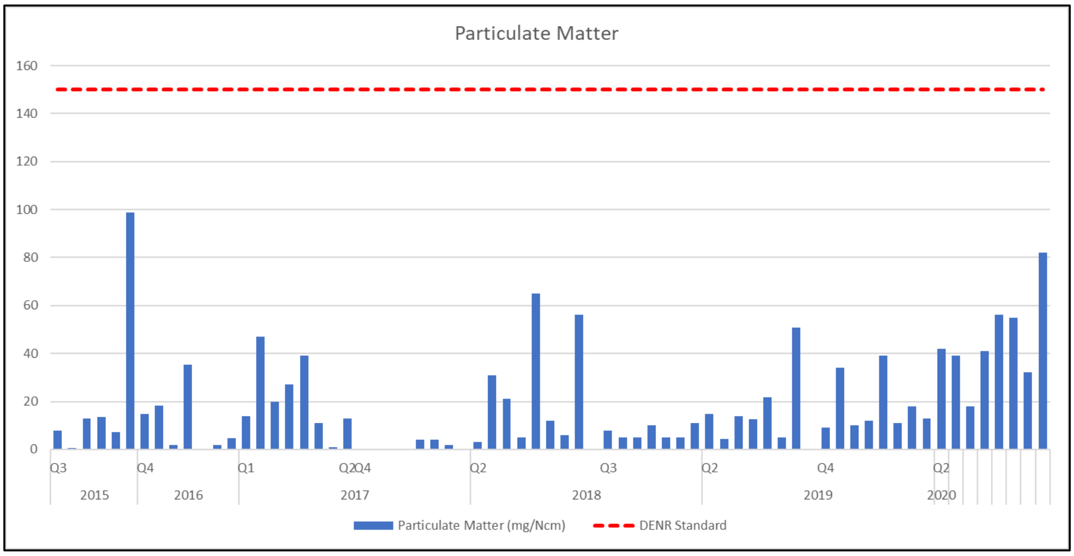


Figure 2.3-11. Source Emission Monitoring Results for Particulate Matter

The DENR Standard for PM noted above is based on Section 19 of the Philippine Clean Air Act, to cite:

Provided, that the maximum limits in µg/NCM particulates in said sources shall be:

1. **Fuel Burning Equipment**
   a) Urban or Industrial Area 150 mg/NCM
   b) Other Area 200 mg/NCM

2. **Cement Plants (Kilns, etc.) 150 mg/NCM**

It is observed that PM standards were generally complied with except for one isolated case in 2/13/14 that the recorded value was 166 **µ**g/NcM.

Baseline PM10 for ambient air monitoring, the test results are being awaited as of this date of submission of this revised EPRMP.

It is deemed, however, that TSP and not PM10 is the more relevant parameter for the project considering that dusts, i.e. TSPs, are the normal emissions

Particulate Matters are defined by their diameter for air quality regulatory purposes. Those with a diameter of 10 microns or less (PM10) are inhalable into the lungs and can induce adverse health effects.

Airborne particulate matter (PM) is not a single pollutant, but rather is a mixture of many chemical species and composed of small droplets of liquid, dry solid fragments, and solid cores with liquid coatings. Particles vary widely in size, shape and chemical composition, and may contain inorganic ions, metallic compounds, elemental carbon, and organic compounds.

PM may be either directly emitted from sources (primary particles) or formed in the atmosphere through chemical reactions of gases (secondary particles) such as sulfur dioxide (SO_2), nitrogen oxides (NO_X), and certain organic compounds.

Ambient baselines and monitoring of Dioxin & Furans (D&F) are duly noted. However, these parameters are not yet officially requirements and there are no enabling DAOs covering these parameters. Reliable laboratory test analysis and procedures are also not yet available in the Philippines

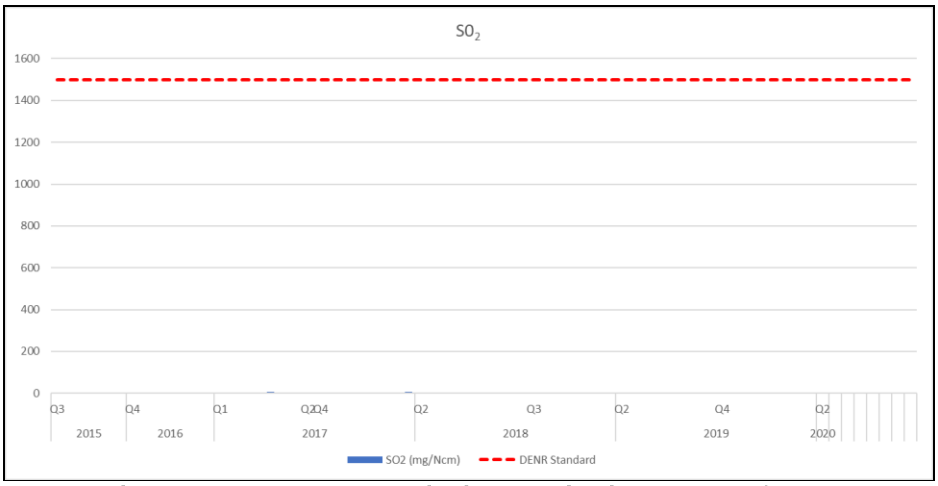


Figure 2.3-12. Source Emission Monitoring Results for S0$_2$

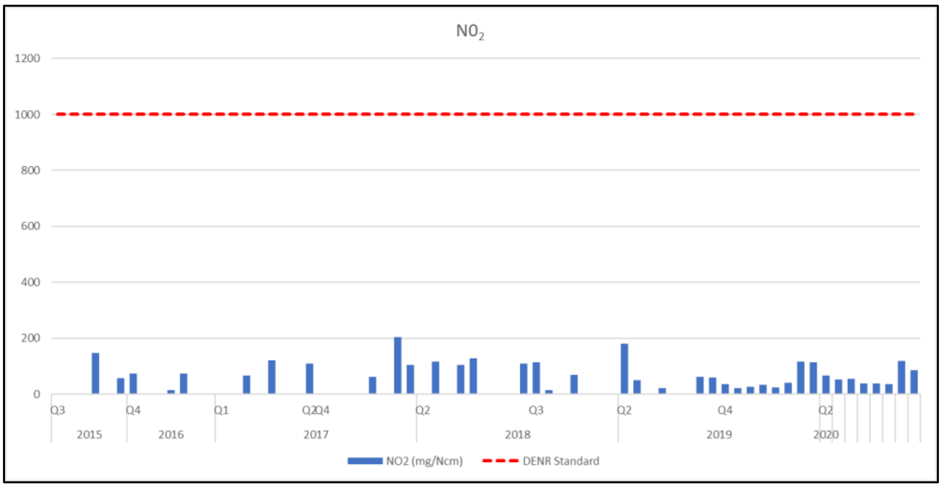


Figure 2.3-13. Source Emission Monitoring Results for NO$_2$

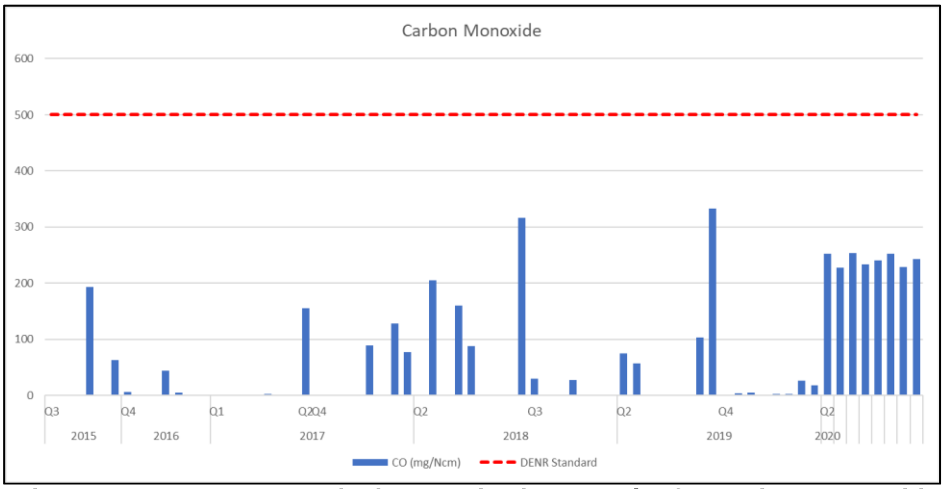


Figure 2.3-14. Source Emission Monitoring Results for Carbon Monoxide

2.3.2.2 Increase in ambient noise level

Characterization of ambient noise levels:

Table 2.3-14. Results of Ambient Noise Level Source Monitoring (2001)

	Date	Noise Daytime (dBA)	Noise Morning & Evening (dBA)	Noise Nightime (dBA)
	DENR Standard Class AA	75	70	65
Sta 1	08/27/2001	48	60	41
Sta 2	08/25/2001	63	54	49
Sta 3	08/24/2001	68	88	60
Sta 4	08/28/2001	57	55	46

Table 2.3-15. Results of Ambient Noise Level Source Monitoring (2015-2020)

Date Sampled	Location	Noise (dB)
5/28/2015	Purok 16	52
5/28/2015	MPCC Warehouse	57
5/28/2015	Purok 9, near Circle Post	44
5/28/2015	Loyalty Park - National Highway	63
4/12/2018	Pilmico Staffhouse	46.54
4/12/2018	Purok 9, near Circle Post	46.74
4/13/2018	Purok 16	57.85
4/13/2018	Guest House	55.56
8/9/2018	Paniangan - Revira Residence	48
8/9/2018	Paniangan - Sayson Residence	46
9/12/2018	Purok 16	60
9/12/2018	Purok 9, near Circle Post	41
9/12/2018	Guest House	60
11/9/2018	Paniangan - Revira Residence	53
11/9/2018	Paniangan - Sayson Residence	42
5/22/2019	Purok 9, Tag-ibo, Brgy. Dalipuga	47
5/22/2019	Purok 2, Tag-ibo, Dalipuga	44
5/22/2019	Purok 9, Kiwalan	43
5/22/2019	Purok 10, Matuog	57
9/4/2019	Purok 9, Tag-ibo, Brgy. Dalipuga	50
9/4/2019	Purok 2, Tag-ibo, Dalipuga	51
9/4/2019	Purok 9, Kiwalan	54
9/4/2019	Purok 10, Matuog	56
9/4/2019	Acmac	50
2/19/2020	Purok 9, Tag-ibo, Brgy. Dalipuga	54
2/19/2020	Purok 2, Tag-ibo, Dalipuga	46
2/19/2020	Purok 9, Kiwalan	52
2/19/2020	Purok 10, Matuog	58
2/19/2020	Acmac	49

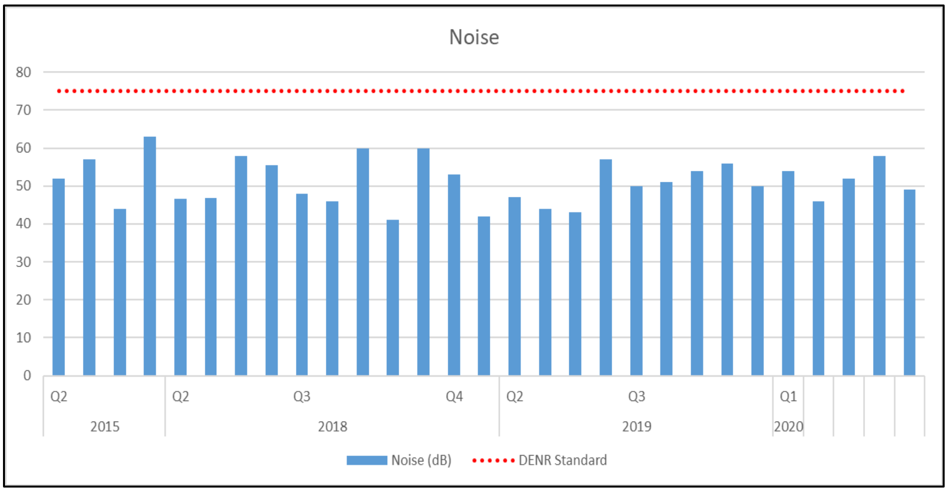


Figure 2.3-15. Ambient Noise Monitoring Results

The plant operations did not exceed the DENR standards for noise level; more importantly in the project vicinity. The highest noise level recorded during the monitoring is only 72 dB which is lower to DENR standard of 75 dB.

Table 2.3-16. Noise Monitoring for 2020

Date Sampled	Location	Noise (dB) Morning	Noise (dB) Daytime	Noise (dB) Evening
2/19/2020	Purok 9, Tag-ibo, Brgy. Dalipuga	53.00	56.00	52.00
2/19/2020	Purok 2, Tag-ibo, Brgy. Dalipuga	46.00	48.00	45.00
2/19/2020	Purok 9, Brgy. Kiwalan	51.00	54.00	49.00
2/19/2020	Purok 10, Matuog, Brgy. Kiwalan	59.00	54.00	57.00
2/19/2020	Brgy. Acmac	46.00	49.00	51.00
7/1/2020	Purok 9, Tag-ibo, Brgy. Dalipuga	53.00	53.00	51.00
7/1/2020	Purok 2, Tag-ibo, Brgy. Dalipuga	50.00	53.00	52.00
7/1/2020	Purok 9, Brgy. Kiwalan	50.00	58.00	59.00
7/1/2020	Purok 10, Matuog, Brgy. Kiwalan	60.00	53.00	61.00
7/1/2020	Brgy. Acmac	44.00	52.00	49.00
9/30/2020	Purok 9, Tag-ibo, Brgy. Dalipuga	61.00	63.00	65.00
9/30/2020	Purok 2, Tag-ibo, Brgy. Dalipuga	59.00	57.00	57.00
9/30/2020	Purok 9, Brgy. Kiwalan	66.00	62.00	55.00
9/30/2020	Purok 10, Matuog, Brgy. Kiwalan	58.00	64.00	57.00
9/30/2020	Brgy. Acmac	58.00	61.00	58.00
11/23/2020	Purok 9, Tag-ibo, Brgy. Dalipuga	56.00	53.00	56.00
11/23/2020	Purok 2, Tag-ibo, Brgy. Dalipuga	53.00	48.00	54.00
11/23/2020	Purok 9, Brgy. Kiwalan	60.00	57.00	51.00
11/23/2020	Purok 10, Matuog, Brgy. Kiwalan	58.00	50.00	56.00
11/23/2020	Brgy. Acmac	48.00	54.00	58.00

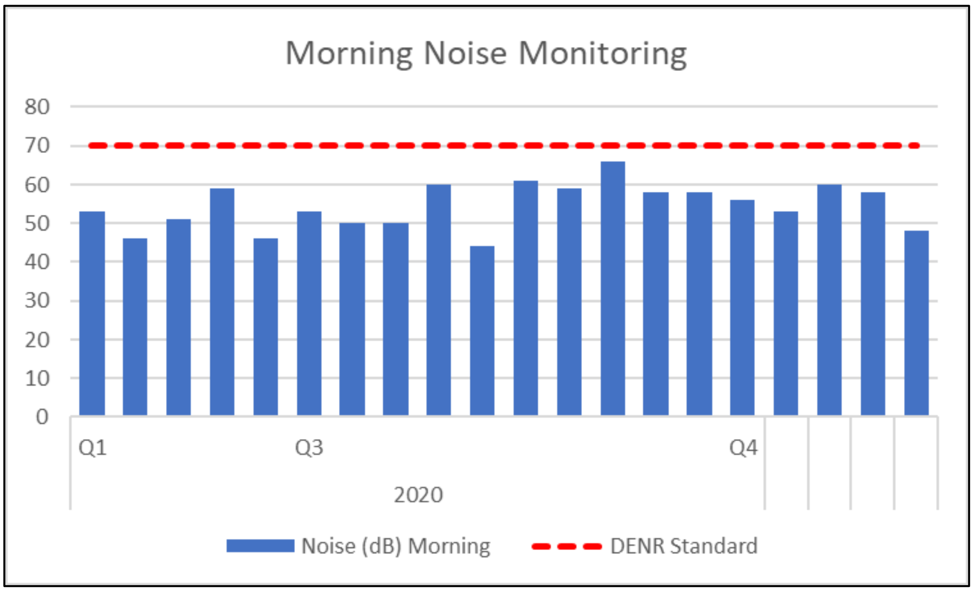


Figure 2.3-16. Morning Noise Monitoring Results (2020)

The plant operations did not exceed the DENR standards for Morning Noise level; more importantly in the project vicinity. The highest Noise level recorded during the monitoring is only 66 dB which is lower to DENR morning standard of 70 dB.

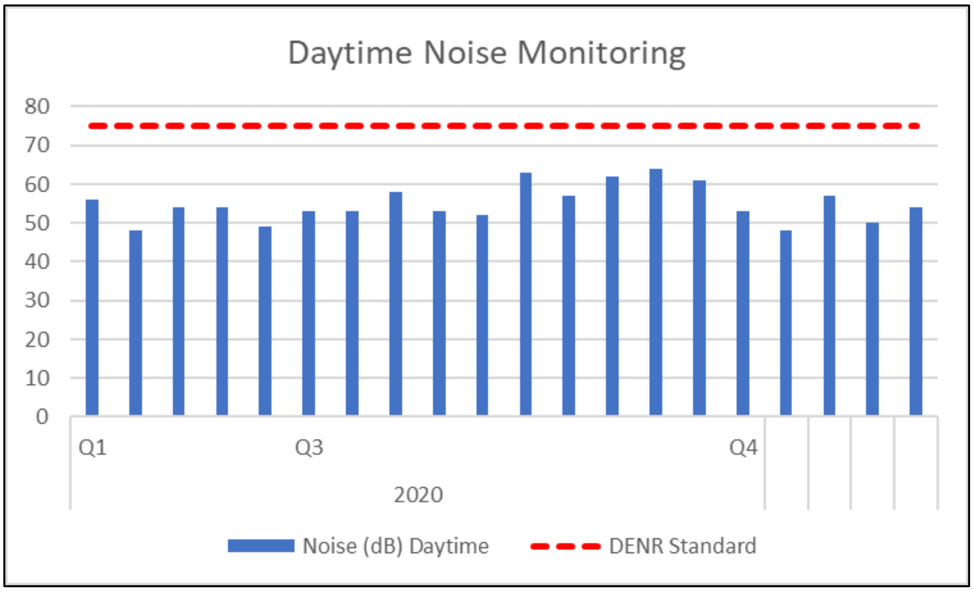


Figure 2.3-17. Daytime Noise Monitoring Results (2020)

The plant operations did not exceed the DENR standards for Daytime Noise level; more importantly in the project vicinity. The highest Noise level recorded during the monitoring is only 64 dB which is lower to DENR daytime standard of 75 dB.

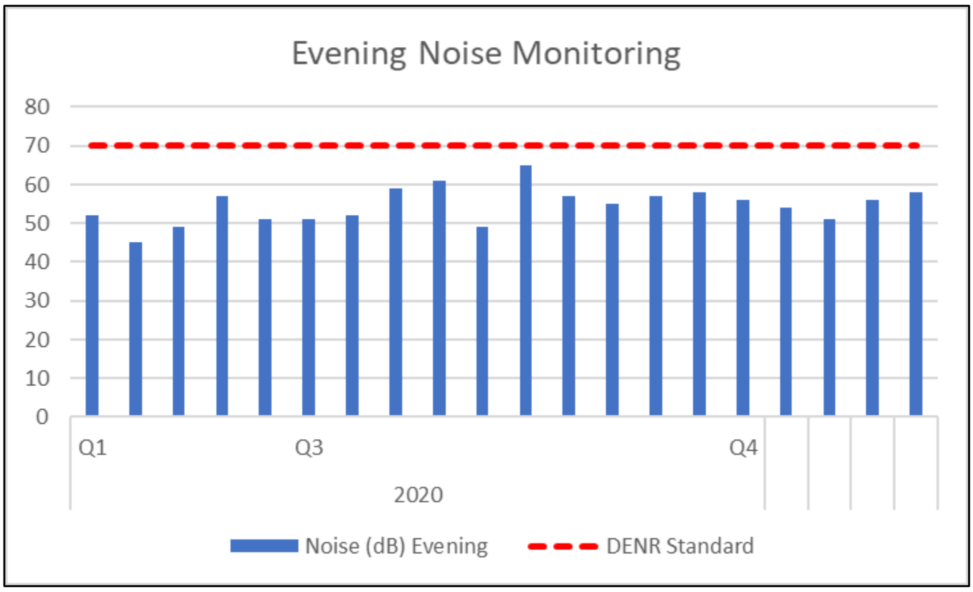


Figure 2.3-18. Evening Noise Monitoring Results (2020)

The plant operations did not exceed the DENR standards for Evening Noise level; more importantly in the project vicinity. The highest Noise level recorded during the monitoring is only 65 dB which is lower to DENR evening standard of 70 dB.

2.3.3 An Air Dispersion Modeling (ADM)

An Air Dispersion Modelling was undertaken for the combined operation of the projects noting that the domain, the Air Sensitive Receptors (ASRs) and the air quality parameters are common. Compliance is made with the Implementing Rules and Regulations of the Philippine Clean Air Act (RA 8749).

Emission sources were as follows: 1. Scenario 2 (Uncontrolled Scenario and Controlled Condition)-for the Proposed expansion; 2. Scenario 1 (Uncontrolled Scenario and Controlled Condition)-Existing. Emission Sources from the Cement Plant for point sources including processing components as Bouyant Line sources, Pre heater/Pre calciner, Clinker Cooler and Kiln Stack as Point Sources while Quarry Sites as Major Area Sources. Results of the predictive peak values of emission dispersion modeling are presented in 2 dimensional and 3 dimensional domain: 8,000 m (8 km) X 8,000 m (8 km). Raw data of results are generated in output and plot files presented in the following Nomenclature: (x=distance from source, km), (y=distance from source, km), (z=elevation), conc=ground-level concentration, ug/m3).Parameters considered to this dispersion model are particulate matter, metals and gaseous criteria air pollutants namely: PM10, Total Suspended Particulate Matter (TSP), Sulfur dioxide (SO_2), Nitrogen oxides (NOx) and Carbon Monoxide (CO).

Air quality management program are among factors which may be related to the results of the dispersion model. These include the following: (a) emission control systems; (b) stack source testing (metals), (c) ambient air quality monitoring, (d) ambient air quality control measures. Emission control systems for Pre heater/Pre calciner, Clinker Cooler, Raw Mill and Kiln Stack are Electrostatic Precipitators while Baghouse Filters for Finding Grinding Mills. Other facilities such as Clinker Storage, Cement Silo, Pozzolan Storage, Gypsum Storage, Coal Mill, Finish Mill and Clinker Bin among others were controlled by covered structural facilities.

Input data such as point source emission strength based on concentration from stack sources which are provided by the proponent using Sampling methodologies using approved test methods pursuant to the DENR Administrative Orders (DAOs), Memorandum Circulars (MCs) under the Implementing Rules and Regulations of the Philippine Clean Air Act of 1999 (RA 8749). US-EPAAP-42 Emission Factors were used for buoyant line and area sources in the cement manufacturing.

Output of model run includes one (1) hour, eight (8) and twenty-four (24) hour time average isopleths diagrams and table of worst case scenarios. Emission dispersion is governed by the meteorological characteristics of an area based on wind speed, wind direction, stability class etc. among others. Meteorological data used is based on TIER 4 meteorological data, NCAR MM5 (5th-generation Mesoscale Model) prognostic meteorological model was the basis for meteorological background of the areas. Data are generated by running the NCAR MM5 (5th-generation Mesoscale Model) prognostic meteorological model for a specified location and site domain. Once the MM5 preprocessing has been completed, the MM5 output file is converted into a format recognized by the AERMET model (meteorological preprocessor for the AERMOD model). The final output is generated by creating a pseudo met-station at the specified site location.

Terrain data were generated using the Shuttle Radar Topography Mission (SRTM) which is an international research effort that obtained digital elevation models on a near-global scale to generate the most complete high-resolution digital topographic database of Earth. AERMOD executes complex terrain utilizing elected terrain using SRTM3 terrain data processed by AERMAP terrain processor.

Below are the summary outputs for Scenario 2 (uncontrolled and controlled conditions) and Scenario 1 (uncontrolled and controlled conditions) of worst case scenario (Scenario 1) simulating all four (4) lines of the cement plant.

AIR DISPERSION MODELING GUIDELINES

The Environmental Management Bureau (EMB) published Guidelines for Air Dispersion Modeling. The primary purpose of the guidelines (MC 2008-003) is to:

i. To provide guidance on carrying out atmospheric dispersion modeling in the Philippines in order to meet the requirements under the RA 8749;

ii. To provide a consistent approach in undertaking dispersion modeling using a tiered approach; and

iii. To improve the accuracy of modeling results so they can be relied upon when considering the potential adverse impacts of emissions to air.

AMBIENT AIR QUALITY GUIDELINE VALUES & STANDARDS

Guideline values in respect to discharge of pollutants from the source specific air pollutants with their respective averaging terms are presented in **Table 2.3-17** and **Table 2.3-18**.

Table 2.3-17. Ambient Air Quality Guideline Values

Pollutants	Short Term			Long Term		
	(ug/ncm)	ppm	Averaging Term	(ug/ncm)	ppm	Averaging term
Suspended Particulate Matter TSP PM – 10	 230 150		 24-hour 24-hour	 90 60		 1 year 1 year
Sulfur dioxide	180	0.07	24-hour	80	0.03	1 year
Nitrogen dioxide	150		24-hour			
Photochemical Oxidants as Ozone	140 60	0.07 0.03	1-hour 8-hour			
Carbon monoxide	35 mg/Ncm 10 mg/Ncm	30 9	1-hour 8-hour			
Lead	1.5		3 months	1.0		1 year

National Ambient Air Quality Standards for Specific Source

Table 2.3-18. Air Pollutants from Industrial Sources/Operations

Pollutants	Concentration			Method of Analysis/ Measurement
	(ug/ncm)	ppm	Averaging Term (min)	
Ammonia	200	0.028	30	Nesselerization / Indo Phenol
Carbon Disulfide	30	0.01	30	Tischer Method
Chlorine and Chlorine cmpds expressed as CL2	100	0.03	5	Methyl Orange
Formaldehyde	50	0.04	30	Chromotropic Acid Method or MBTH Colorimetric Method
Hydrogen Chloride	200	0.13	30	Volhard Titration with Iodine solution
Hydrogen Sulfide	100	0.07	30	Methylene Blue
Lead	20	-	30	Atomic Absorption Spectrophotometry
Nitrogen Dioxide	375 260	0.20 0.14	30 60	Griess-Saltzman
Phenol	100	0.03	30	4-Aminoantippyrine
Sulfur Dioxide	470 340	0.18 0.13	30 60	Colorimetric-Pararosaline
Suspended Particulates TSP PM-10	 300 200	 - -	 60 60	Gravimetric
Antimony	0.02 mg/Ncm	-	30	Atomic Absorption Spectrophotometry
Arsenic	0.02 mg/Ncm	-	30	Atomic Absorption Spectrophotometry
Cadmium	0.01 mg/Ncm	-	30	Atomic Absorption Spectrophotometry
Asbestos	2×10^8 Particulates/Ncm (over 5 micrometer in size)	-	30	Light-Microscopy
Sulfuric Acid	0.03 mg/Ncm	-	30	Titration
Nitric Acid	0.04 mg/Ncm	-	30	Titration

2.3.3.1 RECEPTOR ENVIRONMENT

Project Location

Figure 2.3-19 shows the location of the project.

Figure 2.3-19. Location of the project

Regional Meteorology

The climate in Iligan City, Lanao del Norte is a tropical wet and dry climate. There are two principal airstreams that dominate the region, namely, the northeast monsoon which prevails from October to April and the southwest monsoon which is prevalent from May to September. **Table 2.3-2** shows the climatological normals, wind speed-direction distribution rose frequency and wind rose at Iligan City, Lanao del Norte, respectively.

TERRAIN

The model utilized elected terrain using SRTM3 terrain data processed by AEMAP terrain processor. This option assumes terrain height exceeds stack base elevation, model receptors are also assumed on elevated terrain. Terrain elevations for receptors in the receptor Pathway are also considered. Elevated terrain is selected and receptor heights are not specified, then it is assumed to have a value of 0.0 meters. The surface roughness length is the height at which the mean horizontal wind speed approaches zero and is related to the surface roughness characteristics of the terrain. It is not equal to the physical dimensions of the obstacles to the wind flow, but is generally proportional to them. The surface roughness length dialog provides you with empirically determined surface roughness length values (from Sheih et al., 1979) for various land use types for each season. Select an appropriate input value from this dialog. Surface characteristics at the measurement site influence boundary layer parameter estimates. These influences are quantified through the albedo, Bowen ratio, and surface roughness length. In order to better quantify these characteristics, you need to specify the frequency that these characteristics change (annual, seasonal, or monthly) and the number of different sectors. **Figure 2.3-20** shows the extracted terrain elevation using the STRM3. **Figure 2.3-21** shows the extracted terrain elevation using the STRM3 with color scale.

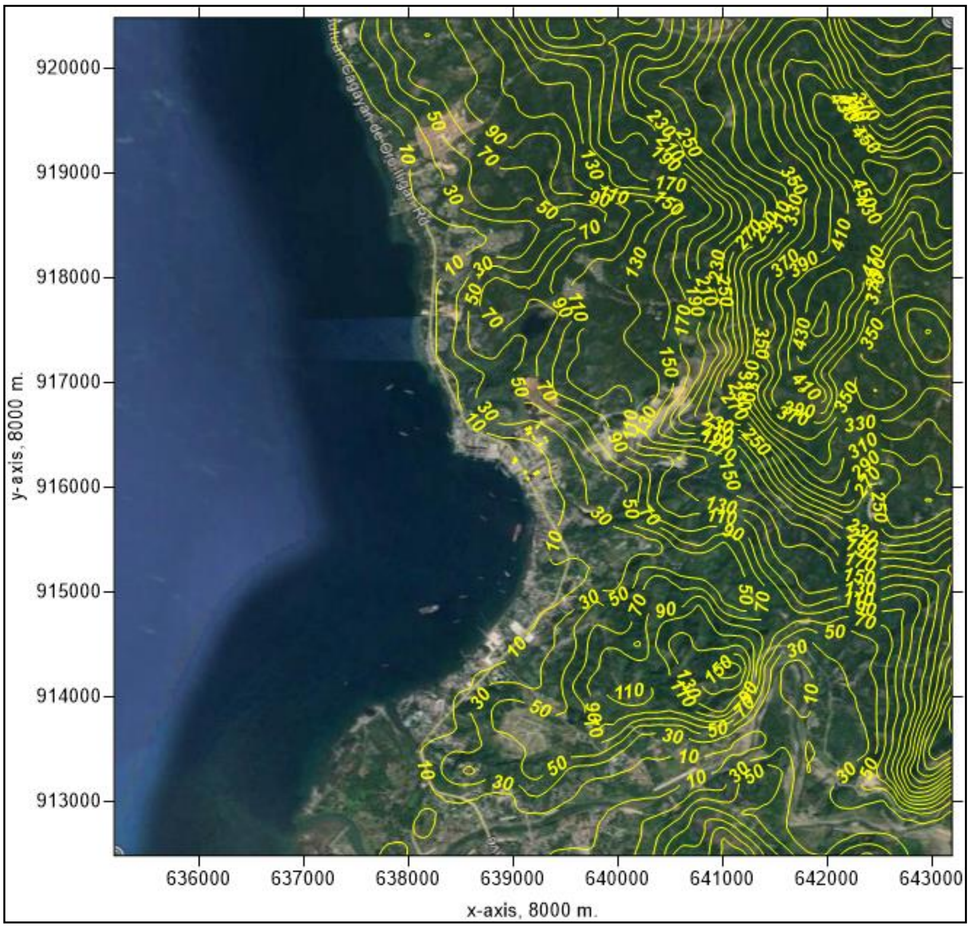


Figure 2.3-20. Terrain SRTM projection

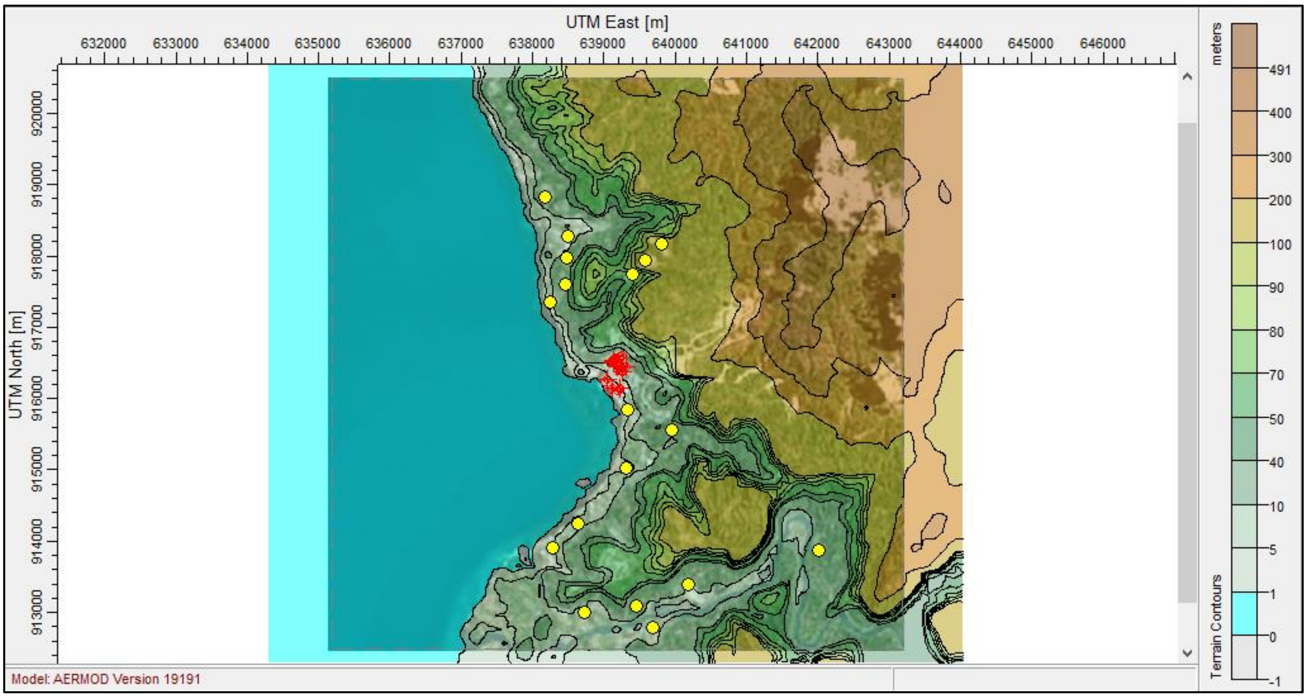


Figure 2.3-21. Terrain SRTM projection with Color Scale

2.3.3.2 PROCESS DESCRIPTION AND EMISSION DISCHARGE (MODEL INPUT)

EXTERNAL COMBUSTION –CEMENT MANUFACTURING

Raw materials in the cement manufacturing process consist of approximately limestone, shale, silica and pyrite. The kiln burns 100% bituminous coal from various sources including Indonesia and the Philippines. Diesel is used to pre-heat the kiln. The hot gas from the kiln is used to pre-heat the raw materials that are being fed into the kiln. The kiln gas is then passed into an electrostatic precipitator (EP) or dust collector before it is discharged to the atmosphere. The kiln stack has an inside diameter of 5 meters. The clinker from the kiln is cooled down with ambient air which passes through an EP before being discharged to a stack.

The initial production step in cement manufacturing is raw materials acquisition. Calcium, the element of highest concentration in portland cement, is obtained from a variety of calcareous raw materials, including limestone, chalk, marl, sea shells, aragonite, and an impure limestone known as "natural cement rock". Typically, these raw materials are obtained from open-face quarries, but underground mines or dredging operations are also used. Raw materials vary from facility to facility. Some quarries produce relatively pure limestone that requires the use of additional raw materials to provide the correct chemical blend in the raw mix. In other quarries, all or part of the noncalcarious constituents are found naturally in the limestone. Occasionally, pockets of pyrite, which can significantly increase emissions of sulfur dioxide (SO_2), are found in deposits of limestone, clays, and shales used as raw materials for portland cement. Because a large fraction (approximately one third) of the mass of this primary material is lost as carbon dioxide (CO_2) in the kiln, Portland cement plants are located close to a calcareous raw material source whenever possible. Other elements included in the raw mix are silicon, aluminum, and iron. These materials are obtained from ores and minerals such as sand, shale, clay, and iron ore. Again, these materials are most commonly from open-pit quarries or mines, but they may be dredged or excavated from underwater deposits. Either gypsum or natural anhydrite, both of which are forms of calcium sulfate, is introduced to the process during the finish grinding operations described below. These materials, also excavated from quarries or mines, are generally purchased from an external source, rather than obtained directly from a captive operation by the cement plant. The portland cement manufacturing industry is relying increasingly on replacing virgin materials with waste materials or byproducts from other manufacturing operations, to the extent that such replacement can be implemented without adversely affecting plant operations, product quality or the environment. Materials that have been used include fly ash, mill scale, and metal smelting slags. The second step in cement manufacture is preparing the raw mix, or kiln feed, for the pyroprocessing operation. Raw material preparation includes a variety of blending and sizing operations that are designed to provide a feed with appropriate chemical and physical properties. The raw material processing operations differ somewhat for wet and dry processes, as described below. Cement raw materials are received with an initial moisture content varying from 1 to more than 50 percent. If the facility uses dry process kilns, this moisture is usually reduced to less than 1 percent before or during grinding. Drying alone can be accomplished in impact dryers, drum dryers, paddle-equipped rapid dryers, air separators, or autogenous mills. However, drying can also be accomplished during grinding in ball-and-tube mills or roller mills. While thermal energy for drying can be supplied by exhaust gases from separate, direct-fired coal, oil, or gas burners, the most efficient and widely used source of heat for drying is the hot exit gases from the pyro processing system.

Materials transport associated with dry raw milling systems can be accomplished by a variety of mechanisms, including screw conveyors, belt conveyors, drag conveyors, bucket elevators, air slide conveyors, and pneumatic conveying systems. The dry raw mix is pneumatically blended and stored in specially constructed silos until it is fed to the pyro processing system. In the wet process, water is added to the raw mill during the grinding of the raw materials in ball or tube mills, thereby producing a pumpable slurry, or slip, of approximately 65 percent solids. The slurry is agitated, blended, and stored in various kinds and sizes of cylindrical tanks or slurry basins until it is fed to the pyro processing system. The heart of the portland cement manufacturing process is the pyro processing system. This system transforms the raw mix into clinkers, which are gray, glass-hard, spherically shaped nodules that range from 0.32 to 5.1 centimeters (cm) (0.125 to 2.0 inches [in.]) in diameter.

The chemical reactions and physical processes that constitute the transformation are quite complex, but they can be viewed conceptually as the following sequential events:

1. Evaporation of free water;
2. Evolution of combined water in the argillaceous components;
3. Calcination of the calcium carbonate ($CaCO_3$) to calcium oxide (CaO);
4. Reaction of CaO with silica to form dicalcium silicate;
5. Reaction of CaO with the aluminum and iron-bearing constituents to form the liquid phase;
6. Formation of the clinker nodules;
7. Evaporation of volatile constituents (e. g., sodium, potassium, chlorides, and sulfates); and
8. Reaction of excess CaO with dicalcium silicate to form tricalcium silicate.

Figure 2.3-22 shows the Cement Process Diagram

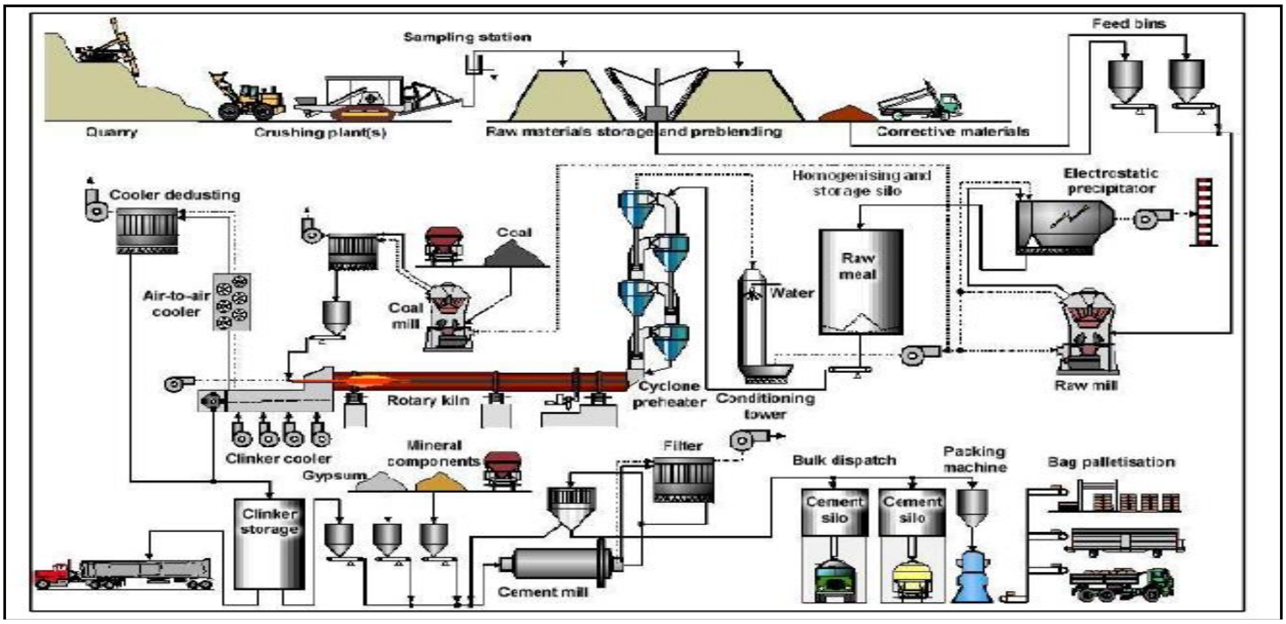


Figure 2.3-22. Cement Process Diagram

EMISSIONS / AIR POLLUTANTS

PARTICULATE MATTER EMISSIONS (PM)

Particulate matter (PM and PM-10), nitrogen oxides (NO_x), Carbon monoxide (CO), and CO_2 are the primary emissions in the manufacture of Portland cement. Small quantities of volatile organic compounds (VOC), ammonia (NH_3), chlorine, and hydrogen chloride (HCl), also may be emitted. Emissions may also include residual materials from the fuel and raw materials or products of incomplete combustion that are considered to be hazardous. Because some facilities burn waste fuels, particularly spent solvents in the kiln, these systems also may emit small quantities of additional hazardous organic pollutants. Also, raw material feeds and fuels typically contain trace amounts of heavy metals that may be emitted as a particulate or vapor. Sources of PM at cement plants include (1) quarrying and crushing, (2) raw material storage, (3) grinding and blending (in the dry process only), (4) clinker production, (5) finish grinding, and (6) packaging and loading. The largest emission source of PM within cement plants is the pyroprocessing system that includes the kiln and clinker cooler exhaust stacks. Often, dust from the kiln is collected and recycled into the kiln, thereby producing clinker from the dust. However, if the alkali content of the raw materials is too high, some or all of the dust is discarded or leached before being returned to the kiln. In many instances, the maximum allowable cement alkali content of 0.6 percent (calculated as sodium oxide) restricts the amount of dust that can be recycled. Bypass systems sometimes have a separate exhaust stack. Additional sources of PM are raw material storage piles, conveyors, storage silos, and unloading facilities. Emissions from Portland cement plants constructed or modified after August 17, 1971 are regulated to limit PM emissions from Portland cement kilns to 0.15 kg/Mg (0.30 lb/ton) of feed (dry basis), and to limit PM emissions from clinker coolers to 0.050 kg/Mg (0.10 lb/ton) of feed (dry basis).

CARBON MONOXIDE EMISSIONS (CO)

The rate of carbon monoxide (CO) emissions from combustion sources depends on the oxidation efficiency of the fuel. By controlling the combustion process carefully, CO emissions can be minimized. Thus, if a unit is operated improperly or not well maintained, the resulting concentrations of CO (as well as organic compounds) may increase by several orders of magnitude. The presence of CO in the exhaust gases of combustion systems results principally from incomplete fuel combustion.

NITROGEN OXIDES EMISSIONS (NOX) IN THE CEMENT PROCESS

Oxides of nitrogen (NO_x) are generated during fuel combustion by oxidation of chemically-bound nitrogen in the fuel and by thermal fixation of nitrogen in the combustion air. As flame temperature increases, the amount of thermally generated NOx increases. The amount of NOx generated from fuel increases with the quantity of nitrogen in the fuel. In the cement manufacturing process, NOx is generated in both the burning zone of the kiln and the burning zone of a precalcining vessel. Fuel use affects the quantity and type of NOx generated. For example, in the kiln, natural gas combustion with a high flame temperature and low fuel nitrogen generates a larger quantity of NOx than does oil or coal, which have higher fuel nitrogen but which burn with lower flame temperatures. The opposite may be true in a precalciner. Types of fuels used vary across the industry. Historically, some combination of coal, oil, and natural gas was used, but over the last 15 years, most plants have switched to coal, which generates less NOx than does oil or gas. However, in recent years a number of plants have switched to systems that burn a combination of coal and waste fuel. The effect of waste fuel use on NOx emissions is not clearly established.

SULFUR OXIDES EMISSIONS (SOX)

Sulfur Dioxide (SO2) emissions generated both from the sulfur compounds in the raw materials and from sulfur in the fuel. The sulfur content of both raw materials and fuels varies from plant to plant and with geographic location. However, the alkaline nature of the cement provides for direct absorption of SO_2 into the product, thereby mitigating the quantity of SO_2 emissions in the exhaust stream. Depending on the process and the source of the sulfur, SO_2 absorption ranges from about 70 percent to more than 95 percent.

2.3.3.3 METHODOLOGY

The Gaussian Plume equation is widely used in dispersion modeling. In this model, emission is transported in a straight line instantly to receptors in transport term away from the source depending on the meteorological data input. Atmosphere is uniform across the entire modeling domain. **Figure 2.3-23** shows the Gaussian plume principle.

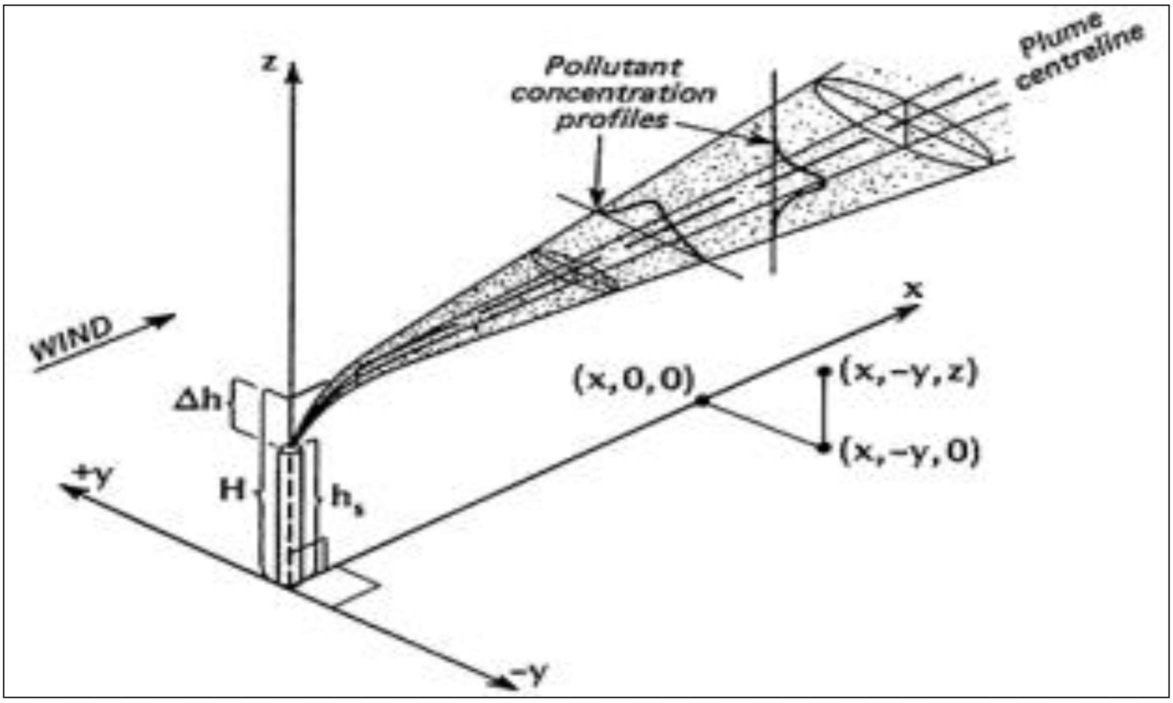


Figure 2.3-23. Gaussian Plume Principle

AERMOD GAUSSIAN PLUME DIPERSION MODEL

AERMOD is a steady-state plume model. In the stable boundary layer (SBL), it assumes the concentration distribution to be Gaussian in both the vertical and horizontal. In the convective boundary layer (CBL), the horizontal distribution is also assumed to be Gaussian, but the vertical distribution is described with a bi-Gaussian probability density function (pdf). This behavior of the concentration distributions in the CBL was demonstrated by Willis and Deardorff (1981) and Briggs (1993). Additionally, in the CBL, AERMOD treats "plume lofting," whereby a portion of plume mass, released from a buoyant source, rises to and remains near the top of the boundary layer before becoming mixed into the CBL. AERMOD also tracks any plume mass that penetrates into the elevated stable layer, and then allows it to re-enter the boundary layer when and if appropriate. For sources in both the CBL and the SBL AERMOD treats the enhancement of lateral dispersion resulting from plume meander. Using a relatively simple approach, AERMOD incorporates current concepts about flow and dispersion in complex terrain. Where appropriate the plume is modeled as either impacting and/or following the terrain. This approach has been designed to be physically realistic and simple to implement while avoiding the need to distinguish among simple, intermediate and complex terrain, as required by other regulatory models. As a result, AERMOD removes the need for defining complex terrain regimes. All terrain is handled in a consistent and continuous manner while considering the dividing streamline concept (Snyder et al. 1985) in stablystratified conditions.**Figure 2.3-24** shows the data flow in the Aermod system.

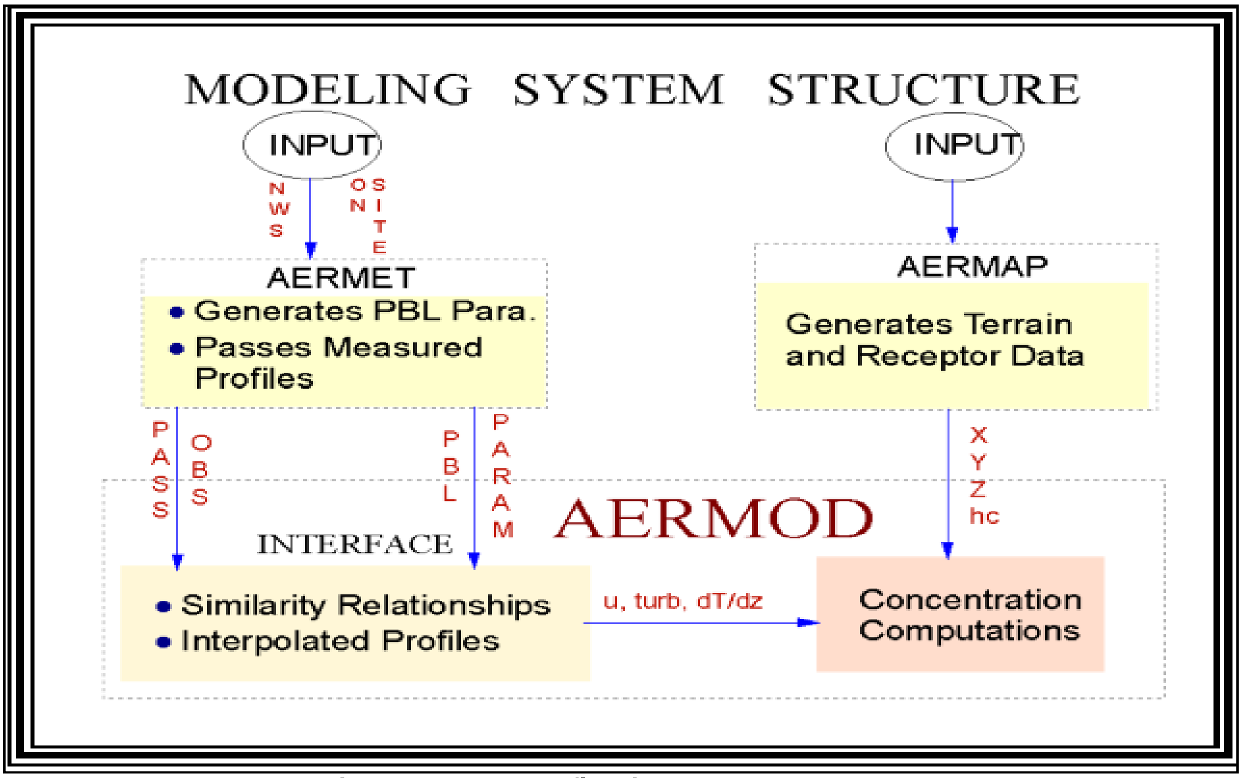


Figure 2.3-24. Data flow in AERMOD SYSTEM

METEOROLOGICAL AND TERRAIN DATA IN DISPERSION MODEL (AERMET & AERMAP)

Aermod meterological data requires Surface characteristics in the form of albedo, surface roughness and Bowen ratio, plus standard meteorological observations (wind speed, wind direction, temperature, and cloud cover), are input to AERMET. AERMET then calculates the PBL parameters: friction velocity (*u**), Monin-Obukhov length (*L*), convective velocity scale (*w*13*), temperature scale (2), mixing height (*z*), and surface heat flux (*H*). These parameters are then passed to the INTERFACE (which is within AERMOD) where similarity expressions (in conjunction with measurements) are used to calculate vertical profiles of wind speed (*u*), lateral and vertical turbulent fluctuations (F*v*, F*w*), potential temperature gradient (*d2/dz*), and potential temperature (2).

The AERMIC terrain pre-processor AERMAP uses gridded terrain data to calculate a representative terrain-influence height (*h*), also referred to as the terrain height scale. The terrain height scale *hcc*, which is uniquely defined for each receptor location, is used to calculate the dividing streamline height. The gridded data needed by AERMAP is selected from Digital Elevation Model (DEM) data. AERMAP is also used to create receptor grids. The elevation for each specified receptor is automatically assigned through AERMAP. For each receptor, AERMAP passes the following information to AERMOD: the receptor's location (*x*), its height above mean sea level (*z*), and the receptor specific terrain height scale (*h*).A comprehensive description of the basic formulation of the AERMOD dispersion modeling including the INTERFACE, AERMET, and AERMAP is present. Included are: 1) a complete description of the AERMET algorithms that provide quantitative hourly PBL parameters; 2) the general form of the concentration equation with adjustments for terrain; 3) plume rise and dispersion algorithms appropriate for both the convective and stable boundary layers; 4) handling of boundary layer inhomogeneity; 5) algorithms for developing vertical profiles of the necessary meteorological parameters; 6) a treatment of the nighttime urban boundary layer; 7) treatment of building downwash (incorporation of PRIME); and 8) enhancement of lateral dispersion due to plume meander. The model described here represents the 04300 versions of AERMOD, AERMET and AERMAP. **Figure 2.3-25** and **2.3-26** shows the snapshot of processed surface and upper level data by Aermet, respectively **Figure 2.3-27** shows the Aermod treatment of boundar parameters. **Figure 2.3-28** shows the terrain within the 8 km x 8 km map model domain.

	Year	Month	Day	Julian Day	Hour	Sensible Heat Flux (W/m^2)	Surface Friction Velocity (m/s)	Convective Velocity Scale (m/s)	Vertical Potential Temperature Gradient above PBL	Height of Convectively-Generated Boundary Layer - PBL (m)	Height of Mechanically-Generated Boundary Layer - SBL (m)	Monin-Obukhov Length (m)	Surface Roughness Length (m)	Bowen Ratio	Albedo	Wind Speed Ws (m/s)	Wind Direction WD (degrees)	Reference Height for Ws and Wd (m)	Temperature - temp (K)	Reference Height for temp (m)	Precipitation Code
Min.	2015	Jan	1	1	1	-999.0	-9.000	-9.000	-9.000	-999.0	-999.4	-99999.0	1.000	2.00	0.15	-99.10	0.0	10.0	273.1	2.0	
Max.	2015	Dec	31	365	24	394.2	1.210	2.069	0.005	2439.5	3460.6	9999.0	1.000	2.00	1.00	5.10	999.0	10.0	302.0	2.0	
Graph																					
1	2015	Jan	1	1	1	-999.0	-9.000	-9.000	-9.000	-999.0	-999.4	-99999.0	1.000	2.00	1.00	0.00	0.0	10.0	298.8	2.0	
2	2015	Jan	1	1	2	-4.6	0.027	-9.000	-9.000	-999.0	67.0	12.6	1.000	2.00	1.00	1.00	170.0	10.0	298.8	2.0	
3	2015	Jan	1	1	3	-4.6	0.027	-9.000	-9.000	-999.0	61.0	15.0	1.000	2.00	1.00	1.00	204.0	10.0	298.2	2.0	
4	2015	Jan	1	1	4	-26.7	0.282	-9.000	-9.000	-999.0	187.0	75.9	1.000	2.00	1.00	2.10	182.0	10.0	297.8	2.0	
5	2015	Jan	1	1	5	-4.1	0.047	-9.000	-9.000	-999.0	117.0	84.5	1.000	2.00	1.00	1.00	183.0	10.0	298.9	2.0	
6	2015	Jan	1	1	6	-4.1	0.047	-9.000	-9.000	-999.0	43.0	84.2	1.000	2.00	1.00	1.00	182.0	10.0	297.4	2.0	
7	2015	Jan	1	1	7	-4.2	0.057	-9.000	-9.000	-999.0	51.0	87.5	1.000	2.00	1.00	1.00	185.0	10.0	299.4	2.0	
8	2015	Jan	1	1	8	24.1	0.226	0.305	0.005	60.0	255.0	-28.5	1.000	2.00	0.34	1.00	203.0	10.0	299.1	2.0	
9	2015	Jan	1	1	9	120.7	0.289	-9.000	-9.000	-999.0	-999.0	-99999.0	1.000	2.00	0.23	0.00	0.0	10.0	299.5	2.0	
10	2015	Jan	1	1	10	213.1	0.453	-9.000	-9.000	-999.0	722.0	-38.1	1.000	2.00	0.17	2.10	169.0	10.0	297.8	2.0	
11	2015	Jan	1	1	11	225.0	0.457	-9.000	-9.000	-999.0	740.0	-37.1	1.000	2.00	0.16	2.10	184.0	10.0	297.4	2.0	
12	2015	Jan	1	1	12	214.1	0.229	-9.000	-9.000	-999.0	370.0	-4.8	1.000	2.00	0.16	1.00	204.0	10.0	298.2	2.0	
13	2015	Jan	1	1	13	204.1	0.296	-9.000	-9.000	-999.0	364.5	-7.8	1.000	2.00	0.15	1.00	222.0	10.0	298.5	2.0	

Figure 2.3-25. Aermod Surface Meteorology (SFC)

	Year	Month	Day	Hour	Measurement Height (m)	1, if this is the last (highest) level for this hour, or 0 otherwise	Direction the wind is blowing from for the current level (degrees)	Wind Speed for the current level (m/s)	Temperature at the current level (C)	Standard deviation of the wind direction fluctuations (degrees)	Standard deviation of the vertical wind speed fluctuations (m/s)
Min.	2015	Jan	1	1	10.0	1	0.0	-20.10	-2.0	99.0	99.00
Max.	2015	Dec	31	24	10.0	1	999.0	5.10	29.8	99.0	99.00
Graph											
1	2015	Jan	1	1	10.0	1	0.0	0.00	24.9	99.0	99.00
2	2015	Jan	1	2	10.0	1	170.0	1.00	26.7	99.0	99.00
3	2015	Jan	1	3	10.0	1	204.0	1.00	25.1	99.0	99.00
4	2015	Jan	1	4	10.0	1	182.0	2.10	24.7	99.0	99.00
5	2015	Jan	1	5	10.0	1	183.0	1.00	25.7	99.0	99.00
6	2015	Jan	1	6	10.0	1	182.0	1.00	24.2	99.0	99.00
7	2015	Jan	1	7	10.0	1	185.0	1.00	26.3	99.0	99.00
8	2015	Jan	1	8	10.0	1	203.0	1.00	26.0	99.0	99.00
9	2015	Jan	1	9	10.0	1	0.0	0.00	26.4	99.0	99.00
10	2015	Jan	1	10	10.0	1	181.0	2.10	24.8	99.0	99.00
11	2015	Jan	1	11	10.0	1	184.0	2.10	24.5	99.0	99.00
12	2015	Jan	1	12	10.0	1	250.0	1.00	25.1	99.0	99.00
13	2015	Jan	1	13	10.0	1	233.0	1.00	25.7	99.0	99.00
14	2015	Jan	1	14	10.0	1	179.0	2.10	26.6	99.0	99.00
15	2015	Jan	1	15	10.0	1	262.0	1.00	26.9	99.0	99.00
16	2015	Jan	1	16	10.0	1	181.0	1.55	25.6	99.0	99.00
17	2015	Jan	1	17	10.0	1	0.0	0.00	24.4	99.0	99.00
18	2015	Jan	1	18	10.0	1	227.0	2.10	26.0	99.0	99.00
19	2015	Jan	1	19	10.0	1	224.0	2.10	26.8	99.0	99.00

Figure 2.3-26. Aermod Profile Meteorology (PFL)

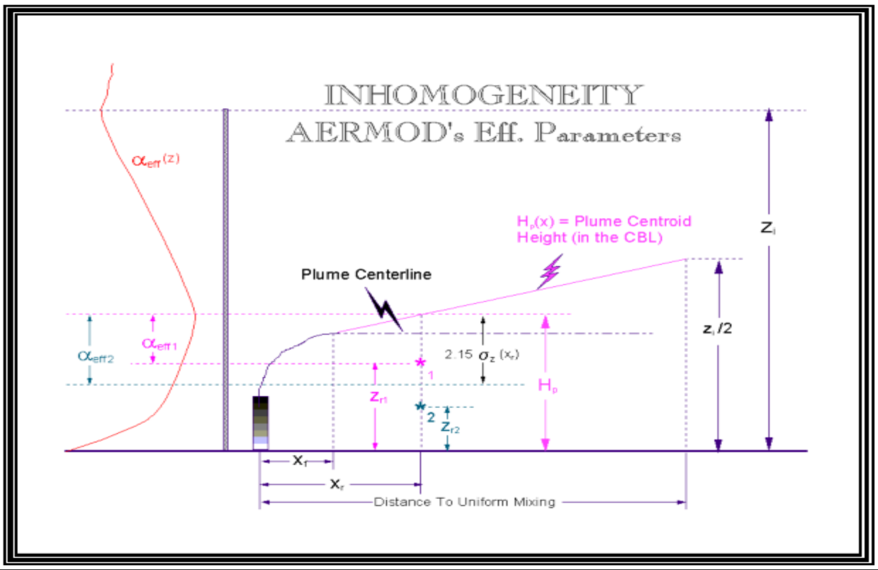


Figure 2.3-27. AERMOD Treatment of Boundary Parameters

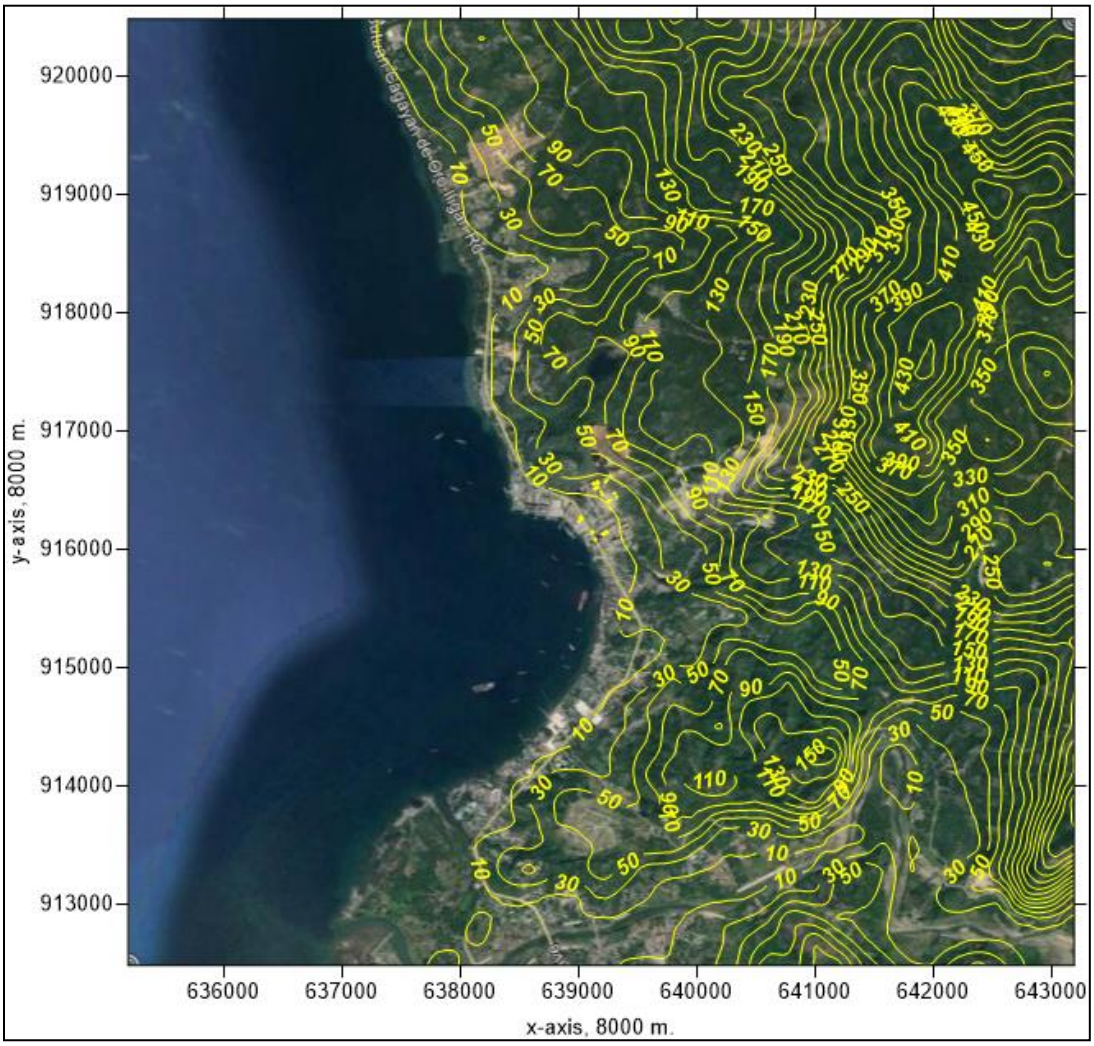


Figure 2.3-28. Terrain Within the 8km x 8km Domain Model

INPUT DATA IN THE DISPERSION MODEL (SOURCE PATHWAY)

To assess the levels in the ambient air concentration in the quarry and cement manufacturing plant, emission modelling for PM10, TSP, CO,SO_2, and NO_2 was performed both measured (Stack Test) by point and area source estimate (Emission Factors). Ground level concentrations at different distances from the plants were computed according to the emission strengths using the Gaussian Plume Dispersion Model. **Tables 2.3-19** to **2.3-20** shows the modeling input parameters.

Included are all aspects of Air Pollution Sources (Point, Area, Volume, Line, etc.)

Simple terrain with receptor height of 1.5 m (Average Filipino Height), rural area, terrain (Roughness coefficient) and building wake effects was used in the full meteorology scenario. Emission input data were used to simulate dispersion under scenario 1 (uncontrolled and controlled condition) and scenario 2 (uncontrolled and controlled condition) emissions in the Cement Manufacturing and Quarry Sites. Parameters considered in the model run were as follows: Total Suspended Particulates (TSP), Carbon Monoxide (CO), PM10 and SO2 (Sulfur Dioxide) and NOx (Oxides of Nitrogen)

Model Input Data:

Table 2.3-19. Model Input Data for Scenario 2

DATA FOR AIR DISPERSION MODELLING FOR SCENARIO II

I. Cement Raw Material, Product Processing and Handling	Proponent	tons of Materials processed/ hr	Operating Hours /day	PM AP 42 EF (lb/Ton)	PM 10 AP 42 EF (lb/Ton) @ 0.75	PM Emission Stregnth (g/s)	PM Emission Stregnth (g/sec-m2)	PM10 Emission Stregnth (g/s)	PM10 Emission Stregnth (g/sec-m2)	Height (meters)	X* (meters)	Y* (meters)	x1	y1	x2	y2	x3	y3	x4	y4
Limestone Crushing Primary	RCII	300	15	0.00100000	0.00075000	0.00003771	0.0000001402	0.00002828	0.0000001051	22.40	639273.7	916640.1	639265.5	916631.9	639265.5	916648.3	639281.9	916648.3	639281.9	916631.9
Limestone Crushing Secondary	RCII	300	15	0.00100000	0.00075000	0.00003771	0.0000001342	0.00002828	0.0000001006	15.20	639262.0	916620.0	639253.6	916611.6	639253.6	916628.4	639270.4	916628.4	639270.4	916611.6
Limestone screening (primary	RCII	300	15	0.00100000	0.00075000	0.00003771	0.0000001450	0.00002828	0.0000001088	12.20	639239.0	916588.0	639230.9	916579.9	639230.9	916596.1	639247.1	916596.1	639247.1	916579.9
Limestone transfer (primary /secondary)	RCII	300	15	0.00100000	0.00075000	0.00003771	0.0000001450	0.00002828	0.0000001088	12.20	639225.2	916567.3	639217.1	916559.2	639217.1	916575.3	639233.3	916575.3	639233.3	916559.2
Drying	RCII	200	21	0.00800000	0.00600000	0.00020111	0.0000000823	0.00015083	0.0000000617	22.73	639299.3	916473.0	639274.6	916448.3	639274.6	916497.7	639324.0	916497.7	639324.0	916448.3
Raw Milling	RCII	140	19	0.01200000	0.00900000	0.00021116	0.0000002419	0.00015837	0.0000001814	37.91	639248.0	916403.2	639233.2	916388.4	639233.2	916417.9	639262.8	916417.9	639262.8	916388.4
Raw Mill Air Separator	RCII	140	19	0.00310000	0.00232500	0.00005455	0.0000000625	0.00004091	0.0000000469	37.91	639248.0	916403.2	639233.2	916388.4	639233.2	916417.9	639262.8	916417.9	639262.8	916388.4
Raw Mill Feed belt	RCII	140	19	0.00940000	0.00705000	0.00016541	0.0000001895	0.00012406	0.0000001421	37.91	639269.5	916414.0	639254.7	916399.3	639254.7	916428.8	639284.3	916428.8	639284.3	916399.3
Coal Milling	RCII	15	16	0.00240000	0.00180000	0.00000452	0.0000000090	0.00000339	0.0000000067	24.60	639139.4	916510.6	639128.2	916499.4	639128.2	916521.8	639150.6	916521.8	639150.6	916499.4
Finish Grinding Mill 1	RCII	65	20	0.00240000	0.00180000	0.00001961	0.0000000171	0.00001471	0.0000000128	30.75	639127.5	916551.5	639110.5	916534.5	639110.5	916568.4	639144.4	916568.4	639144.4	916534.5
Finish Grinding Mill 1 Air Separator	RCII	65	20	0.00240000	0.00180000	0.00001961	0.0000000171	0.00001471	0.0000000128	30.75	639127.5	916551.5	639110.5	916534.5	639110.5	916568.4	639144.4	916568.4	639144.4	916534.5
Finish Grinding Mill 1 Weigh Hopper	RCII	65	20	0.00022000	0.00016500	0.00000180	0.0000000016	0.00000135	0.0000000012	30.75	639161.9	916562.0	639144.9	916545.0	639144.9	916578.9	639178.8	916578.9	639178.8	916545.0
Finish Grinding Mill 1 Feed belts	RCII	65	20	0.00240000	0.00180000	0.00001961	0.0000000171	0.00001471	0.0000000128	30.75	639161.9	916562.0	639144.9	916545.0	639144.9	916578.9	639178.8	916578.9	639178.8	916545.0
Finish Grinding Mill 1 Fly Ash Feeding	RCII	20	20	0.00240000	0.00180000	0.00000603	0.0000001284	0.00000452	0.0000000963	30.75	639156.4	916574.4	639152.9	916571.0	639152.9	916577.8	639159.8	916577.8	639159.8	916571.0
Packhouse 1 RP No. 2	RCII	96	7	0.00800000	0.00600000	0.00009653	0.0000000816	0.00007240	0.0000000612	26.75	639020.6	916258.4	639003.4	916241.2	639003.4	916275.6	639037.8	916275.6	639037.8	916241.2
Packhouse 1 RP No. 4	RCII	76.8	8	0.00800000	0.00600000	0.00007722	0.0000000653	0.00005792	0.0000000490	26.75	639020.6	916258.4	639003.4	916241.2	639003.4	916275.6	639037.8	916275.6	639037.8	916241.2
Finish Grinding Mill 2	RCMI	65	20	0.00800000	0.00600000	0.00006536	0.0000000742	0.00004902	0.0000000556	27.46	639239.7	916139.3	639224.8	916124.5	639224.8	916154.2	639254.5	916154.2	639254.5	916124.5
Finish Grinding Mill 2 Weigh Hopper	RCMI	190	20	0.00800000	0.00600000	0.00019105	0.0000002169	0.00014329	0.0000001626	27.46	639208.7	916127.8	639193.9	916113.0	639193.9	916142.7	639223.6	916142.7	639223.6	916113.0
Finish Grinding Mill 2 Feed belts	RCMI	190	20	0.00800000	0.00600000	0.00019105	0.0000002169	0.00014329	0.0000001626	27.46	639208.7	916127.8	639193.9	916113.0	639193.9	916142.7	639223.6	916142.7	639223.6	916113.0
Packhouse 2 RP No. 3	RCMI	57.6	9	0.00800000	0.00600000	0.00005792	0.0000000382	0.00004344	0.0000000287	31.35	639115.1	916142.9	639095.7	916123.4	639095.7	916162.3	639134.6	916162.3	639134.6	916123.4
Packhouse 2 HBBF	RCMI	40	13	0.00800000	0.00600000	0.00004022	0.0000000265	0.00003017	0.0000000199	31.35	639115.1	916142.9	639095.7	916123.4	639095.7	916162.3	639134.6	916162.3	639134.6	916123.4

II. Kiln and Clinker	Proponent	tons of Materials processed/ hr	Operating Hours /day	PM AP 42 EF (lb/Ton)	PM 10 AP 42 EF (lb/Ton) @ 0.75	PM Emission Stregnth (g/s)	PM Emission Stregnth (g/sec-m2)	PM10 Emission Stregnth (g/s)	PM10 Emission Stregnth (g/sec-m2)	Height (meters)	X* (meters)	Y* (meters)	x1	y1	x2	y2	x3	y3	x4	y4
Preheater	RCII	130	21.1	0.02600000	0.01950000	0.0004248366	0.0000006516	0.0003186275	0.0000004887	50.48	639199.6	916458.7	639186.8	916445.9	639186.8	916471.4	639212.3	916471.4	639212.3	916445.9
Kiln	RCII	130	21.1	0.20000000	0.15000000	0.0032679739	0.0000033971	0.0024509804	0.0000025478	16.02	639188.9	916482.1	639173.4	916466.6	639173.4	916497.6	639204.4	916497.6	639204.4	916466.6
Clinker Cooler	RCII	102	21.1	0.09600000	0.07200000	0.0012307692	0.0000015739	0.0009230769	0.0000011804	15.72	639156.8	916522.0	639142.8	916508.0	639142.8	916536.0	639170.8	916536.0	639170.8	916508.0

Emission Test Results	Proponent	Capacity	Volumetric	Stack		Stack Temp.		PM	CO	NOx	Sox	etc.	Control	Approx. Distance		UTM Coordinates	
		Tons/hr or	(Nm3/min)	Ht(m)	Diam (m)	Inlet (°C)	Outlet (°C)	mg/Nm3					%	X*	Y*	Longitud	Latitude
1. Dryer Stack	RCII	200 TPH	4255	35.00	3.20		49	18	254	55	3		Baghouse, 9	108		639319.7	916439.5
2. Kiln Stack	RCII	130 TPH	2769	60.00	5.00		93	42	252	68	3		EP. 95%	0		639263.0	916344.3
3. AQC Stack	RCII	102 TPH	1346	26.00	2.10		189	41	234	39	3		EP. 95%	233		639154.9	916551.1
4. Coal Stack	RCII	12 TPH	506	26.00	1.24		69	39	228	53	3		Baghouse, 9	210		639135.8	916511.8
5. FM1 Stack	RCII	65 TPH	646	8.24	0.96		61	31	229	118	3		Baghouse, 9	253		639128.7	916558.0
6. FM2 Stack	RCMI	65 TPH	52	9.14	0.78		36	83	243	86	3		Baghouse, 9	199		639228.2	916151.4
7. PH1 Exhaust	RCII	173 TPH	335	9.14	0.52		46	55	252	37	2		Baghouse, 9	261		639017.0	916267.0
8. PH2 Stack	RCMI	98 TPH	51	6.16	0.75		49	56	241	39	5		Baghouse, 9	247		639115.0	916148.0

Etc… (New Installation)	Proponent	Tons/hr or KW or BHP	PM AP 42 EF (lb/Ton)	PM 10 AP 42 EF (lb/Ton) @ 0.75	PM Emission Stregnth (g/s)	PM Emission Stregnth (g/sec-m2)	PM10 Emission Stregnth (g/s)	PM10 Emission Stregnth (g/sec-m2)	X* (meters)	Y* (meters)	x1	y1	x2	y2	x3	y3	x4	y4
Packhouse 1 RP No. 1/5	RCII	144	########	0.01950000	0.0004705882	0.0000004744	0.0003529412	0.0000003558	639020.6	916258.4	639004.8	916242.7	639004.8	916274.2	639036.3	916274.2	639036.3	916242.7
Packhouse 1 Tonner Bag Loading	RCII	20	########	0.15000000	0.0005027652	0.0000005068	0.0003770739	0.0000003801	639020.6	916258.4	639004.8	916242.7	639004.8	916274.2	639036.3	916274.2	639036.3	916242.7
Packhouse 1 Auto Palletizer	RCII	20	########	0.07200000	0.0002413273	0.0000002433	0.0001809955	0.0000001825	639001.1	916236.6	638985.3	916220.8	638985.3	916252.3	639016.8	916252.3	639016.8	916220.8
Finish Grinding Mill 2 Pregrinder	RCMI	190	########	0.15000000	0.0047762695	0.0000046014	0.0035822021	0.0000034511	639208.7	916127.8	639192.6	916111.7	639192.6	916143.9	639224.8	916143.9	639224.8	916111.7
Packhouse 2 Bulk Cement Loading	RCMI	250	########	0.07200000	0.0030165913	0.0000033592	0.0022624434	0.0000025194	639140.2	916083.3	639125.2	916068.3	639125.2	916098.2	639155.2	916098.2	639155.2	916068.3

Plant Expansion

Production Capacity:	Cement Clinker	Cement Product
	MMTPY	MMTPY
Existing	0.61	2.00
Expansion	3.10	2.30
Total	3.71	4.30
*MMTPY - Million Metric Tons Per Year		

Table 2.3-20. Model Input Data for Scenario 1

DATA FOR AIR DISPERSION MODELLING FOR SCENARIO I

I. Cement Raw Material, Product Processing and Handling	Proponent	tons of Materials processed/ hr	Operating Hours /day	PM AP 42 EF (lb/Ton)	PM 10 AP 42 EF (lb/Ton) @ 0.75	PM Emission Stregnth (g/s)	PM Emission Stregnth (g/sec-m2)	PM10 Emission Stregnth (g/s)	PM10 Emission Stregnth (g/sec-m2)	Height (meters)	X* (meters)	Y* (meters)	x1	y1	x2	y2	x3	y3	x4	y4
Limestone Crushing Primary	RCII	300	15	0.0010000000	0.0007500000	0.0000377074	0.0000001402	0.0000282805	0.0000001051	22.40	639156.8	916522.0	639148.6	916513.8	639148.6	916530.2	639165.0	916530.2	639165.0	916513.8
Limestone Crushing Secondary	RCII	300	15	0.0010000000	0.0007500000	0.0000377074	0.0000001342	0.0000282805	0.0000001006	15.20	639262.0	916620.0	639253.6	916611.6	639253.6	916628.4	639270.4	916628.4	639270.4	916611.6
Limestone screening (primary	RCII	300	15	0.0010000000	0.0007500000	0.0000377074	0.0000001450	0.0000282805	0.0000001088	12.20	639239.0	916588.0	639230.9	916579.9	639230.9	916596.1	639247.1	916596.1	639247.1	916579.9
Limestone transfer (primary /secondary)	RCII	300	15	0.0010000000	0.0007500000	0.0000377074	0.0000001450	0.0000282805	0.0000001088	12.20	639225.2	916567.3	639217.1	916559.2	639217.1	916575.3	639233.3	916575.3	639233.3	916559.2
Drying	RCII	200	21	0.0080000000	0.0060000000	0.0002011061	0.0000000823	0.0001508296	0.0000000617	22.73	639299.3	916473.0	639274.6	916448.3	639274.6	916497.7	639324.0	916497.7	639324.0	916448.3
Raw Milling	RCII	140	19	0.0120000000	0.0090000000	0.0002111614	0.0000002419	0.0001583710	0.0000001814	37.91	639248.0	916403.2	639233.2	916388.4	639233.2	916417.9	639262.8	916417.9	639262.8	916388.4
Raw Mill Air Separator	RCII	140	19	0.0031000000	0.0023250000	0.0000545500	0.0000000625	0.0000409125	0.0000000469	37.91	639248.0	916403.2	639233.2	916388.4	639233.2	916417.9	639262.8	916417.9	639262.8	916388.4
Raw Mill Feed belt	RCII	140	19	0.0094000000	0.0070500000	0.0001654098	0.0000001895	0.0001240573	0.0000001421	37.91	639269.5	916414.0	639254.7	916399.3	639254.7	916428.8	639284.3	916428.8	639284.3	916399.3
Coal Milling	RCII	15	16	0.0024000000	0.0018000000	0.0000045249	0.0000000090	0.0000033937	0.0000000067	24.60	639139.4	916510.6	639128.2	916499.4	639128.2	916521.8	639150.6	916521.8	639150.6	916499.4
Finish Grinding Mill 1	RCII	65	20	0.0024000000	0.0018000000	0.0000196078	0.0000000171	0.0000147059	0.0000000128	30.75	639127.5	916551.5	639110.5	916534.5	639110.5	916568.4	639144.4	916568.4	639144.4	916534.5
Finish Grinding Mill 1 Air Separator	RCII	65	20	0.0024000000	0.0018000000	0.0000196078	0.0000000171	0.0000147059	0.0000000128	30.75	639127.5	916551.5	639110.5	916534.5	639110.5	916568.4	639144.4	916568.4	639144.4	916534.5
Finish Grinding Mill 1 Weigh Hopper	RCII	65	20	0.0002200000	0.0001650000	0.0000017974	0.0000000016	0.0000013480	0.0000000012	30.75	639161.9	916562.0	639144.9	916545.0	639144.9	916578.9	639178.8	916578.9	639178.8	916545.0
Finish Grinding Mill 1 Feed belts	RCII	65	20	0.0024000000	0.0018000000	0.0000196078	0.0000000171	0.0000147059	0.0000000128	30.75	639161.9	916562.0	639144.9	916545.0	639144.9	916578.9	639178.8	916578.9	639178.8	916545.0
Finish Grinding Mill 1 Fly Ash Feeding	RCII	20	20	0.0024000000	0.0018000000	0.0000060332	0.0000001284	0.0000045249	0.0000000963	30.75	639156.4	916574.4	639152.9	916571.0	639152.9	916577.8	639159.8	916577.8	639159.8	916571.0
Packhouse 1 RP No. 2	RCII	96	7	0.0080000000	0.0060000000	0.0000965309	0.0000000816	0.0000723982	0.0000000612	26.75	639020.6	916258.4	639003.4	916241.2	639003.4	916275.6	639037.8	916275.6	639037.8	916241.2
Packhouse 1 RP No. 4	RCII	76.8	8	0.0080000000	0.0060000000	0.0000772247	0.0000000653	0.0000579186	0.0000000490	26.75	639020.6	916258.4	639003.4	916241.2	639003.4	916275.6	639037.8	916275.6	639037.8	916241.2
Finish Grinding Mill 2	RCMI	65	20	0.0080000000	0.0060000000	0.0000653595	0.0000000742	0.0000490196	0.0000000556	27.46	639239.7	916139.3	639224.8	916124.5	639224.8	916154.2	639254.5	916154.2	639254.5	916124.5
Finish Grinding Mill 2 Weigh Hopper	RCMI	190	20	0.0080000000	0.0060000000	0.0001910508	0.0000002169	0.0001432881	0.0000001626	27.46	639208.7	916127.8	639193.9	916113.0	639193.9	916142.7	639223.6	916142.7	639223.6	916113.0
Finish Grinding Mill 2 Feed belts	RCMI	190	20	0.0080000000	0.0060000000	0.0001910508	0.0000002169	0.0001432881	0.0000001626	27.46	639208.7	916127.8	639193.9	916113.0	639193.9	916142.7	639223.6	916142.7	639223.6	916113.0
Packhouse 2 RP No. 3	RCMI	57.6	9	0.0080000000	0.0060000000	0.0000579186	0.0000000382	0.0000434389	0.0000000287	31.35	639115.1	916142.9	639095.7	916123.4	639095.7	916162.3	639134.6	916162.3	639134.6	916123.4
Packhouse 2 HBBF	RCMI	40	13	0.0080000000	0.0060000000	0.0000402212	0.0000000265	0.0000301659	0.0000000199	31.35	639115.1	916142.9	639095.7	916123.4	639095.7	916162.3	639134.6	916162.3	639134.6	916123.4

II. Kiln and Clinker	Proponent	tons of Materials processed/ hr	Operating Hours /day	PM AP 42 EF (lb/Ton)	PM 10 AP 42 EF (lb/Ton) @ 0.75	PM Emission Stregnth (g/s)	PM Emission Stregnth (g/sec-m2)	PM10 Emission Stregnth (g/s)	PM10 Emission Stregnth (g/sec-m2)	Height (meters)	X* (meters)	Y* (meters)	x1	y1	x2	y2	x3	y3	x4	y4
Preheater	RCII	130	21.1	0.02600000	0.01950000	0.0004248366	0.0000006516	0.0003186275	0.0000004887	50.48	639199.6	916458.7	639186.8	916445.9	639186.8	916471.4	639212.3	916471.4	639212.3	916445.9
Kiln	RCII	130	21.1	0.20000000	0.15000000	0.0032679739	0.0000033971	0.0024509804	0.0000025478	16.02	639188.9	916482.1	639173.4	916466.6	639173.4	916497.6	639204.4	916497.6	639204.4	916466.6
Clinker Cooler	RCII	102	21.1	0.09600000	0.07200000	0.0012307692	0.0000015739	0.0009230769	0.0000011804	15.72	639156.8	916522.0	639142.8	916508.0	639142.8	916536.0	639170.8	916536.0	639170.8	916508.0

Emission Test Results	Proponent	Capacity	Volumetric Flow Rate	Stack		Stack Temp.	PM	CO	NOx	Sox	Control Device	UTM Coordinates	
		Tons/hr or KW or	(Nm3/min)	Ht(m)	Diam (m)	Outlet (°C)	mg/Nm3				%	Longitude	Latitude
1. Dryer Stack	RCII	200 TPH	4255	35.00	3.20	49	18	254	55	3	ghouse, 9	639319.7	916439.5
2. Kiln Stack	RCII	130 TPH	2769	60.00	5.00	93	42	252	68	3	EP. 95%	639263.0	916344.3
3. AQC Stack	RCII	102 TPH	1346	26.00	2.10	189	41	234	39	3	EP. 95%	639154.9	916551.1
4. Coal Stack	RCII	12 TPH	506	26.00	1.24	69	39	228	53	3	ghouse, 9	639135.8	916511.8
5. FM1 Stack	RCII	65 TPH	646	8.24	0.96	61	31	229	118	3	ghouse, 9	639128.7	916558.0
6. FM2 Stack	RCMI	65 TPH	52	9.14	0.78	36	83	243	86	3	ghouse, 9	639228.2	916151.4
7. PH1 Exhaust	RCII	173 TPH	335	9.14	0.52	46	55	252	37	2	ghouse, 9	639017.0	916267.0
8. PH2 Stack	RCMI	98 TPH	51	6.16	0.75	49	56	241	39	5	ghouse, 9	639115.0	916148.0

Building Downwash

Building Downwash occurs when the aerodynamic turbulence induced by nearby buildings cause a pollutant emitted from an elevated source to be mixed rapidly toward the ground (downwash), resulting in higher ground-level concentrations.

"If stacks for new or existing major sources are found to be less than the height defined by EPA's refined formula for determining GEP height, then air quality impacts associated with cavity or wake effects due to the nearby building structures should be determined." (EPA 1986)

GEP Stack Height = H + 1.5L

(EPA's refined formula for determining GEP stack height)
Model should consider Building Downwash for point sources that are within the GEP 5L Area of Influence of a building. For point sources within the GEP 5L Area of Influence, Building Downwash information (direction-specific building heights and widths) should be included in your ISC3 modeling project. Using AERMOD View, you can easily calculate these direction-specific building heights and widths.

For regulatory applications, a building is considered sufficiently close to a stack to cause wake effects when the distance between the stack and the nearest part of the building is less than or equal to five (5) times the lesser of the building height or the projected width of the building.

Distance from stack-bldg <= 5L

For building downwash analyses with direction-specific building dimensions, wake effects are assumed to occur if the stack is within a rectangle composed of two lines perpendicular to the wind direction, one at 5L downwind of the building and the other at 2L upwind of the building and by two lines parallel to the wind direction, each at 0.5L away from each side of the building, as shown below. L is the lesser of the height and projected width of the building for the particular direction sector. This rectangular area has been termed a **Structure Influence Zone (SIZ)**.

2.3.3.4 RESULTS OF DISPERSION MODEL RUN

Dispersion Model report of PROJECT CEMENT PRODUCTION was conducted for purposes of air quality prediction, determination of carrying capacity of the proposed area and identification of impact areas pursuant to compliance under the Implementing Rules and Regulations of the Philippine Clean Air Act (RA8749). Results of the predictive peak values of emission dispersion modeling are presented in 2 dimensional domain: 8,000 m (8 km) X 8,000 m (8 km). There are two scenario (scenario 1 and scenario 2) being employed for the model run. For each scenario, there are 16 runs which includes the uncontrolled and controlled condition for PM10 and TSP. Raw data of results are generated in output and plot files presented in the following Nomenclature: (x=distance from source, km), (y=distance from source, km), (z=elevation), conc=ground-level concentration, ug/m3). **Figure 2.3-29** shows the model map domain with indicated relative point location of the project.

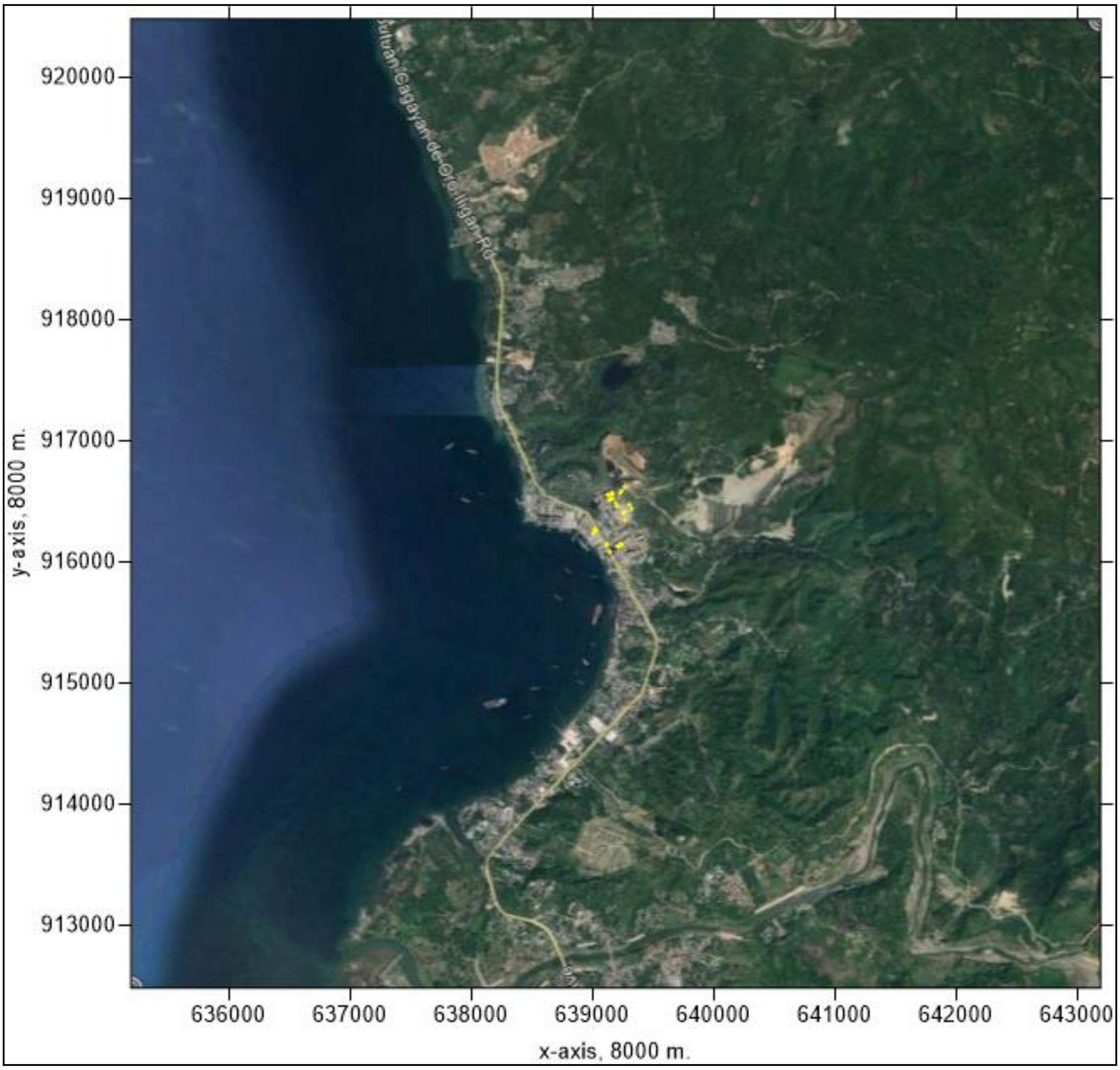
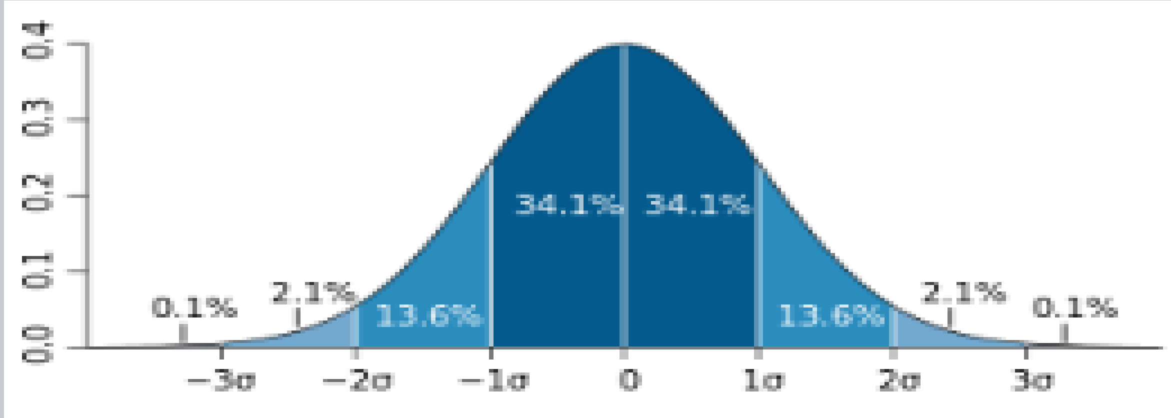


Figure 2.3-29. Model Map Domain with Indicated Relative Point Location of the project

PERCENTILE AND RANKLINGS OF PREDICTED RESULTS

In general terms, for the large number of predicted results following a normal distribution, percentiles may often be represented by reference to a normal curve plot. The normal distribution is plotted along an axis scaled to standard deviations, or sigma units. Mathematically, the normal distribution extends to negative infinity on the left and positive infinity on the right. Percentiles represent the area under the normal curve, increasing from left to right. Each standard deviation presents a fixed percentile.



Representation of the three-sigma rule. The dark blue zone represents observations within one standard deviation (σ) to either side of the mean (μ), which accounts for about 68.2% of the population. Two standard deviations from the mean (dark and medium blue) account for about 95.4%, and three standard deviations (dark, medium, and light blue) for about 99.7%.

Figure 2.3-30. Normal Distribution

Pursuant to RA 8749: the Philippines Clean Air Act of 1999 (CAA) set s out in Section 12 ambient air quality guideline values and standards. The short term guidelines specified in Table A For National Air Quality Guidelines for Criteria Pollutants are maximum limits represented by 98 percentile values not to be exceeded more than once a year. For a proposed new plant that requires a permit atmospheric dispersion modelling will need to be undertaken to demonstrate that these guideline values will be complied with. All ground level concentrations predicted by the dispersion modelling will need to be converted to 98 percentiles to allow a direct comparison to be made with the CAA air quality guidelines. If the dispersion modelling demonstrates, that these requirements will not be met for a new or a proposed modification to a plant, then that new plant or modification will not be permitted. The first test being that the highest 98 percentiles ground level concentrations predicted by dispersion modelling do not exceed the National Ambient Air Quality Guidelines (NAAQG). If they exceed the guidelines then the highest predicted 98 percentile ground level concentration should not exceed the guidelines by the concentrations specified in Rule X.Under Section 3.4 of MC 20008-003, Guidelines for Dispersion Modeling, “If the national ambient air quality guidelines are exceeded then a Tier 4 assessment will be required”.

The ability to assess local air quality using a more appropriate effects-based averaging time means the refined air dispersion models provide a more representative assessment of health and environmental impacts of air emissions from a facility. The 98 percentile ground level concentration predicted using are specific meteorological data with background concentrations included must be less than the relevant national ambient air quality guideline or standard. If higher than the guideline more refined modelling is required and the modeller should either go to 4. For 24 hour average with 365 days, 98% of 365 days is equal to 7.3 or 8^{th} rank (1-0.98 = 0.02* 365 = 7.3). For 1 hour average, 1 year hourly average is 8760 hours. 98% of 8760 hours is equal to 176th rank (1-0.98 =0.02 X 8760= 176). 98% of 1095 (8 hours/year) is equal to 22nd rank (1-0.98 =0.02 X 1095= 21.9). Below are results of 100 to 98 percentile respectively. Results below are in 98 percentile for all parameters for PROJECT CEMENT PRODUCTION are all below the National Ambient Air Quality Guideline Values and the National Ambient Air Quality Standards for Source Specific Air Pollutants under RA 8749.

There are several discrete receptor areas identified which are areas with communities within the project impact area of 8,000 x 8,000 sq. meters. **Figure 2.3-31** shows the locations of discrete receptors Identified.

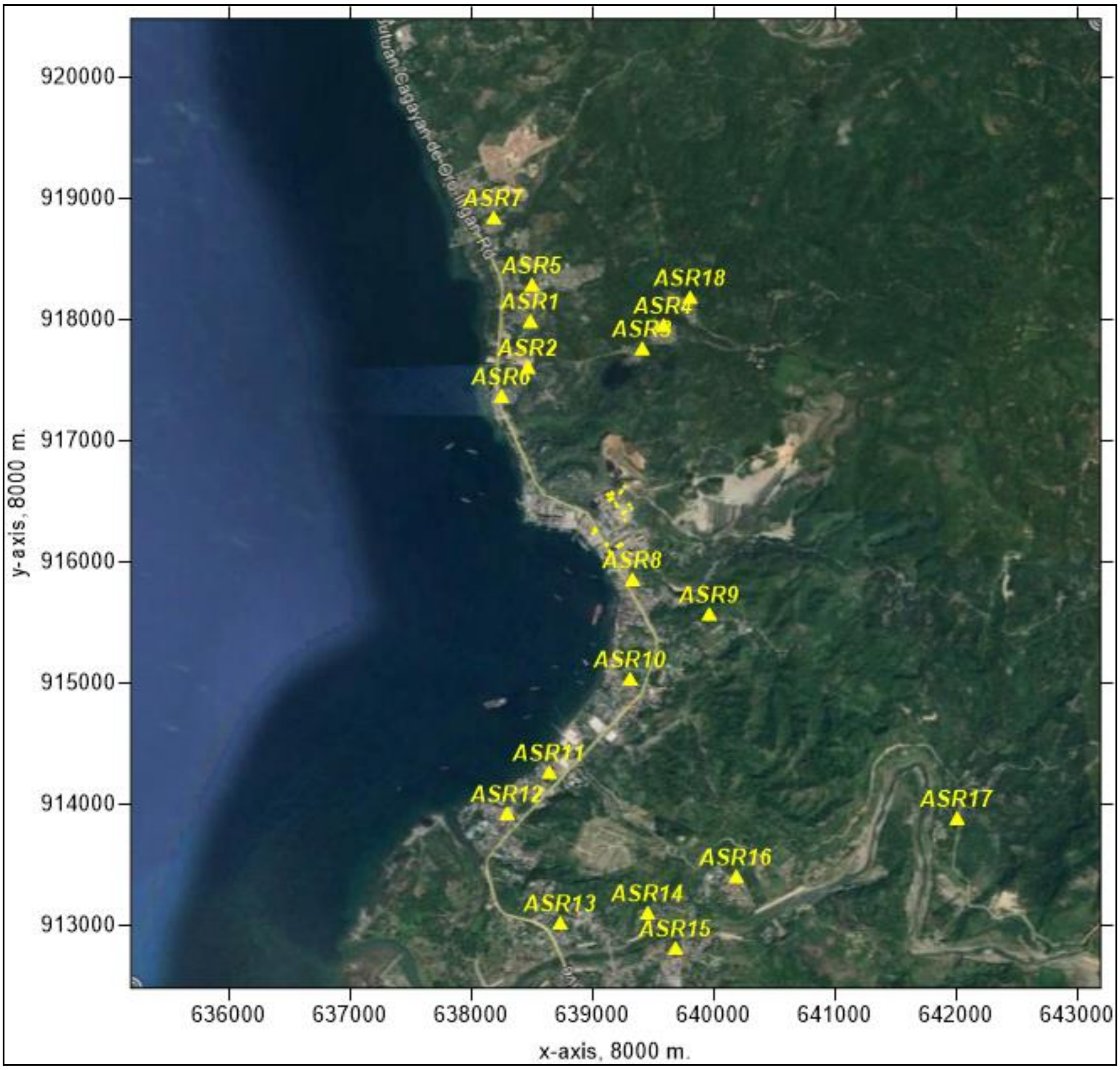


Figure 2.3-31. Location of the ASR's

Scenario 2 - Uncontrolled

Table 2.3-21 shows the comparison of the predicted maximum PM10 and TSP ambient ground level concentration with the DENR standards under uncontrolled scenario2 for 1-hr and 24-hr averaging times. **Table 2.3-22** shows the predicted ambient ground level PM10 and TSP under uncontrolled scenario 2 at ASR's. **Figure 2.3-32** to **2.3-47** shows the predicted PM10 and TSP ambient ground level concentration under uncontrolled scenario 2 condition. **Figure 2.3-48** shows the predicted location of maximum GLC PM10 and TSP concentration under uncontrolled scenario 2 condition for 1-hr and 24-hr averaging times.

Table 2.3-21. Comparison of the Predicted Maximum PM10 and TSP Ground Level Concentration (GLC) with the DENR Standards for 1-HR and 24-HR Averaging Time Uncontrolled

UTM COORDINATE, m.		Averaging Time	CRITERIA POLLUTANT	PREDICTED AMBIENT MAXIMUM Ground Level Concentration (GLC) CONC.	DENR AMBIENT STD.	Distance From Map Domain Center, m.	Direction from Map Domain Center, m,
X (m)	Y (m)			ug/Ncm	ug.Ncm		
639588.91	916882.14	**1-HR**	**PM10**	540.1	**200**	565.7	NE
639588.91	916882.14		**TSP**	3,566.4	**300**	565.7	NE
639588.91	916882.14	**24-HR**	**PM10**	88.0	**150**	800.0	E
639588.91	916882.14		**TSP**	581.1	**230**	800.0	E
639588.91	916882.14	**1-HR**	***PM10**	20.9	**200**	0.0	NE
639588.91	916882.14		***TSP**	136.5	**300**	0.0	NE
639588.91	916882.14	**24-HR**	****PM10**	37.3	**150**	800.0	E
639588.91	916882.14		****TSP**	246.1	**230**	800.0	E
*-	176th						
**-	8th						

Table 2.3-22. SCENARIO 2 –Uncontrolled ASR's

UTM Coordinate		SCENARIO 2								ASR's
		pm10	tsp	pm10	tsp	pm10	tsp	pm10	tsp	
		1hr		24 hr		1hr		24hr		
x	y					176th percentile		8th percentile		
638484.29	917972.28	52.10	336.66	5.14	32.55	1.62	10.57	2.66	16.75	ASR1
638463.32	917592.32	69.82	422.28	7.91	48.62	2.22	14.41	5.53	34.09	ASR2
639406.68	917746.92	124.22	819.96	10.27	67.62	1.08	7.12	4.96	32.72	ASR3
639582.25	917940.84	212.24	1401.25	16.62	109.60	1.71	11.27	10.45	69.02	ASR4
638497.53	918272.33	47.11	294.64	3.84	24.43	1.55	9.88	1.94	12.06	ASR5
638246.53	917353.67	50.17	319.99	5.68	35.95	1.66	10.84	2.69	17.04	ASR6
638180.90	918827.71	29.85	191.48	3.67	23.03	0.87	5.48	1.99	12.77	ASR7
639327.35	915839.98	98.79	627.56	8.13	51.63	4.54	29.01	5.07	31.46	ASR8
639959.64	915555.11	53.22	320.67	3.87	24.49	1.24	8.11	2.48	16.28	ASR9
639306.51	915020.09	55.59	346.45	6.06	37.57	2.08	13.38	2.32	15.09	ASR10
638639.48	914248.84	42.44	265.13	2.81	17.65	1.24	8.09	1.89	12.32	ASR11
638292.07	913908.38	43.05	266.65	3.05	18.83	0.98	6.43	1.68	10.91	ASR12
638729.81	913005.11	25.52	157.35	1.59	9.83	0.68	4.46	1.00	6.51	ASR13
639452.42	913088.49	29.63	183.64	2.82	17.47	0.54	3.54	0.98	6.25	ASR14
639681.71	912796.67	34.40	212.33	3.06	18.85	0.54	3.44	0.97	6.01	ASR15
640181.98	913387.26	26.46	163.14	1.54	9.57	0.51	3.25	1.24	7.90	ASR16
642004.16	913868.11	23.18	138.81	1.64	10.43	0.22	1.41	0.81	4.98	ASR17
639801.99	918167.72	181.82	1200.40	12.36	81.49	1.46	9.65	7.40	48.88	ASR18

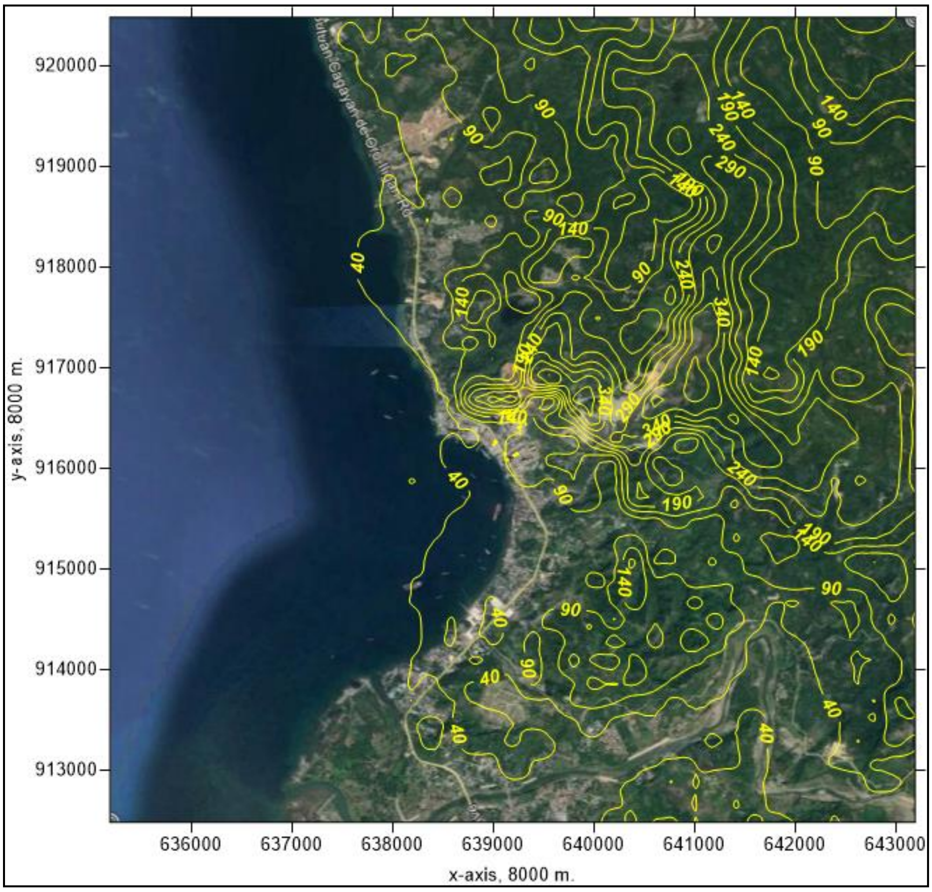


Figure 2.3-32. Predicted Ambient Ground Level PM10 Concentration under Uncontrolled Scenario 2 at 1-hr Averaging Time, µg/Ncm

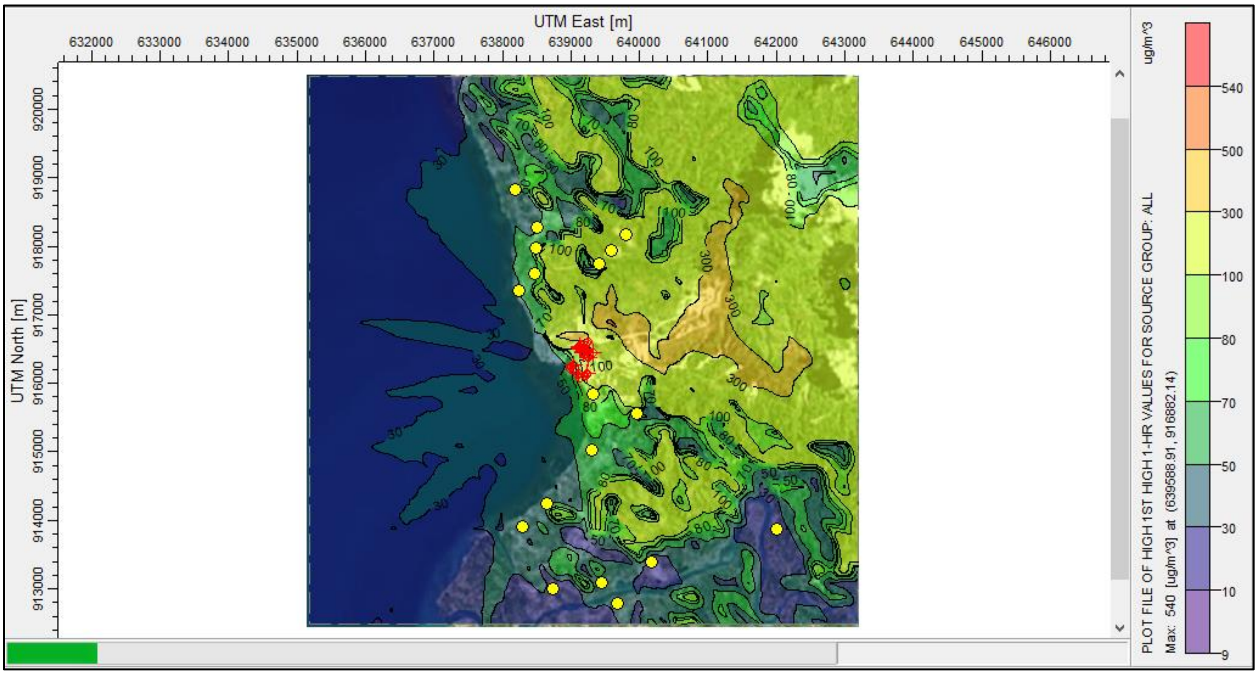


Figure 2.3-33. Predicted Ambient Ground Level PM10 Concentration under Uncontrolled Scenario 2 at 1-hr Averaging Time (with color scale), µg/Ncm

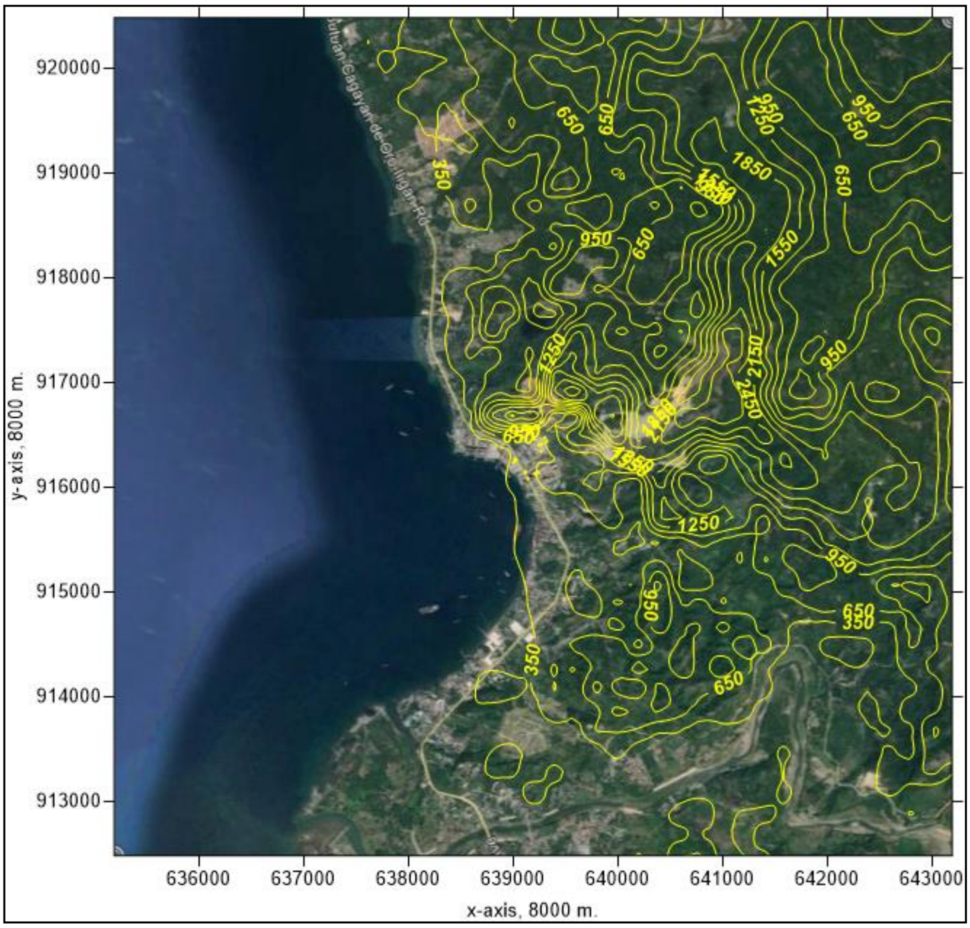


Figure 2.3-34. Predicted Ambient Ground Level TSP Concentration under Uncontrolled Scenario 2 at 1-hr Averaging Time, µg/Ncm

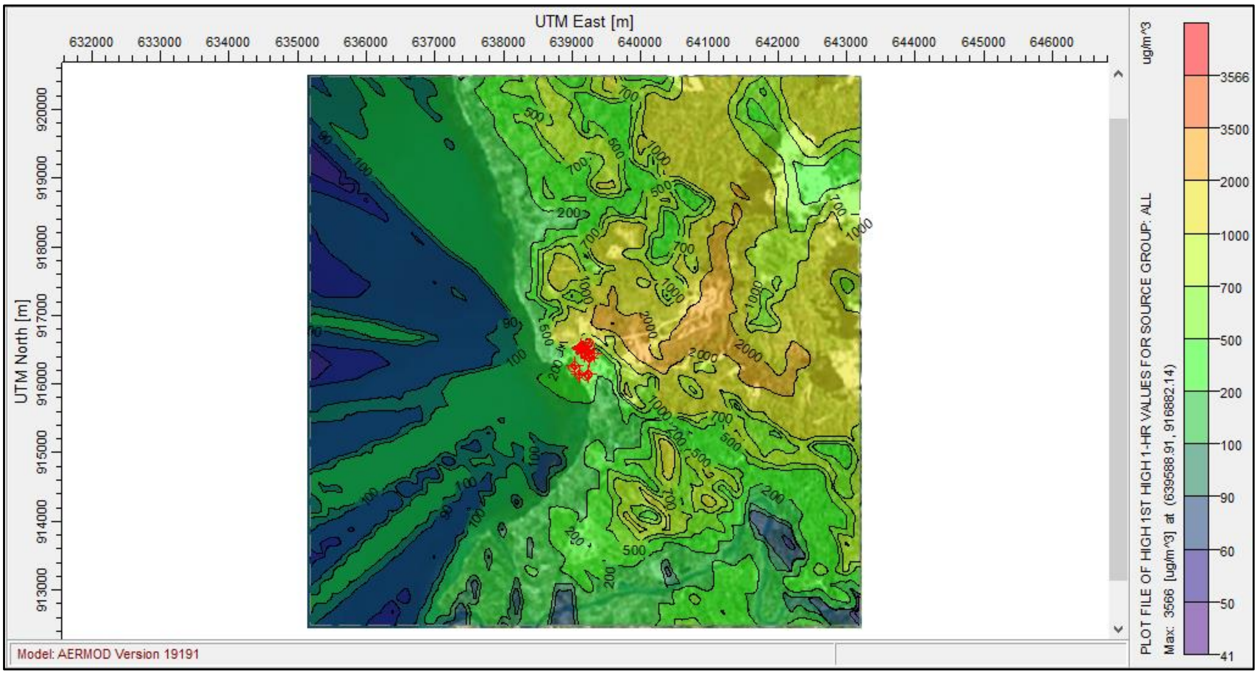


Figure 2.3-35. Predicted Ambient Ground Level TSP Concentration under Uncontrolled Scenario 2 at 1-hr Averaging Time (with color scale), µg/Ncm

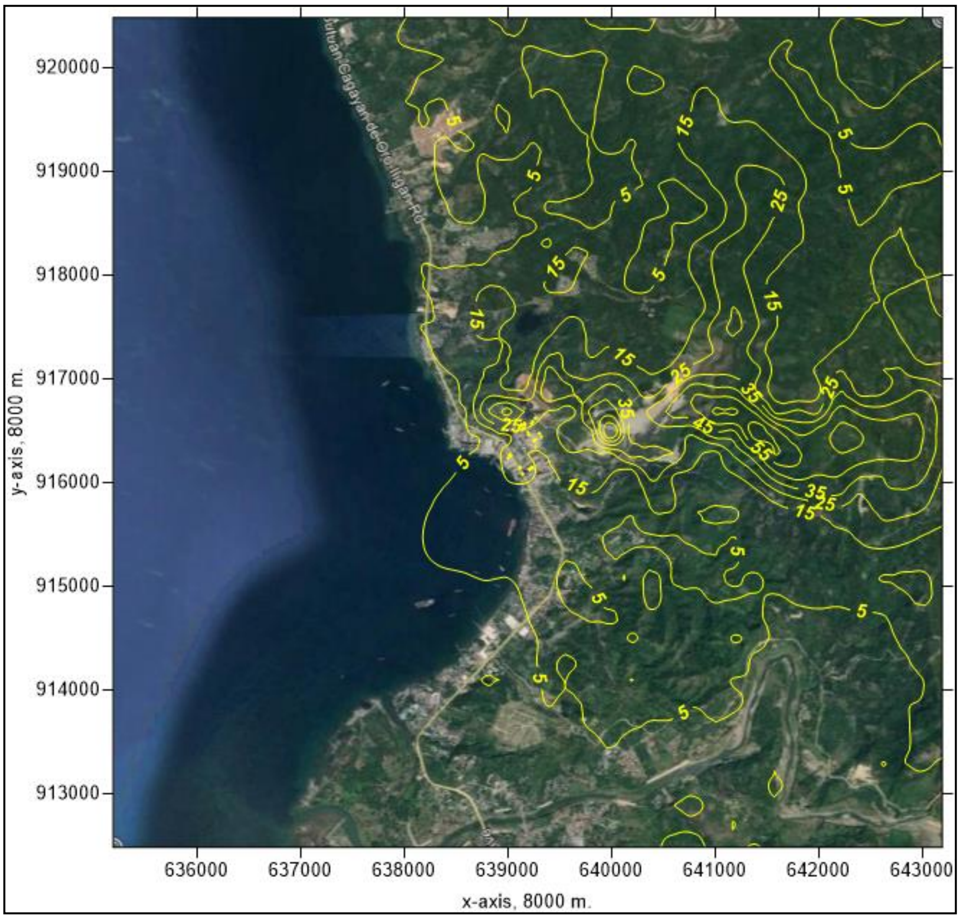


Figure 2.3-36. Predicted Ambient Ground Level PM10 Concentration under Uncontrolled Scenario 2 at 24-hr Averaging Time, µg/Ncm

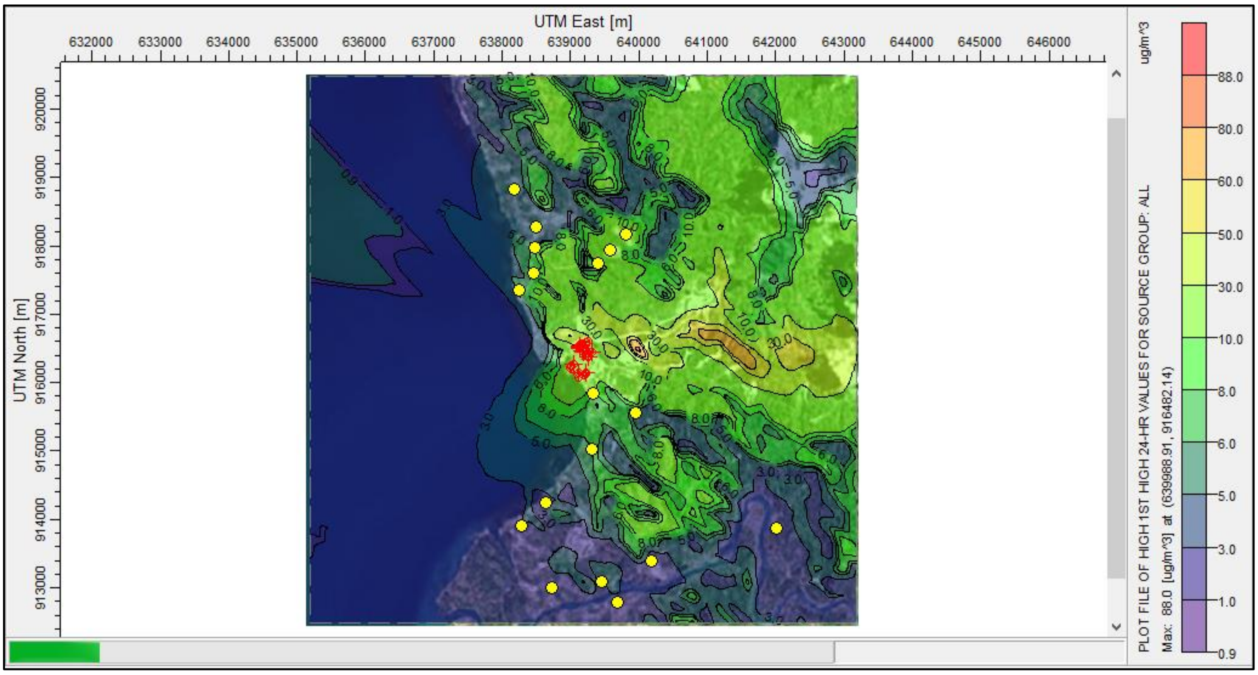


Figure 2.3-37. Predicted Ambient Ground Level PM10 Concentration under Uncontrolled Scenario 2 at 24-hr Averaging Time (with color scale), µg/Ncm

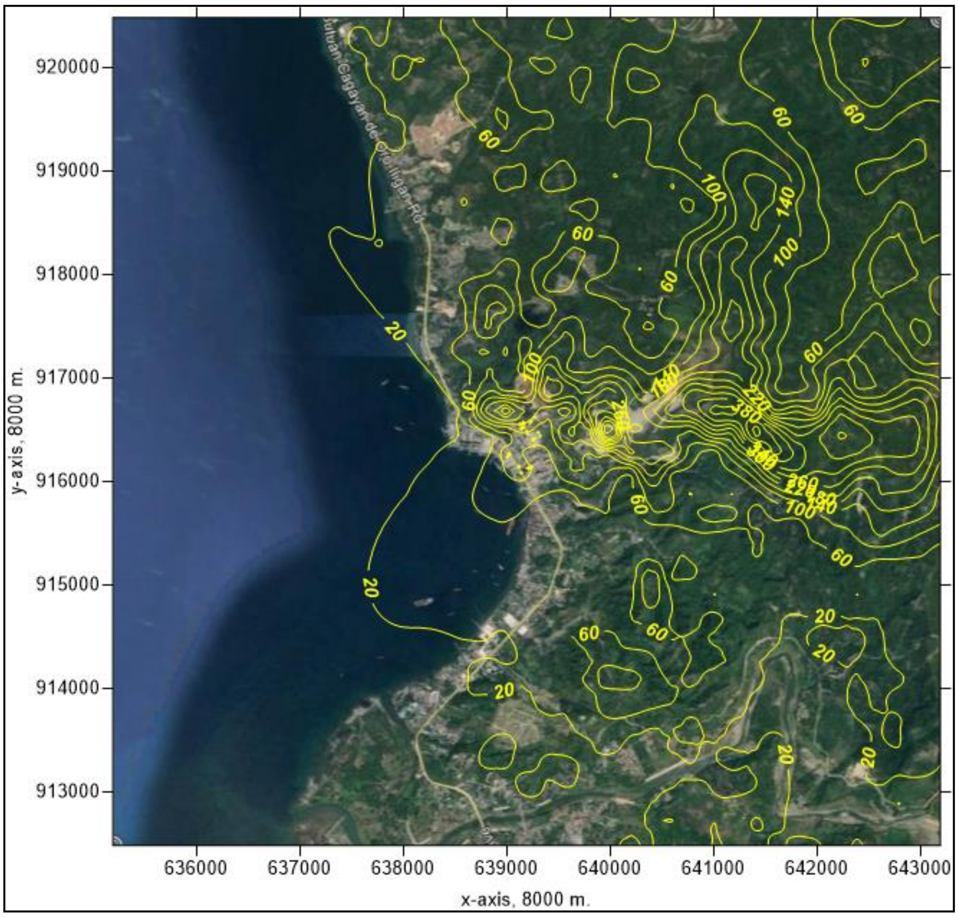


Figure 2.3-38. Predicted Ambient Ground Level TSP Concentration under Uncontrolled Scenario 2 at 24-hr Averaging Time, µg/Ncm

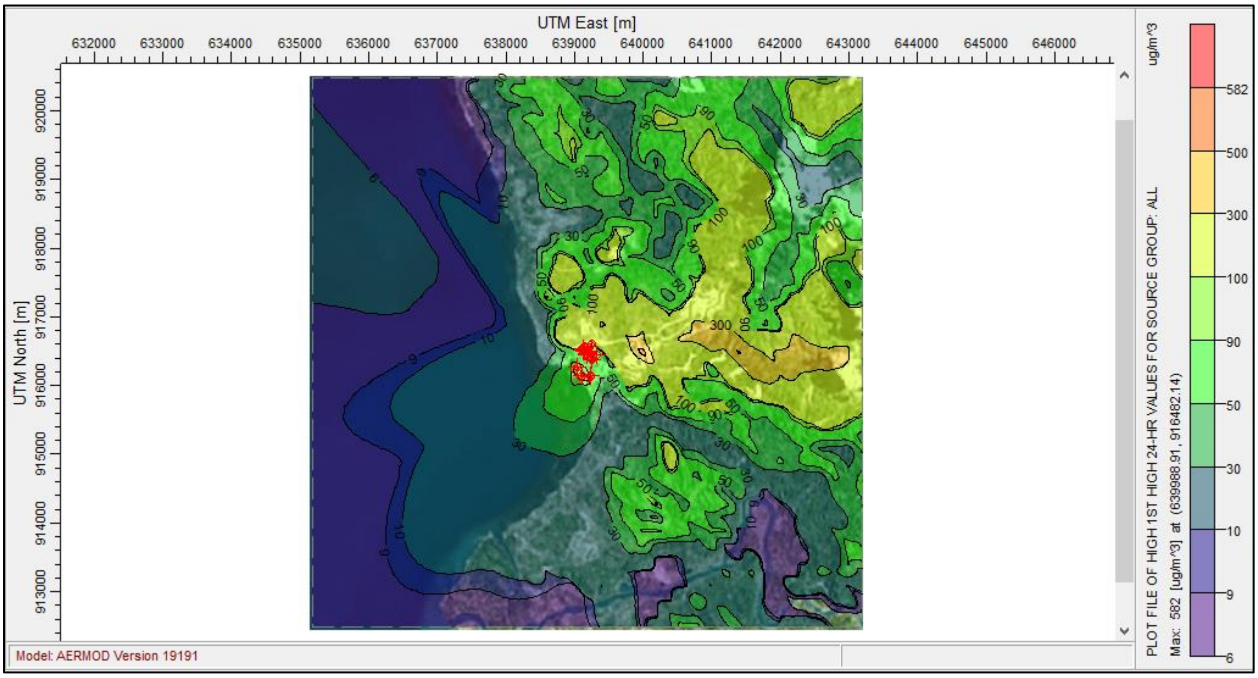


Figure 2.3-39. Predicted Ambient Ground Level TSP Concentration under Uncontrolled Scenario 2 at 24-hr Averaging Time (with color scale), µg/Ncm

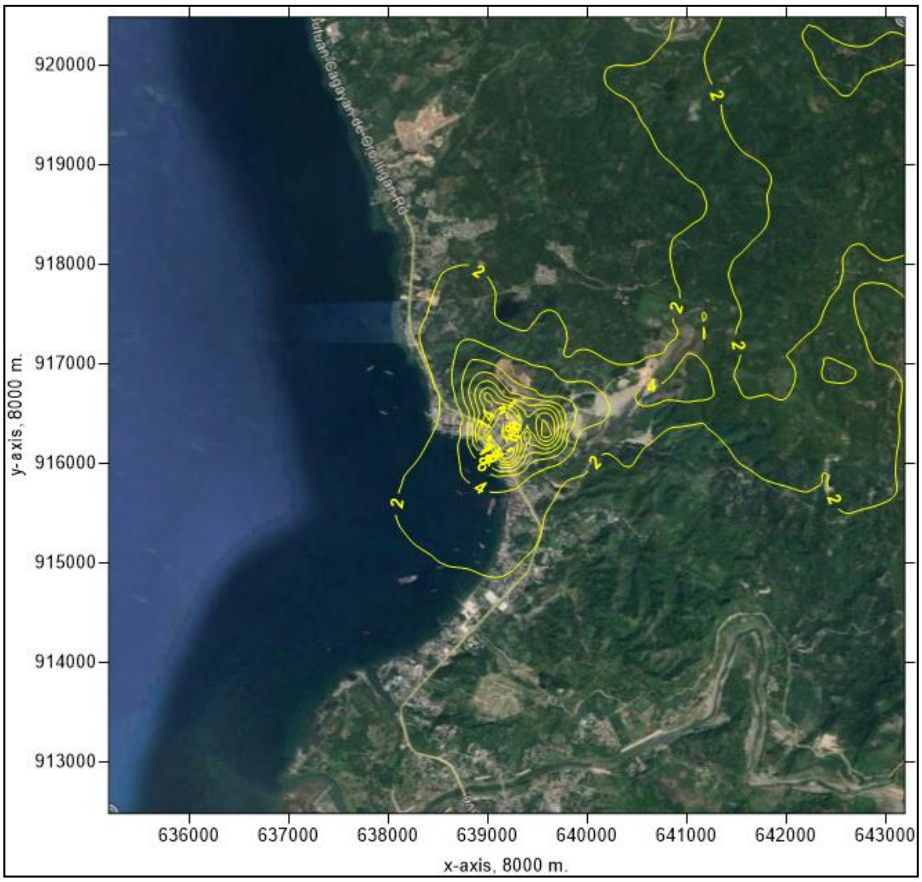


Figure 2.3-40. Predicted Ambient Ground Level PM10 Concentration under Uncontrolled Scenario 2 at 1-hr Averaging Time 176th Percentile, µg/Ncm

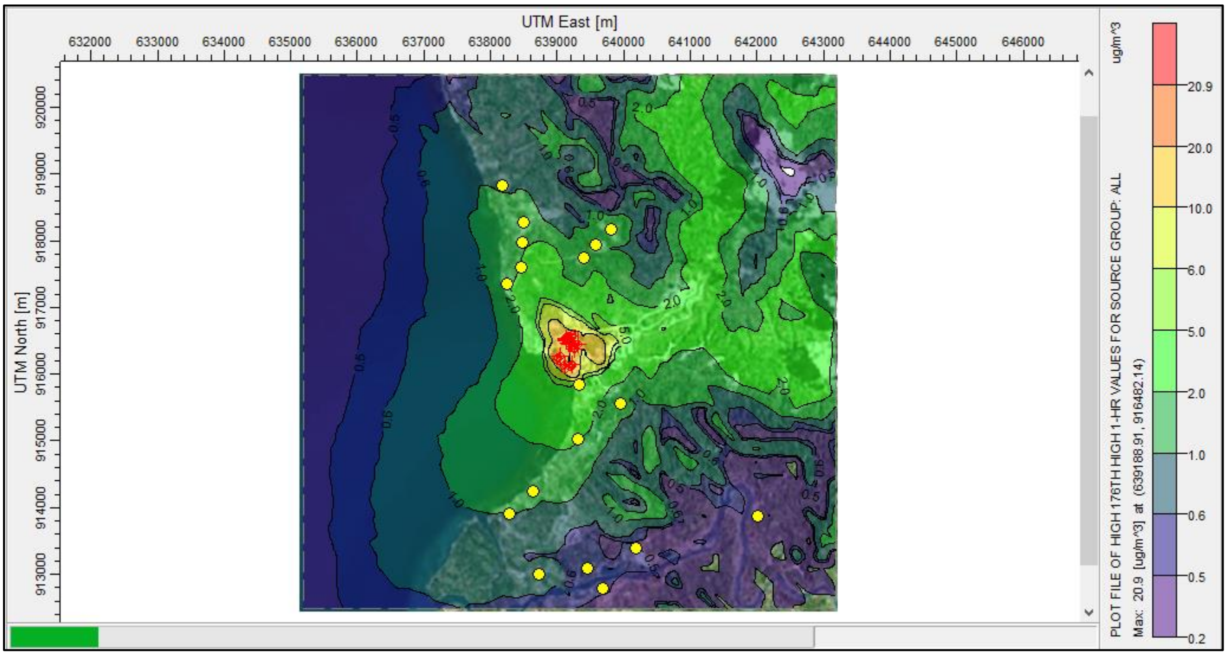


Figure 2.3-41. Predicted Ambient Ground Level PM10 Concentration under Uncontrolled Scenario 2 at 1-hr Averaging Time 176th Percentile (with color scale), µg/Ncm

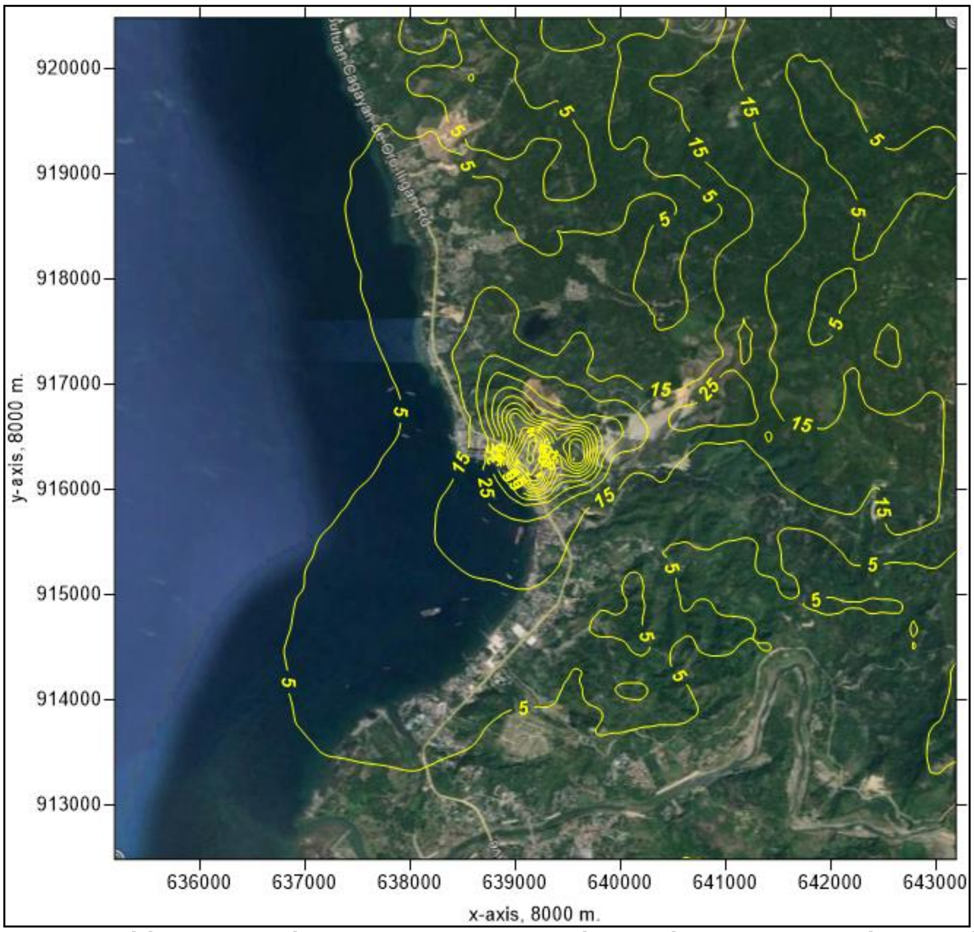


Figure 2.3-42. Ambient Ground Level TSP Concentration under Uncontrolled Scenario 2 at 1-hr Averaging Time 176th Percentile, µg/Ncm

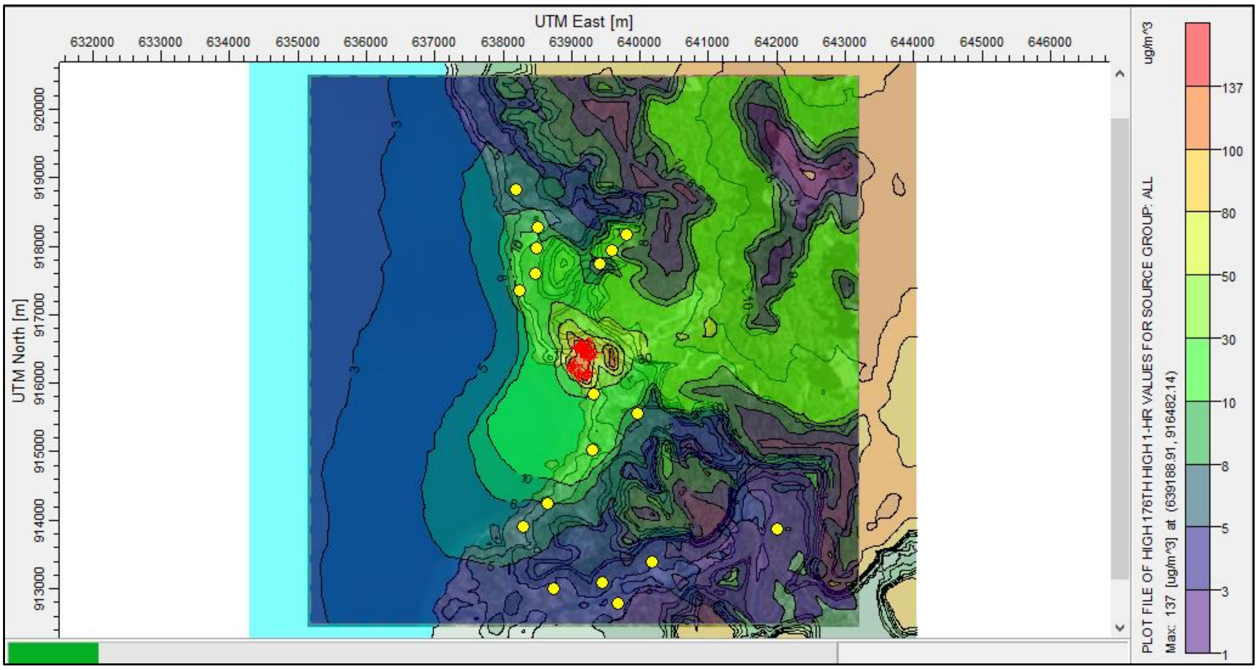


Figure 2.3-43. Predicted Ambient Ground Level TSP Concentration under Uncontrolled Scenario 2 at 1-hr Averaging Time 176th Percentile (with color scale), µg/Ncm

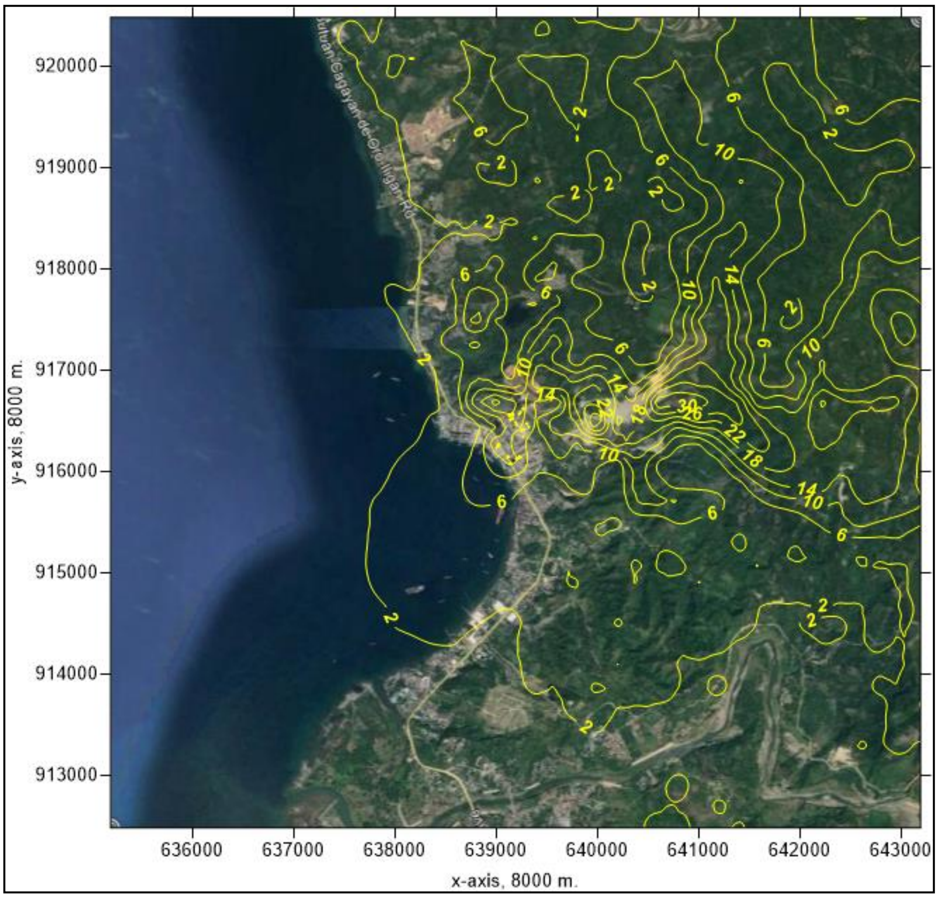


Figure 2.3-44. Predicted Ambient Ground Level PM10 Concentration under Uncontrolled Scenario 2 at 24-hr Averaging Time 98th Percentile, µg/Ncm

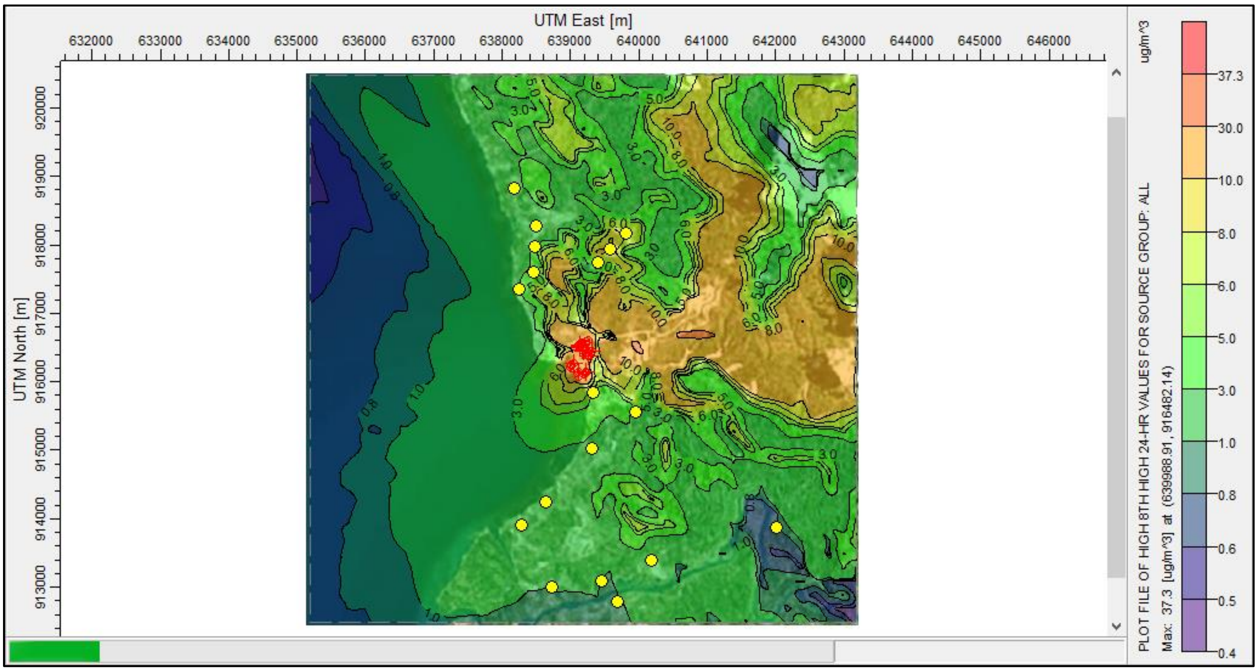


Figure 2.3-45. Predicted Ambient Ground Level PM10 Concentration under Uncontrolled Scenario 2 at 24-hr Averaging Time 98th Percentile (with color scale), µg/Ncm

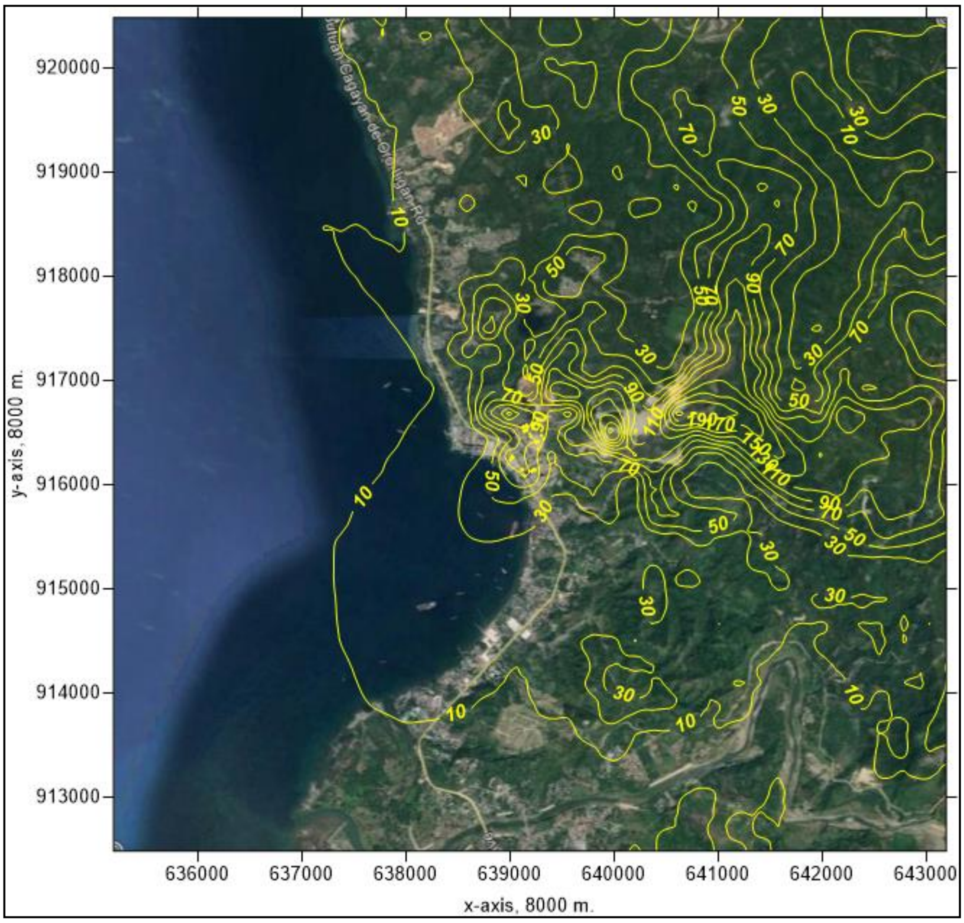


Figure 2.3-46. Predicted Ambient Ground Level TSP Concentration under Uncontrolled Scenario 2 at 24-hr Averaging Time 98th Percentile, µg/Ncm

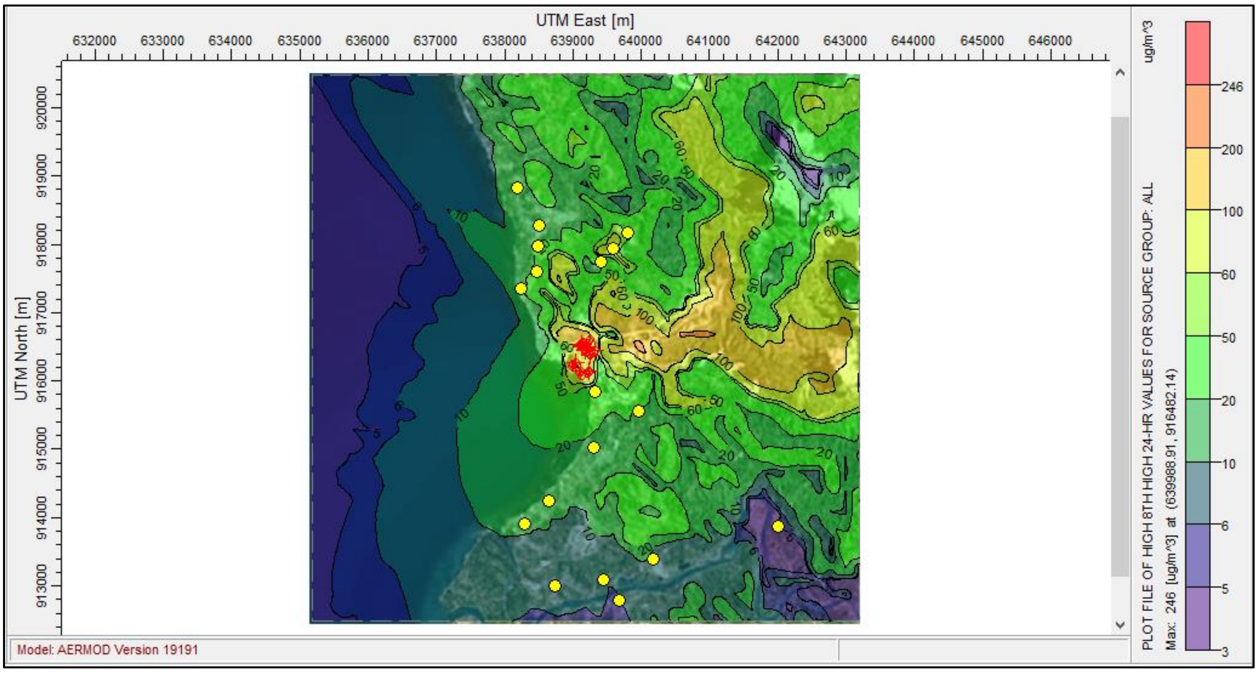


Figure 2.3-47. Predicted Ambient Ground Level TSP Concentration under Uncontrolled Scenario 2 at 24-hr Averaging Time 98th Percentile (with color scale), µg/Ncm

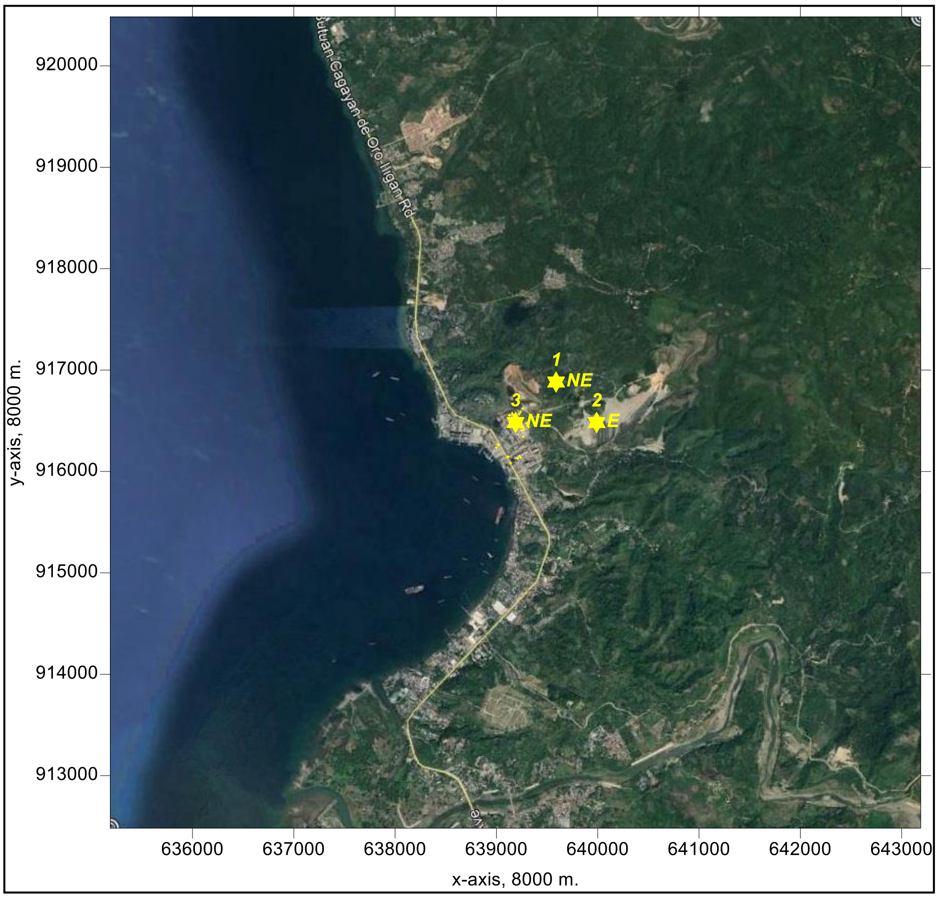


Figure 2.3-48. Predicted Location of Maximum GLC PM10 and TSP Concentration under Uncontrolled Scenario 2 at 1-hr and 24-hr Averaging Time, µg/Ncm

Scenario 2 – Controlled Case

Table 2.3-23 shows the comparison of the predicted maximum PM10 and TSP ambient ground level concentration with the DENR standards under controlled scenario2 for 1-hr and 24-hr averaging times. **Table 2.3-24** shows the predicted ambient ground level PM10 and TSP under controlled scenario 2 at ASR's. **Figures 2.3-49 to 2.3-54** shows the predicted PM10 and TSP ambient ground level concentration under controlled scenario 2 condition. **Figure 2.3-65** shows the predicted location of maximum GLC PM10 and TSP concentration under controlled scenario 2 condition for 1-hr and 24-hr averaging times.

Table 2.3-23. Comparison of the Predicted Maximum PM10 and TSP Ground Level Concentration (GLC) with the DENR Standards for 1-HR and 24-HR Averaging Time Controlled

UTM COORDINATE, m.		Averaging Time	CRITERIA POLLUTANT	PREDICTED AMBIENT MAXIMUM Ground Level Concentration (GLC) CONC.	DENR AMBIENT STD.	Distance From Map Domain Center, m.	Direction from Map Domain Center, m,
X (m)	Y (m)			ug/Ncm	ug.Ncm		
640588.91	916682.14	**1-HR**	**PM10**	23.3	**200**	1414.2	E
640588.91	916682.14		**TSP**	180.0	**300**	565.7	NE
640588.91	916682.14	**24-HR**	**PM10**	3.9	**150**	2200.0	E
640588.91	916682.14		**TSP**	29.3	**230**	800.0	E
640588.91	916682.14	**1-HR**	***PM10**	1.0	**200**	0.0	NE
640588.91	916682.14		***TSP**	6.9	**300**	0.0	NE
640588.91	916682.14	**24-HR**	****PM10**	1.6	**150**	1414.2	E

UTM COORDINATE, m.		Averaging Time	CRITERIA POLLUTANT	PREDICTED AMBIENT MAXIMUM Ground Level Concentration (GLC) CONC.	DENR AMBIENT STD.	Distance From Map Domain Center, m.	Direction from Map Domain Center, m,
X (m)	Y (m)			ug/Ncm	ug.Ncm		
640588.91	916682.14		**TSP	**12.4**	**230**	800.0	E
*-	176th						
**-	8th						

Table 2.3-24. SCENARIO 2 CONTROLLED ASR's

UTM Coordinate		SCENARIO 2								ASR's
		pm10	tsp	pm10	tsp	pm10	tsp	pm10	tsp	
		1hr		24 hr		1hr		24hr		
x	y					176th percentile		8th percentile		
638484.29	917972.28	2.58	17.07	0.25	1.66	0.08	0.53	0.13	0.86	ASR1
638463.32	917592.32	3.54	21.72	0.39	2.50	0.11	0.72	0.27	1.73	ASR2
639406.68	917746.92	5.19	41.38	0.44	3.41	0.05	0.36	0.21	1.65	ASR3
639582.25	917940.84	8.89	70.71	0.71	5.53	0.07	0.57	0.44	3.48	ASR4
638497.53	918272.33	2.27	14.80	0.18	1.23	0.08	0.53	0.10	0.62	ASR5
638246.53	917353.67	2.45	16.16	0.27	1.82	0.08	0.54	0.13	0.86	ASR6
638180.90	918827.71	1.47	9.72	0.18	1.17	0.04	0.30	0.10	0.64	ASR7
639327.35	915839.98	4.72	31.46	0.39	2.59	0.21	1.49	0.24	1.60	ASR8
639959.64	915555.11	2.38	15.90	0.19	1.23	0.06	0.41	0.12	0.81	ASR9
639306.51	915020.09	2.64	17.34	0.29	1.88	0.10	0.67	0.11	0.76	ASR10
638639.48	914248.84	2.05	13.35	0.13	0.89	0.06	0.41	0.09	0.62	ASR11
638292.07	913908.38	2.06	13.40	0.14	0.95	0.05	0.32	0.08	0.55	ASR12
638729.81	913005.11	1.22	7.91	0.08	0.49	0.03	0.22	0.05	0.33	ASR13
639452.42	913088.49	1.42	9.25	0.13	0.88	0.03	0.18	0.05	0.31	ASR14
639681.71	912796.67	1.64	10.68	0.15	0.95	0.03	0.17	0.05	0.30	ASR15
640181.98	913387.26	1.26	8.21	0.07	0.48	0.02	0.17	0.06	0.40	ASR16
642004.16	913868.11	1.08	6.99	0.08	0.53	0.01	0.07	0.04	0.25	ASR17
639801.99	918167.72	7.62	60.57	0.53	4.11	0.06	0.49	0.31	2.47	ASR18

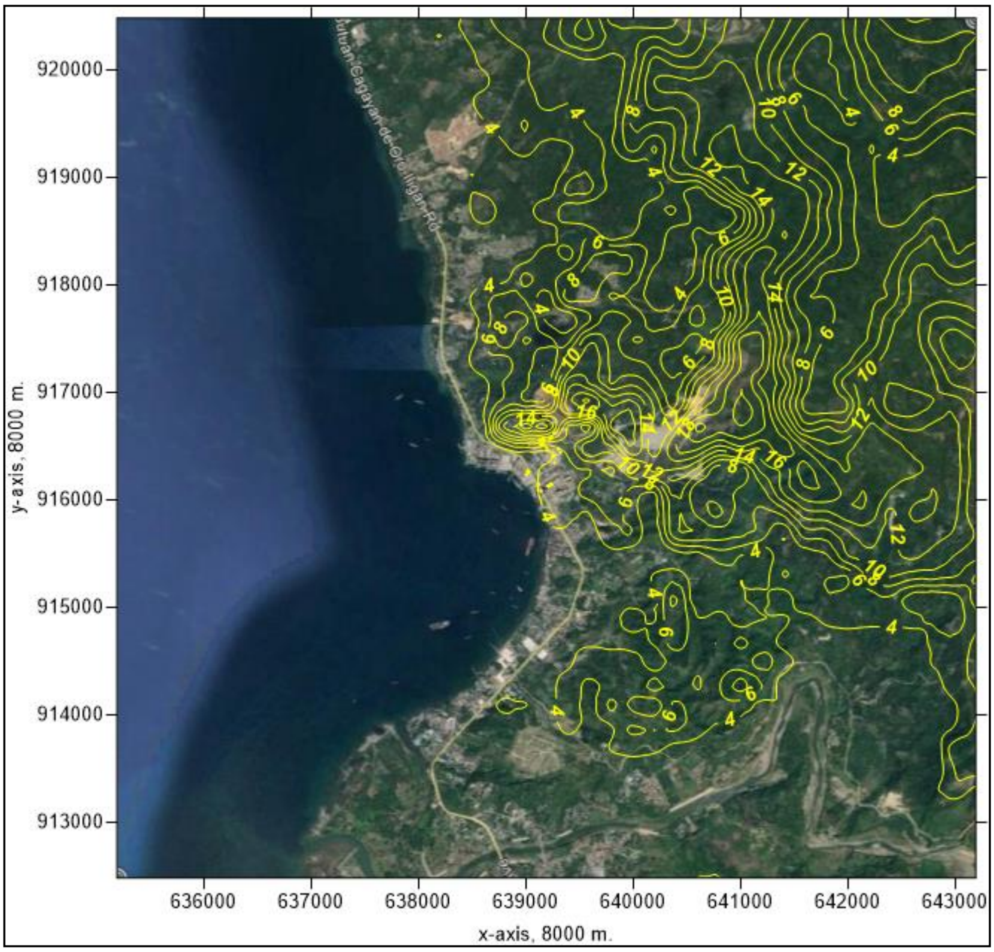


Figure 2.3-49. Predicted Ambient Ground Level PM10 Concentration under Controlled Scenario 2 at 1-hr Averaging Time, µg/Ncm

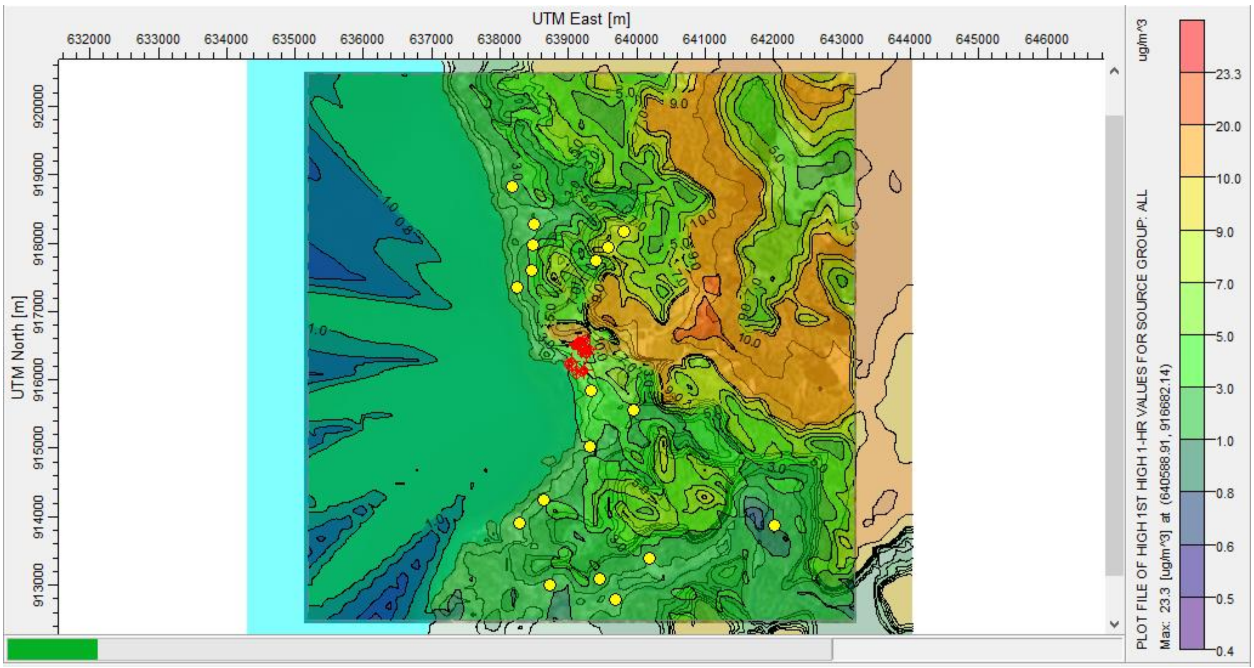


Figure 2.3-50. Predicted Ambient Ground Level PM10 Concentration under Controlled Scenario 2 at 1-hr Averaging Time (with color scale), µg/Ncm

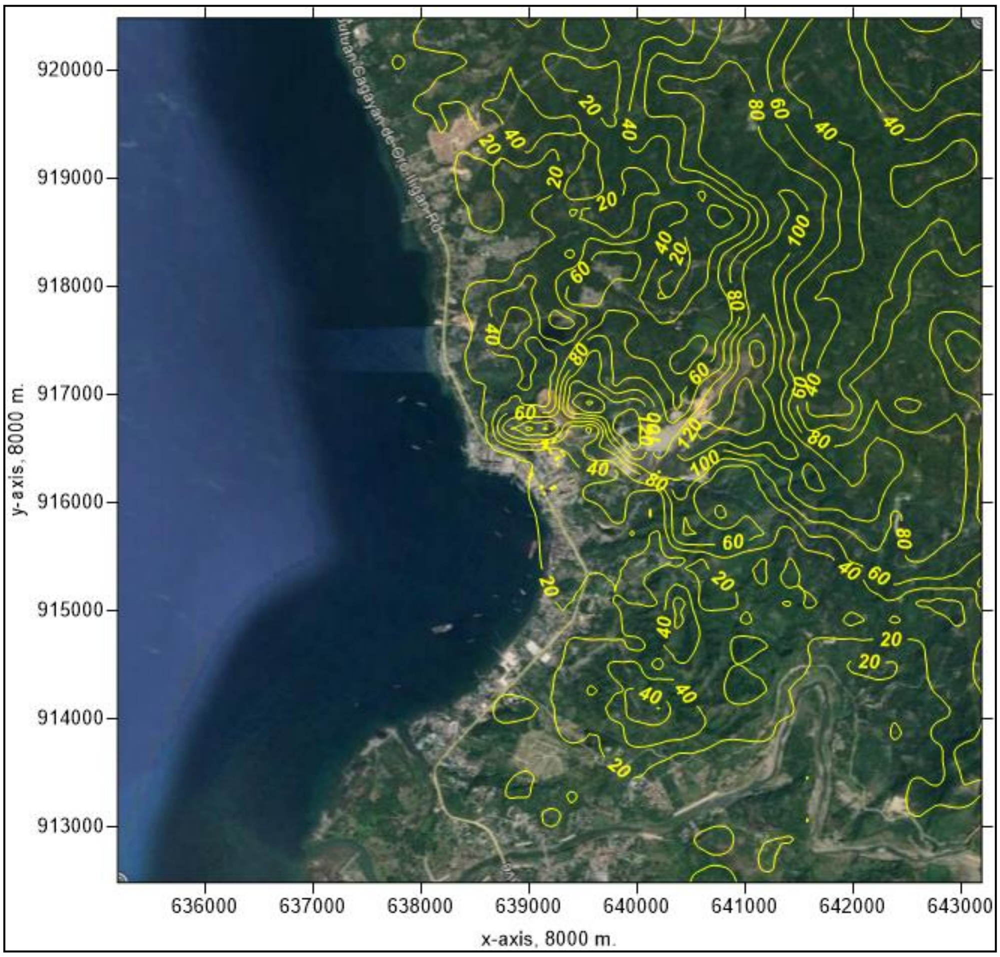


Figure 2.3-51. Predicted Ambient Ground Level TSP Concentration under Controlled Scenario 2 at 1-hr Averaging Time, µg/Ncm

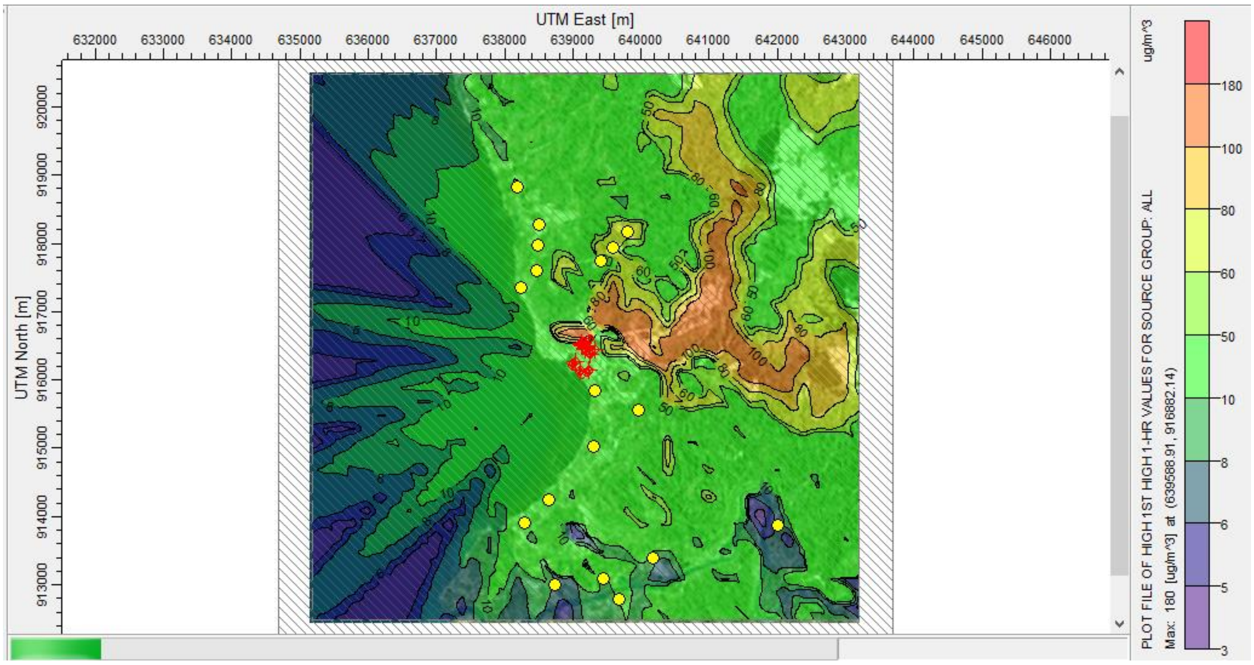


Figure 2.3-52. Predicted Ambient Ground Level TSP Concentration under Controlled Scenario 2 at 1-hr Averaging Time (with color scale), µg/Ncm

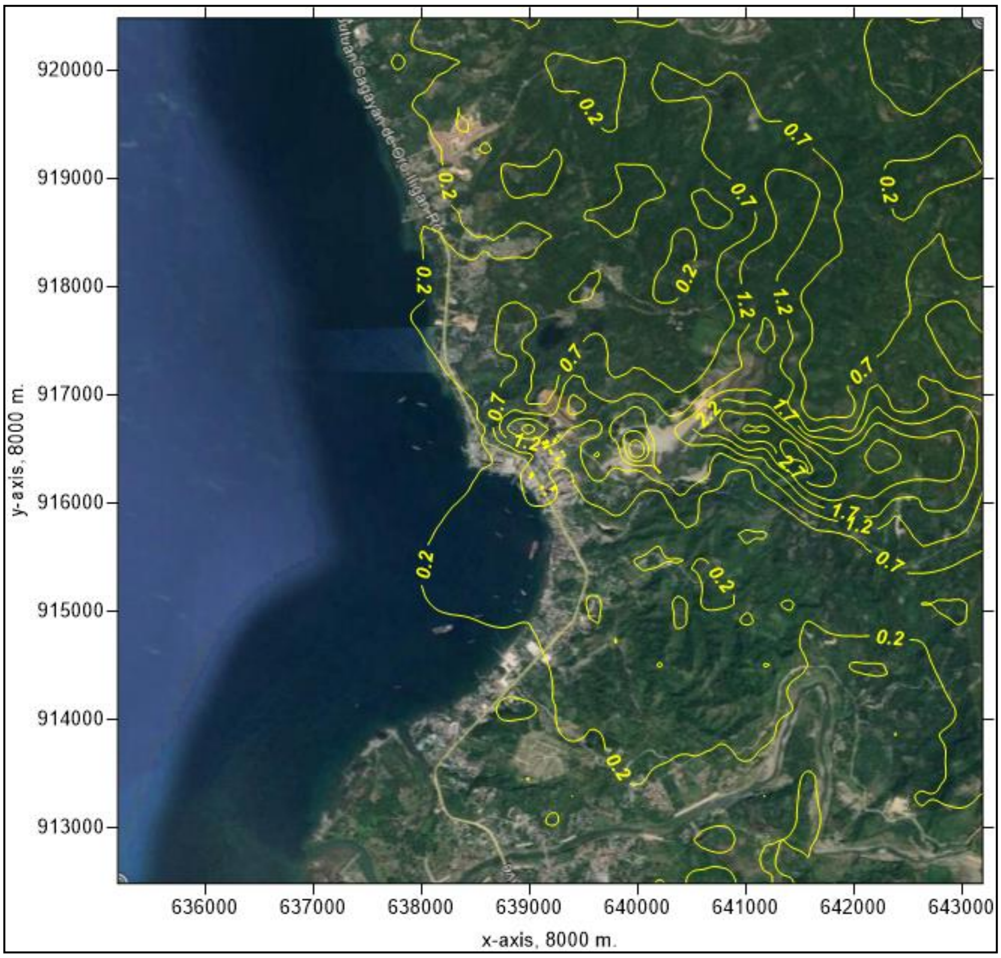


Figure 2.3-53. Predicted Ambient Ground Level PM10 Concentration under Controlled Scenario 2 at 24-hr Averaging Time, µg/Ncm

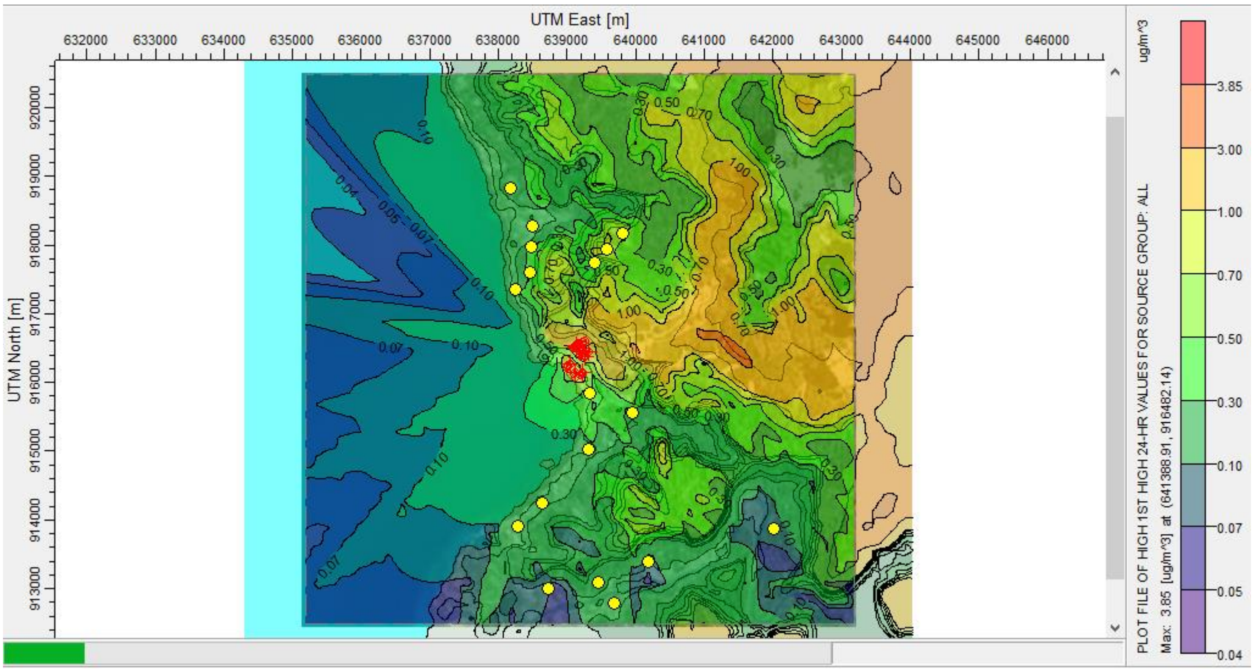


Figure 2.3-54. Predicted Ambient Ground Level PM10 Concentration under Controlled Scenario 2 at 24-hr Averaging Time (with color scale), µg/Ncm

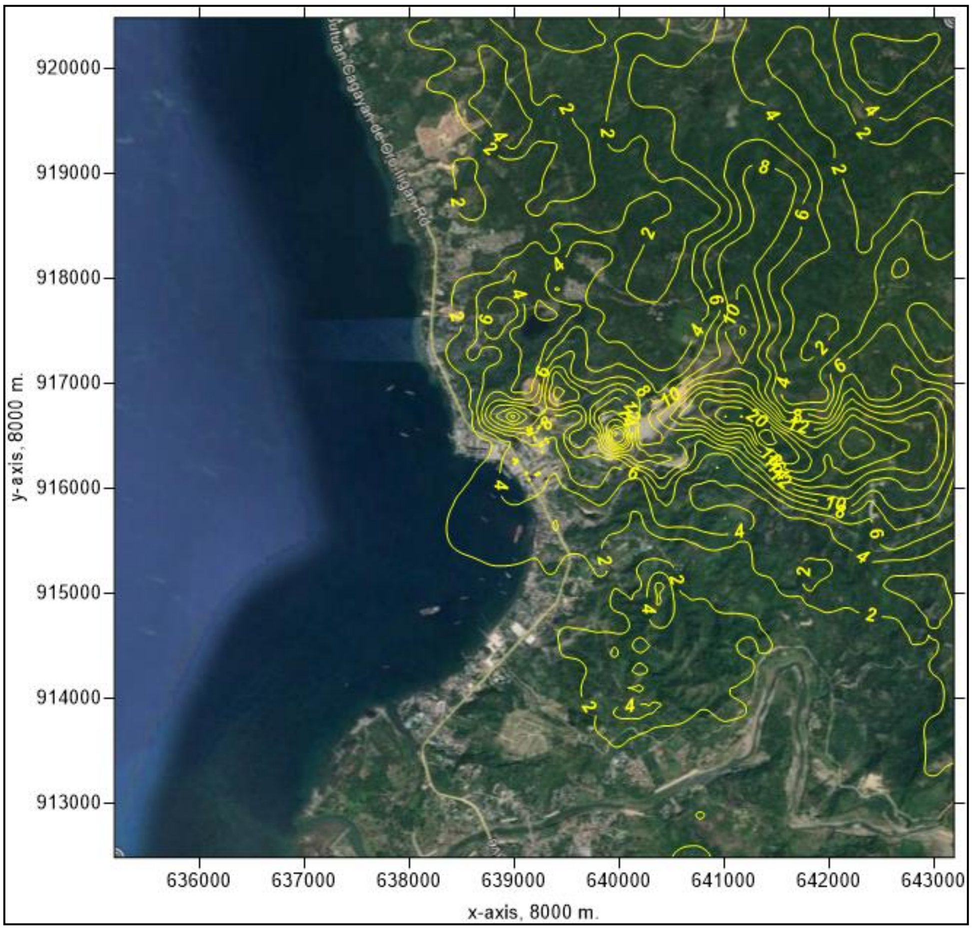


Figure 2.3-55. Predicted Ambient Ground Level TSP Concentration under Controlled Scenario 2 at 24-hr Averaging Time, µg/Ncm

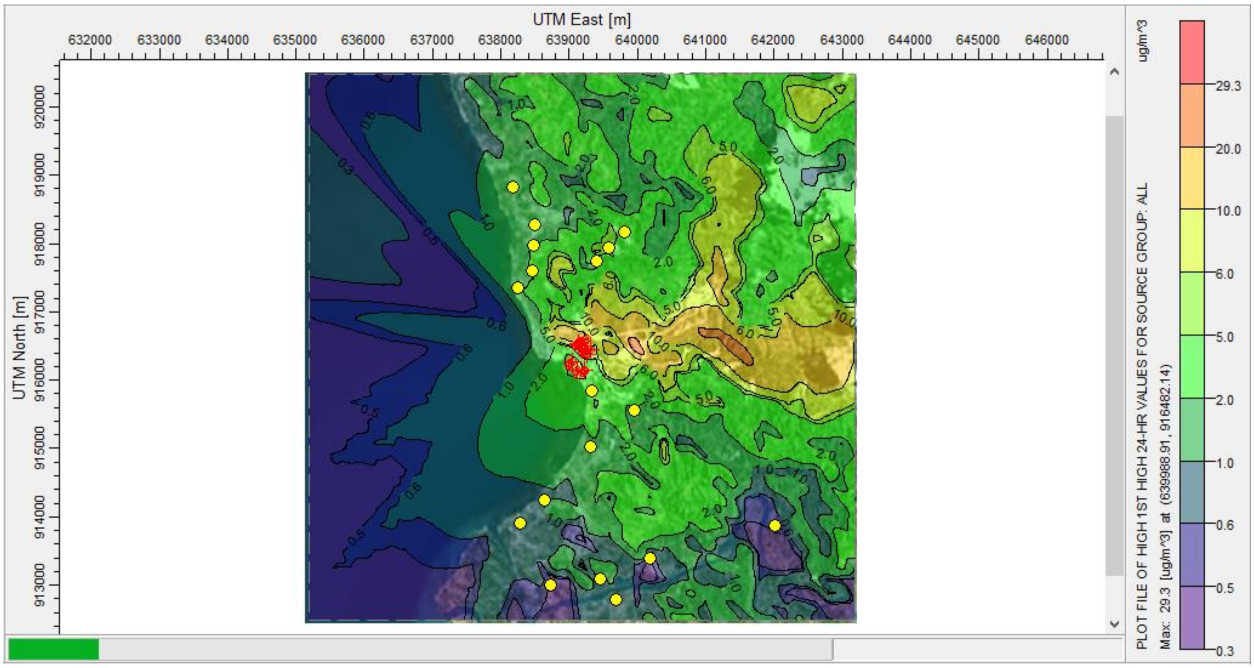


Figure 2.3-56. Predicted Ambient Ground Level TSP Concentration under Controlled Scenario 2 at 24-hr Averaging Time (with color scale), µg/Ncm

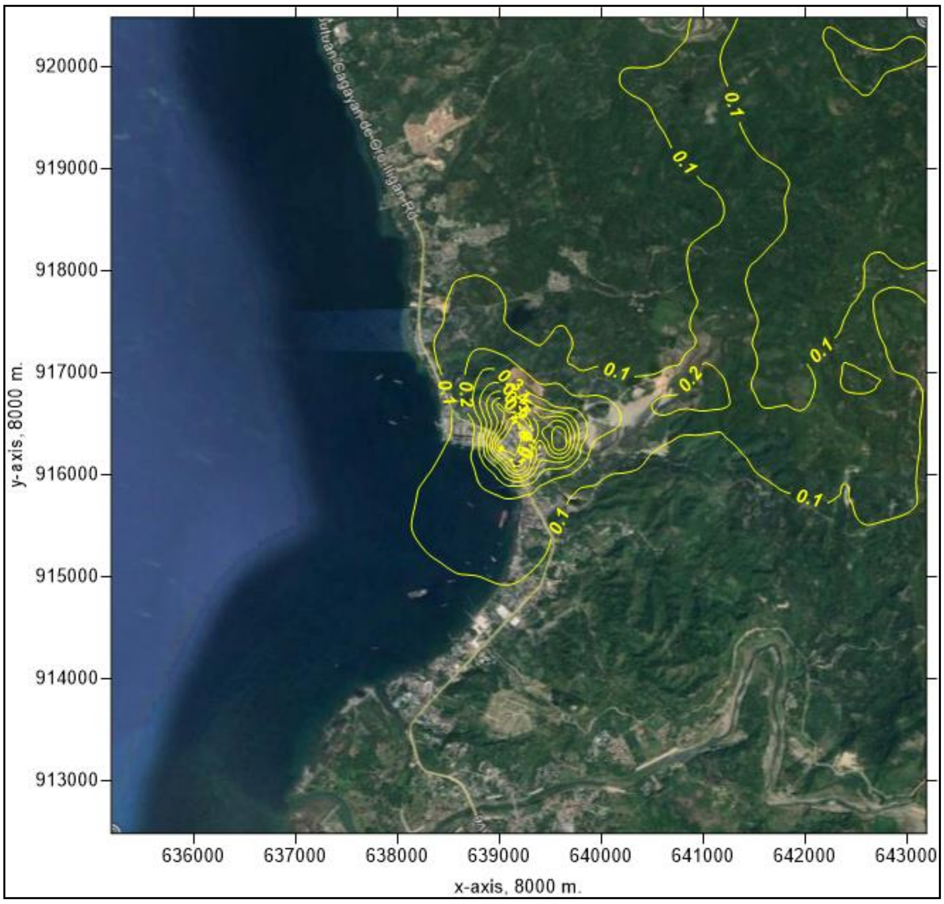


Figure 2.3-57. Predicted Ambient Ground Level PM10 Concentration under Controlled Scenario 2 at 1-hr Averaging Time 176th Percentile, µg/Ncm

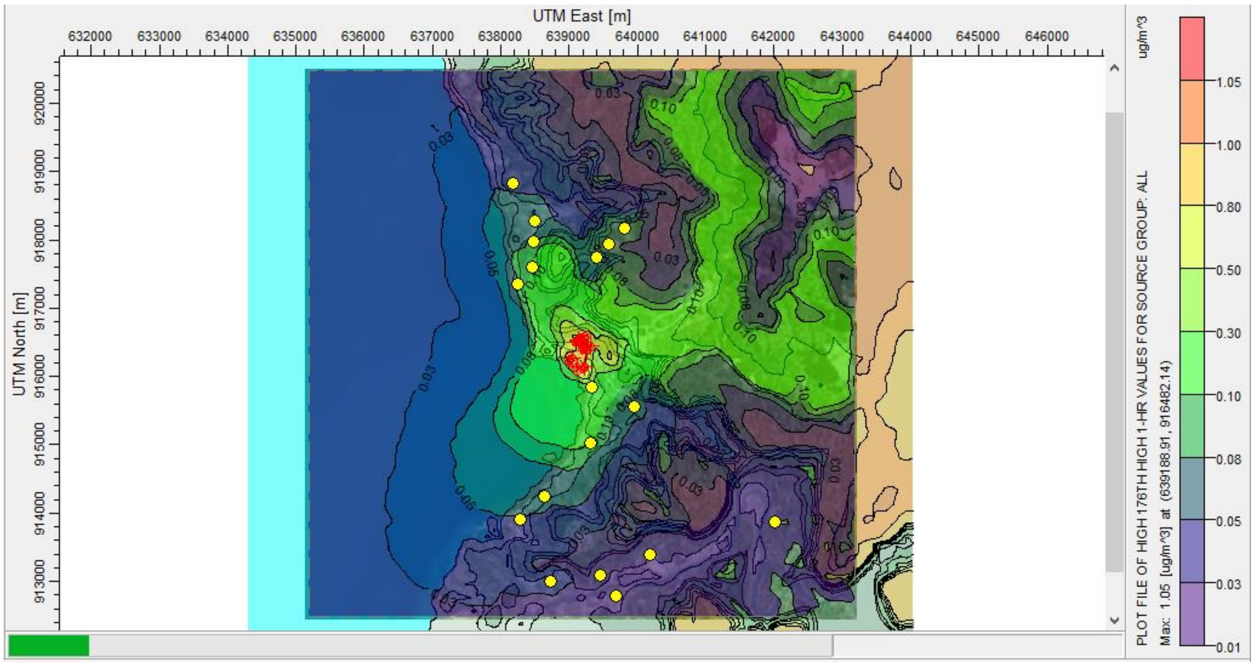


Figure 2.3-58. Predicted Ambient Ground Level PM10 Concentration under Controlled Scenario 2 at 1-hr Averaging Time 176th Percentile (with color scale), µg/Ncm

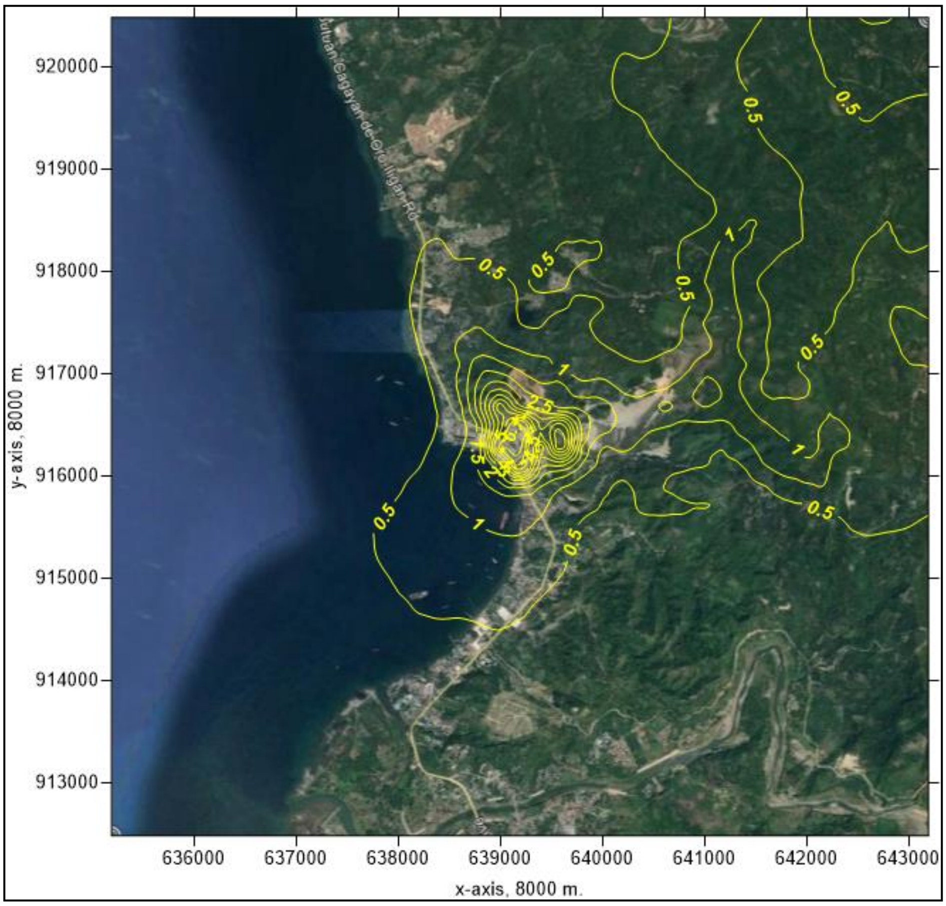


Figure 2.3-59. Predicted Ambient Ground Level TSP Concentration under Controlled Scenario 2 at 1-hr Averaging Time 176th Percentile, µg/Ncm

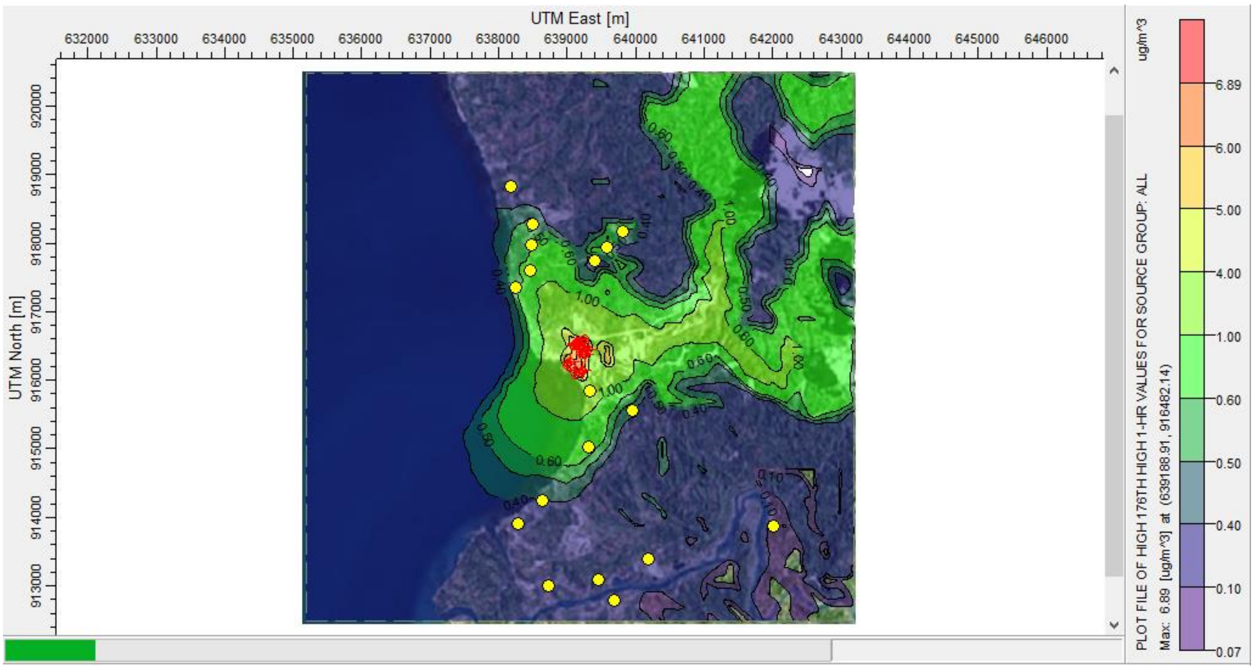


Figure 2.3-60. Predicted Ambient Ground Level TSP Concentration under Controlled Scenario 2 at 1-hr Averaging Time 176th Percentile (with color scale), µg/Ncm

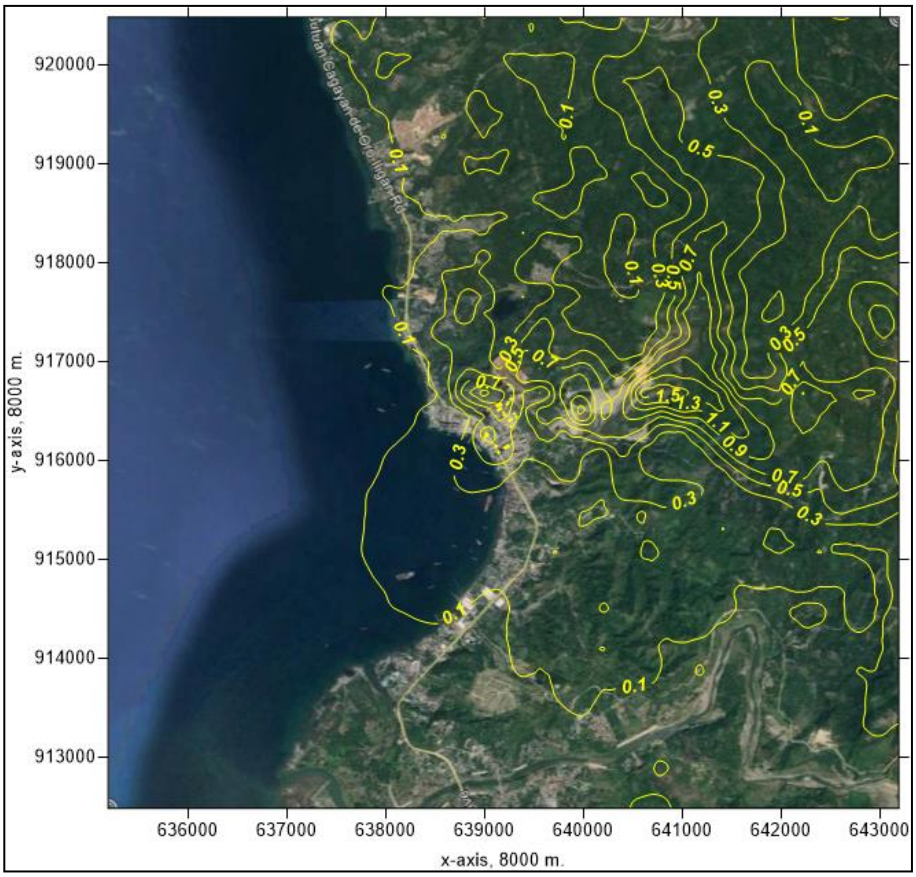


Figure 2.3-61. Predicted Ambient Ground Level PM10 Concentration under Controlled Scenario 2 at 24-hr Averaging Time 98th Percentile, μg/Ncm

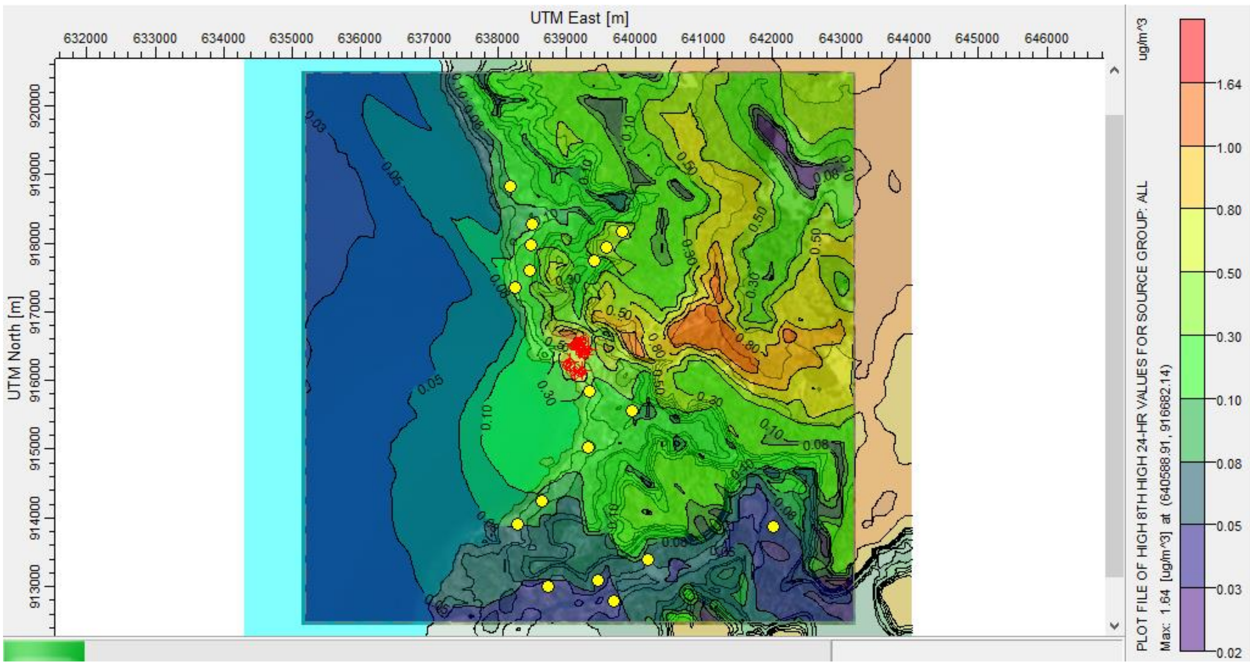


Figure 2.3-62. Predicted Ambient Ground Level PM10 Concentration under Controlled Scenario 2 at 24-hr Averaging Time 98th Percentile (with color scale), μg/Ncm

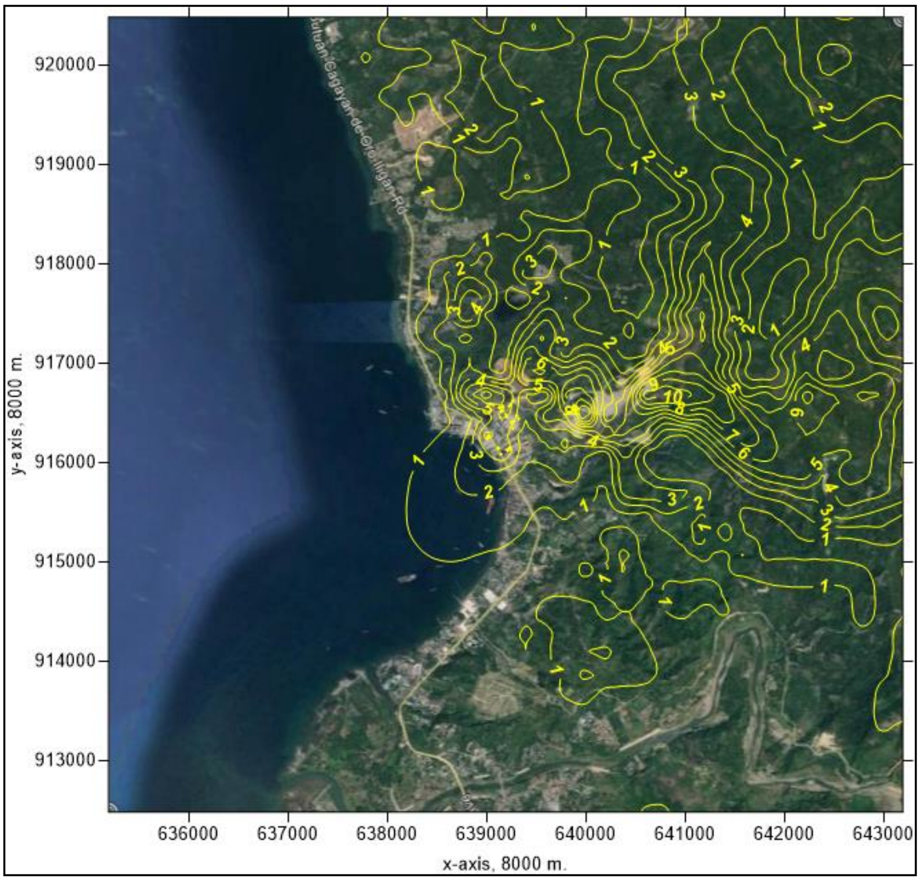


Figure 2.3-63. Predicted Ambient Ground Level PM10 Concentration under Controlled Scenario 2 at 24-hr Averaging Time 98th Percentile, µg/Ncm

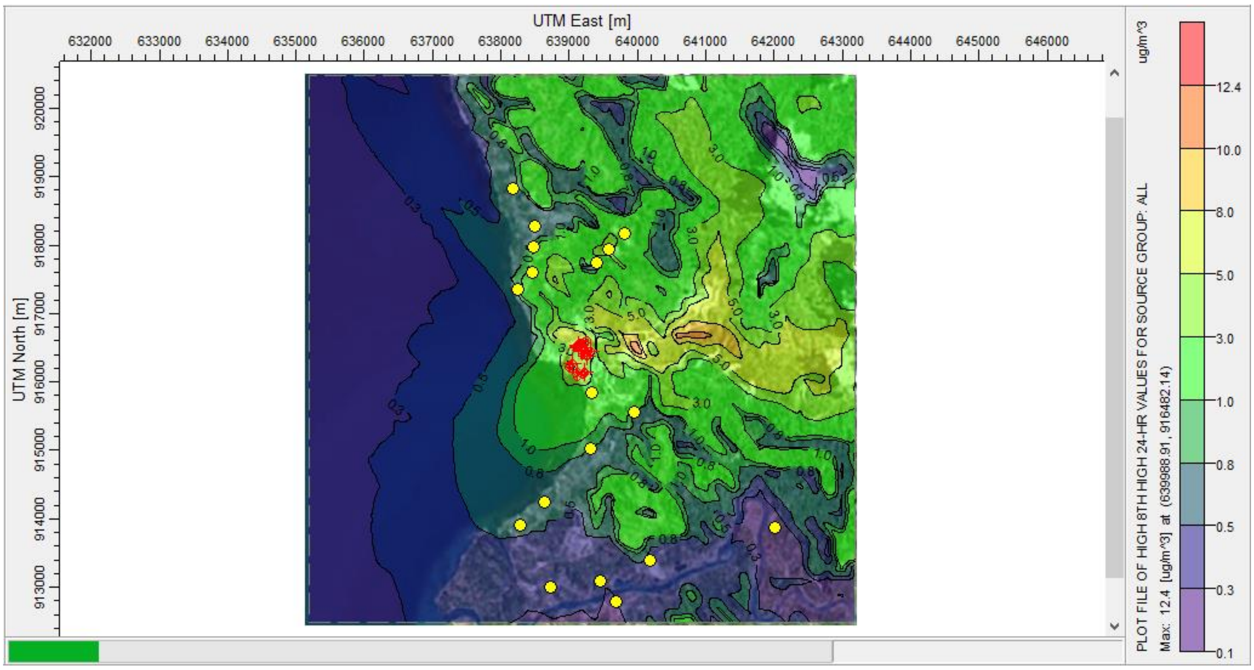


Figure 2.3-64. Predicted Ambient Ground Level PM10 Concentration under Controlled Scenario 2 at 24-hr Averaging Time 98th Percentile (with color scale), µg/Ncm

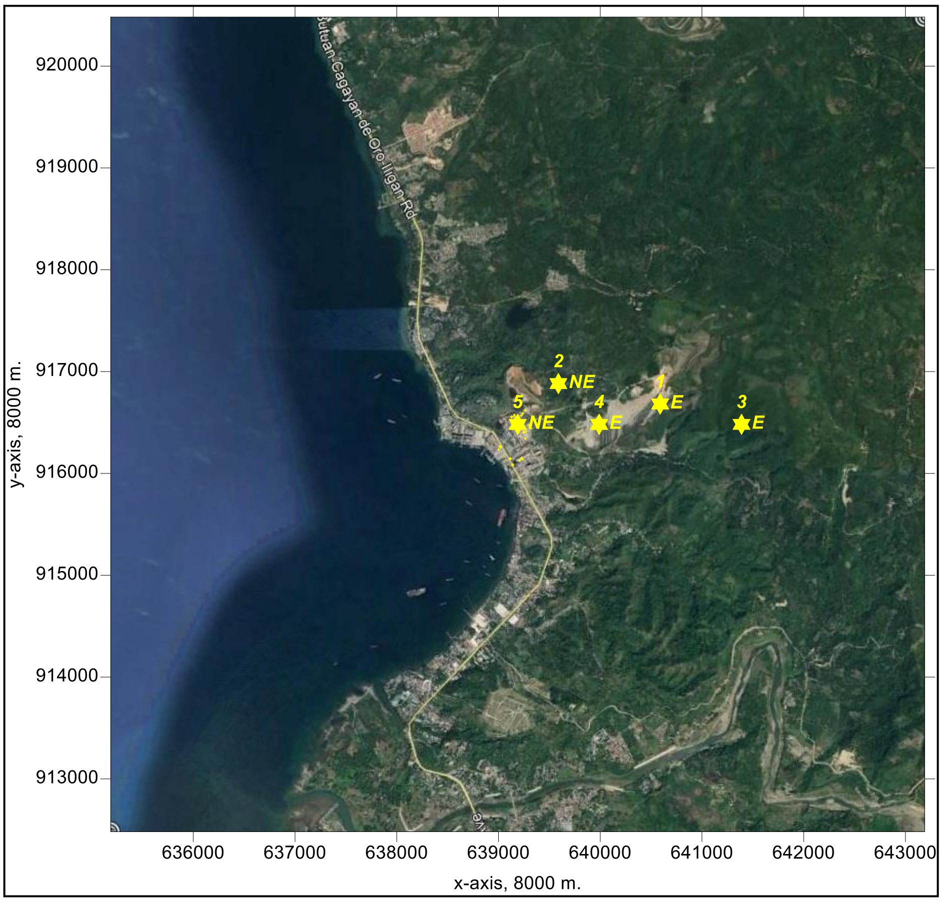


Figure 2.3-65. Predicted Location of Maximum GLC PM10 and TSP Concentration under Controlled Scenario 2 at 1-hr and 24-hr Averaging Time, µg/Ncm

Scenario 1 – Uncontrolled

Table 2.3-25 shows the comparison of the predicted maximum PM10 and TSP ambient ground level concentration with the DENR standards under uncontrolled scenario1 for 1-hr and 24-hr averaging times. **Table 2.3-26** shows the predicted ambient ground level PM10 and TSP under uncontrolled scenario 1 at ASR's. **Figure 2.3-58** to **2.3-74** shows the predicted PM10 and TSP ambient ground level concentration under uncontrolled scenario 1 condition. **Figure 2.3-74** shows the predicted location of maximum GLC PM10 and TSP concentration under uncontrolled scenario 1 condition for 1-hr and 24-hr averaging times

Table 2.3-25. Comparison of the Predicted maximum PM10 and TSP Ground Level Concentration (GLC) with the DENR Standards for 1-HR and 24-HR Averaging Time Uncontrolled

UTM COORDINATE, m.		Averaging Time	CRITERIA POLLUTANT	PREDICTED AMBIENT MAXIMUM Ground Level Concentration (GLC) CONC.	DENR AMBIENT STD.	Distance From Map Domain Center, m.	Direction from Map Domain Center, m,
X (m)	Y (m)			ug/Ncm	ug.Ncm		
639588.91	916882.14	1-HR	PM10	540.1		565.7	NE
639588.91	916882.14		TSP	3,566.4	300	567.7	NE
639588.91	916882.14	24-HR	PM10	88.0		800.0	E
639588.91	916882.14		TSP	581.1	150	800.0	E
639588.91	916882.14	1-HR	*PM10	20.9		0.0	NE
639588.91	916882.14		*TSP	136.5		0.0	NE
639588.91	916882.14	24-HR	**PM10	37.3		800.0	E

UTM COORDINATE, m.		Averaging Time	CRITERIA POLLUTANT	PREDICTED AMBIENT MAXIMUM Ground Level Concentration (GLC) CONC.	DENR AMBIENT STD.	Distance From Map Domain Center, m.	Direction from Map Domain Center, m,
X (m)	Y (m)			ug/Ncm	ug.Ncm		
639588.91	916882.14		**TSP	246.1		800.0	E
*-	176th						
**-	8th						

Table 2.3-26. SCENARIO 1 UNCONTROLLED

UTM Coordinate		SCENARIO 1								ASR's
		pm10	tsp	pm10	tsp	pm10	tsp	pm10	tsp	
		1hr		24 hr		1hr		24hr		
x	y					176th percentile		8th percentile		
638484.29	917972.28	52.10	336.65	5.14	32.55	1.62	10.57	2.66	16.75	ASR1
638463.32	917592.32	69.46	422.05	7.89	48.60	2.22	14.41	5.53	34.07	ASR2
639406.68	917746.92	124.22	819.96	10.27	67.62	1.08	7.12	4.96	32.72	ASR3
639582.25	917940.84	212.24	1401.25	16.62	109.60	1.71	11.27	10.45	69.02	ASR4
638497.53	918272.33	47.09	294.61	3.84	24.43	1.55	9.88	1.94	12.05	ASR5
638246.53	917353.67	50.16	319.97	5.68	35.94	1.66	10.84	2.69	17.04	ASR6
638180.90	918827.71	29.85	191.47	3.66	23.03	0.87	5.48	1.99	12.77	ASR7
639327.35	915839.98	98.85	627.56	8.14	51.63	4.55	29.01	5.07	31.45	ASR8
639959.64	915555.11	53.27	320.67	3.86	24.49	1.24	8.11	2.48	16.28	ASR9
639306.51	915020.09	55.59	346.43	6.06	37.57	2.08	13.38	2.32	15.09	ASR10
638639.48	914248.84	42.42	265.10	2.81	17.65	1.24	8.08	1.89	12.32	ASR11
638292.07	913908.38	43.03	266.62	3.05	18.82	0.98	6.43	1.68	10.91	ASR12
638729.81	913005.11	25.51	157.33	1.59	9.82	0.68	4.46	1.00	6.51	ASR13
639452.42	913088.49	29.63	183.63	2.82	17.47	0.54	3.54	0.98	6.24	ASR14
639681.71	912796.67	34.38	212.30	3.06	18.85	0.54	3.44	0.97	6.01	ASR15
640181.98	913387.26	26.45	163.13	1.54	9.57	0.51	3.25	1.24	7.90	ASR16
642004.16	913868.11	23.16	138.77	1.64	10.43	0.22	1.41	0.81	4.98	ASR17
639801.99	918167.72	181.82	1200.40	12.36	81.49	1.46	9.65	7.40	48.88	ASR18

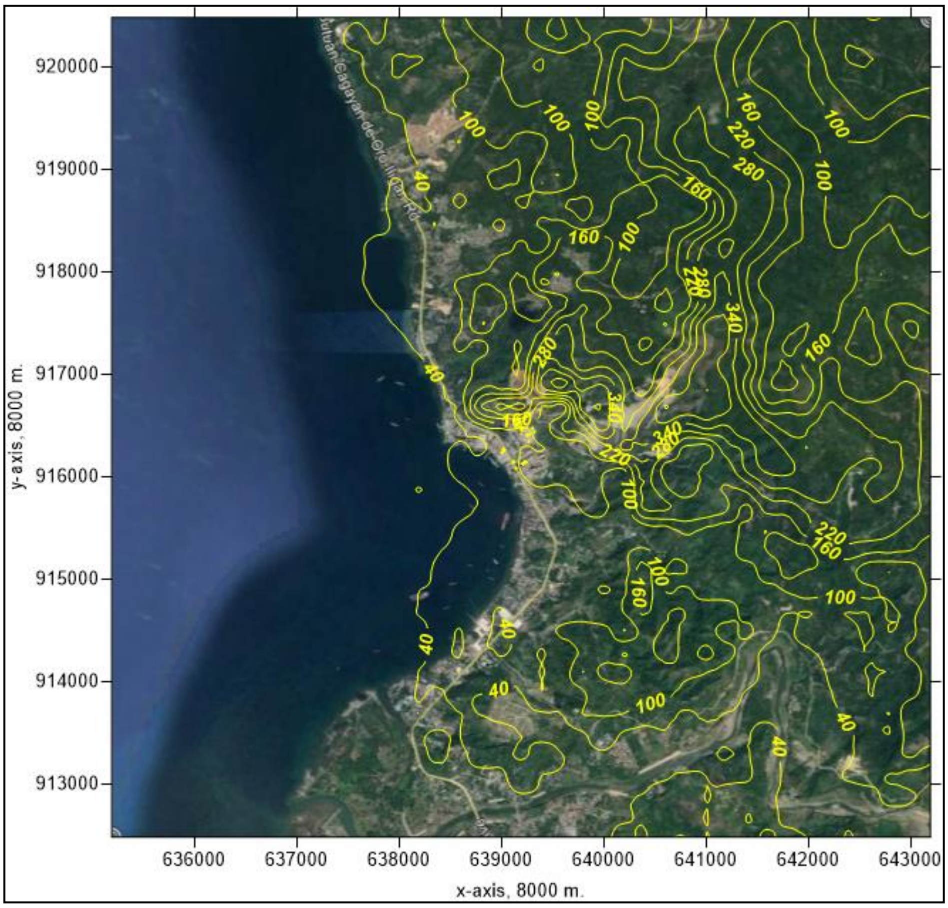


Figure 2.3-66. Predicted Ambient Ground Level PM10 Concentration under Uncontrolled Scenario 1 at 1-hr Averaging Time, ug/Ncm

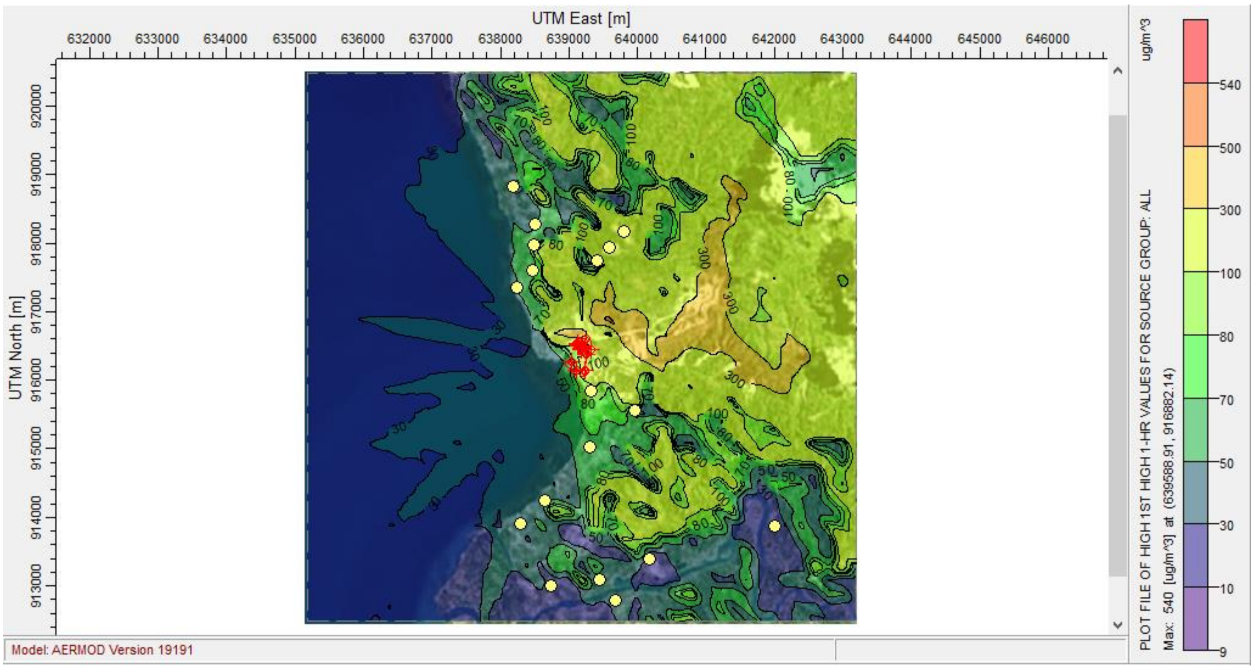


Figure 2.3-67. Predicted Ambient Ground Level PM10 Concentration under Uncontrolled Scenario 1 at 1-hr Averaging Time (with color scale), ug/Ncm

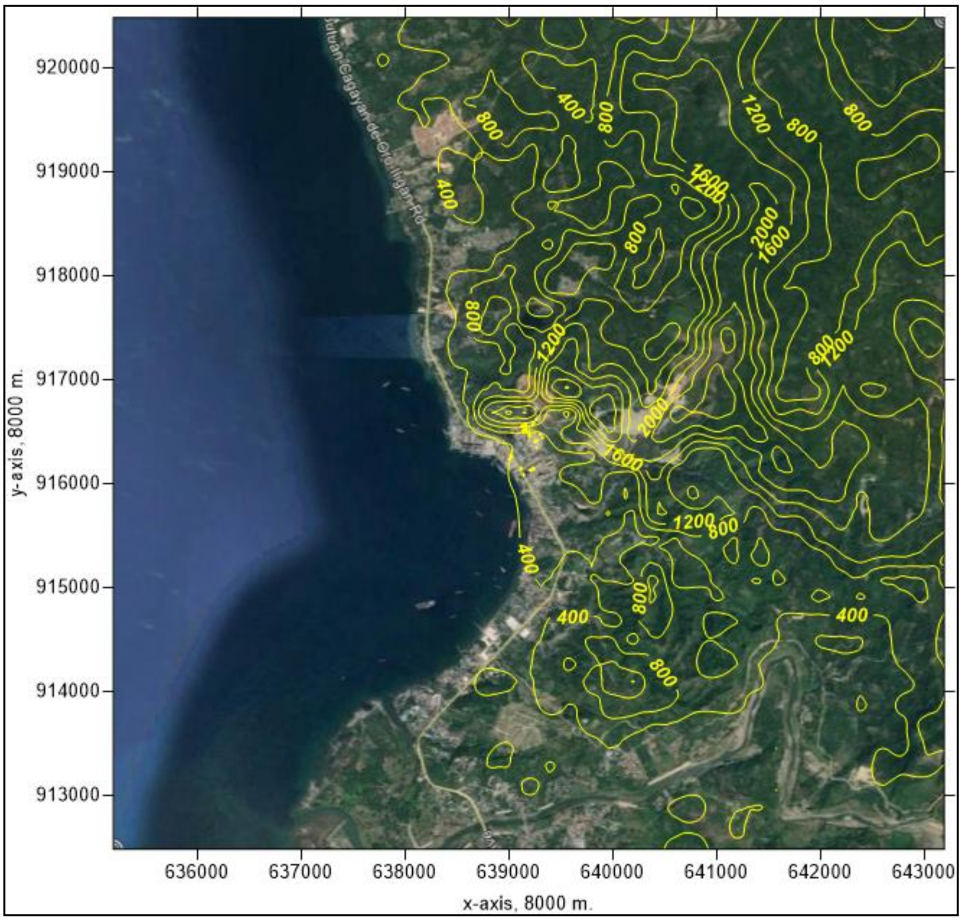


Figure 2.3-68. Predicted Ambient Ground Level TSP Concentration under Uncontrolled Scenario 1 at 1-hr Averaging Time, ug/Ncm

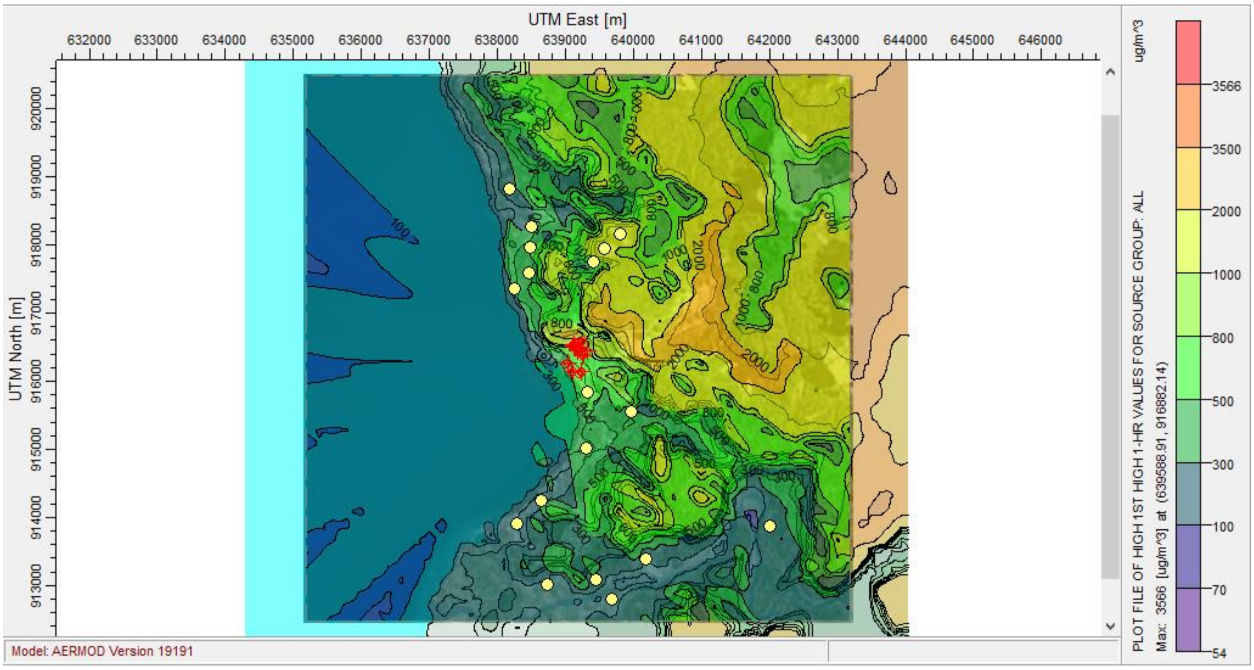


Figure 2.3-69. Predicted Ambient Ground Level TSP Concentration under Uncontrolled Scenario 1 at 1-hr Averaging Time (with color scale), ug/Ncm

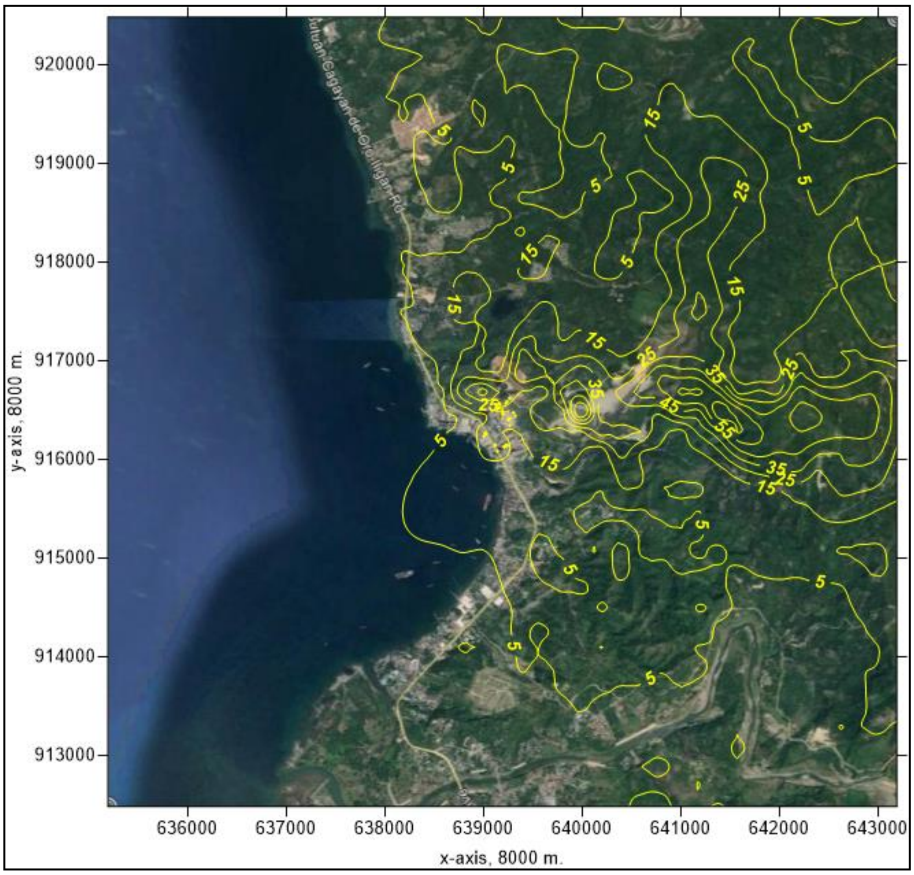


Figure 2.3-70. Predicted Ambient Ground Level PM10 Concentration under Uncontrolled Scenario 1 at 24-hr Averaging Time, ug/Ncm

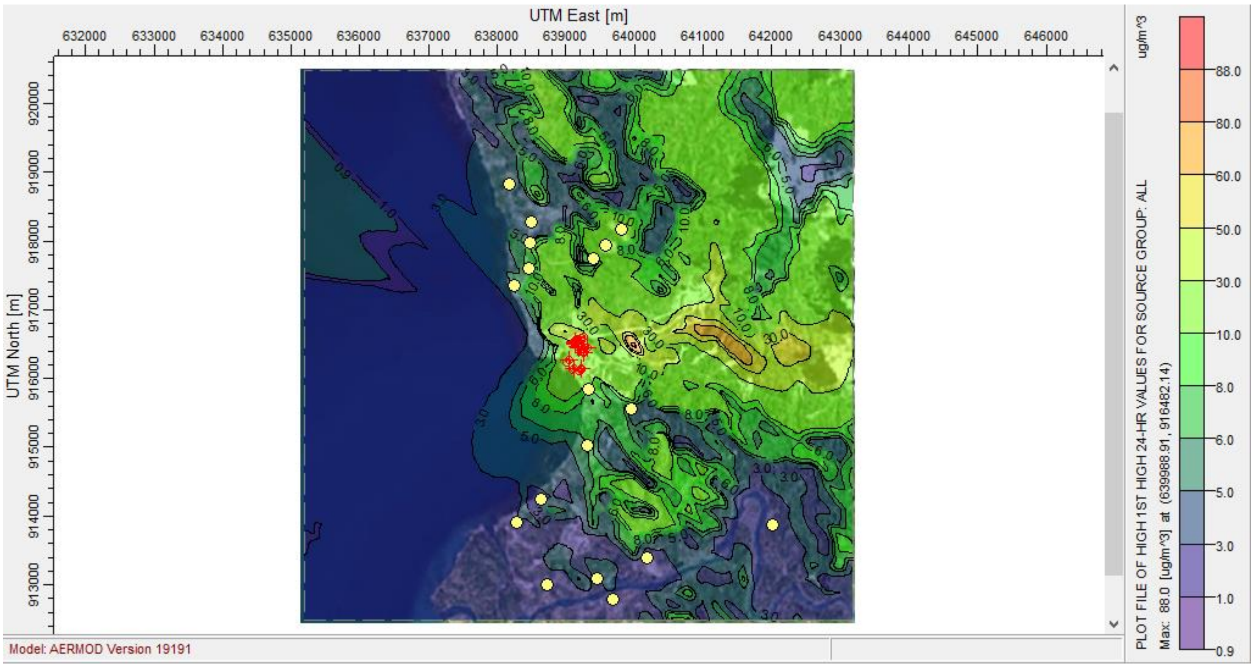


Figure 2.3-71. Predicted Ambient Ground Level PM10 Concentration under Uncontrolled Scenario 1 at 24-hr Averaging Time (with color scale), ug/Ncm

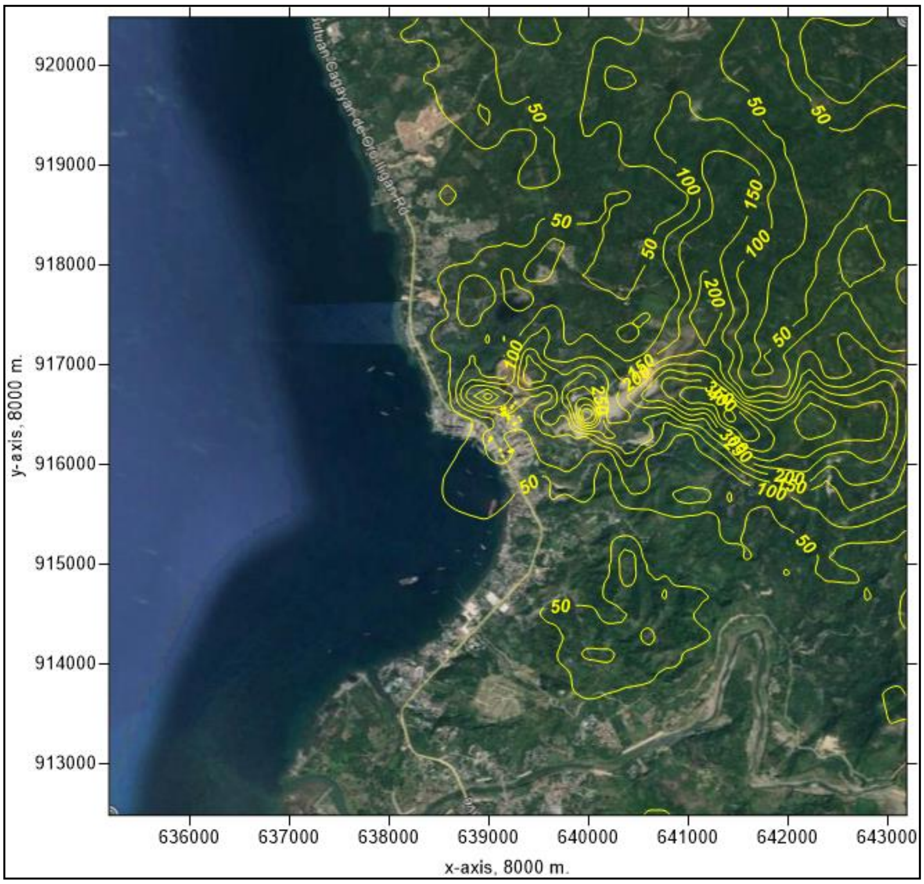


Figure 2.3-72. Predicted Ambient Ground Level TSP Concentration under Uncontrolled Scenario 1 at 24-hr Averaging Time, ug/Ncm

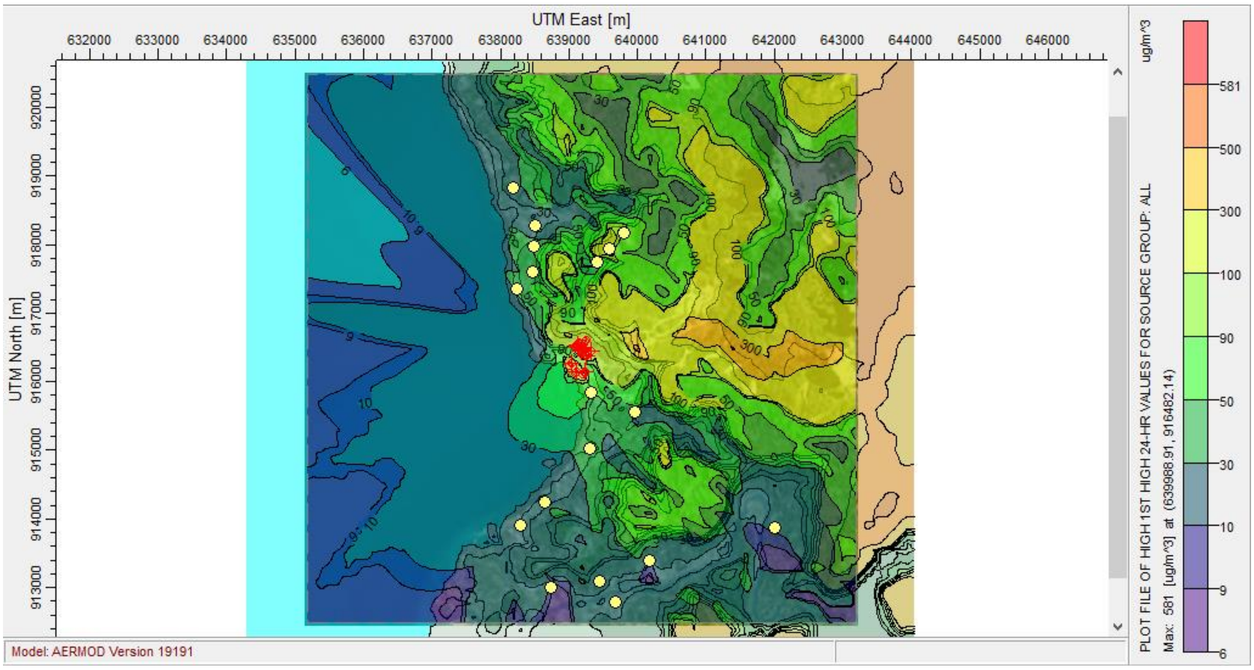


Figure 2.3-73. Predicted Ambient Ground Level TSP Concentration under Uncontrolled Scenario 1 at 24-hr Averaging Time (with color scale), ug/Ncm

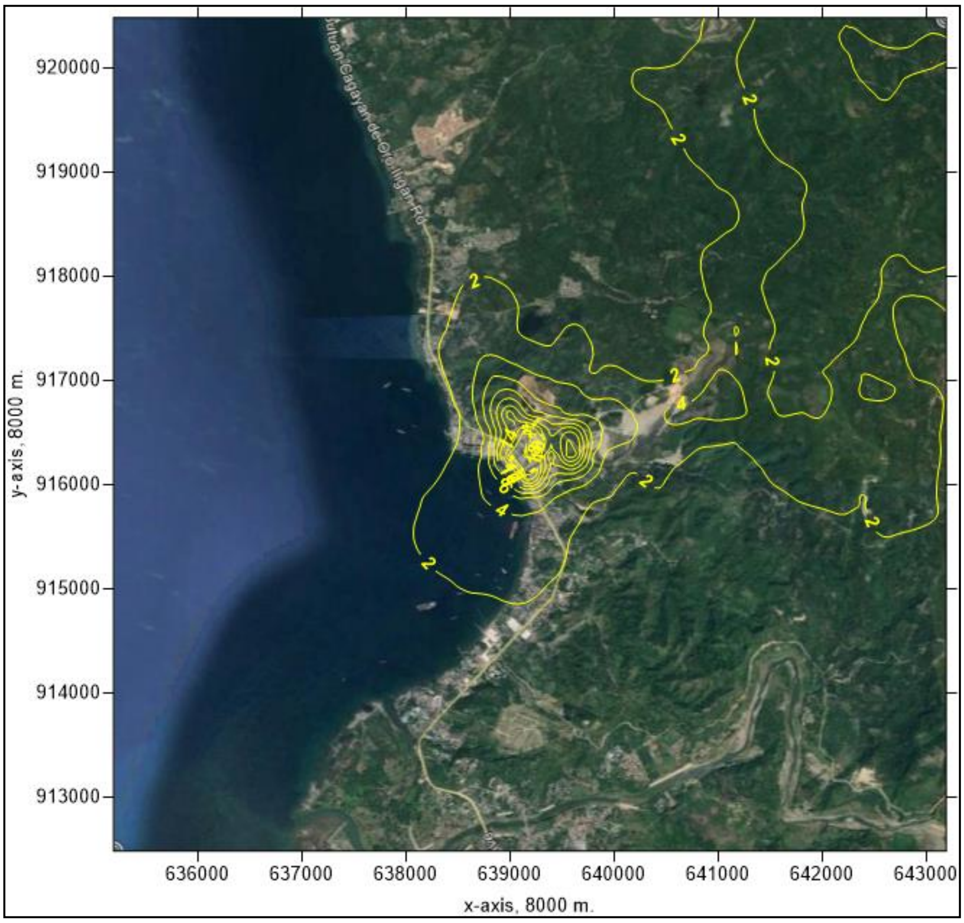


Figure 2.3-74. Predicted Ambient Ground Level PM10 Concentration under Uncontrolled Scenario 1 at 1-hr Averaging Time 176th Percentile, ug/Ncm

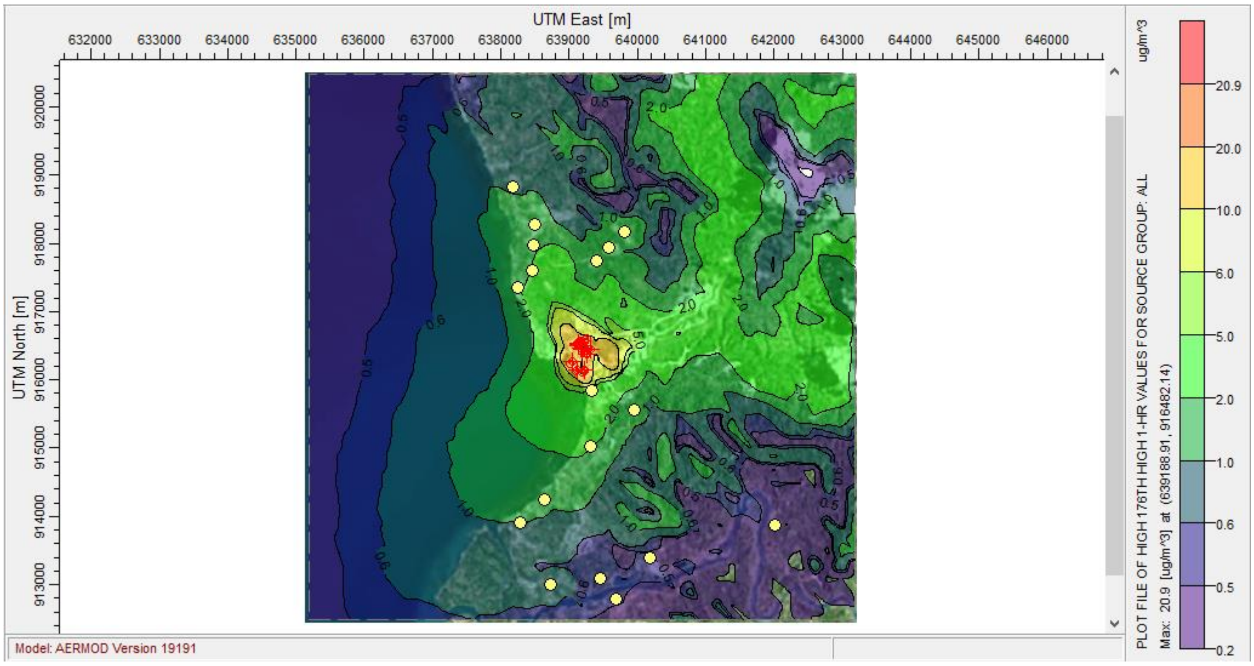


Figure 2.3-75. Predicted Ambient Ground Level PM10 Concentration under Uncontrolled Scenario 1 at 1-hr Averaging Time 176th Percentile (with color scale), ug/Ncm

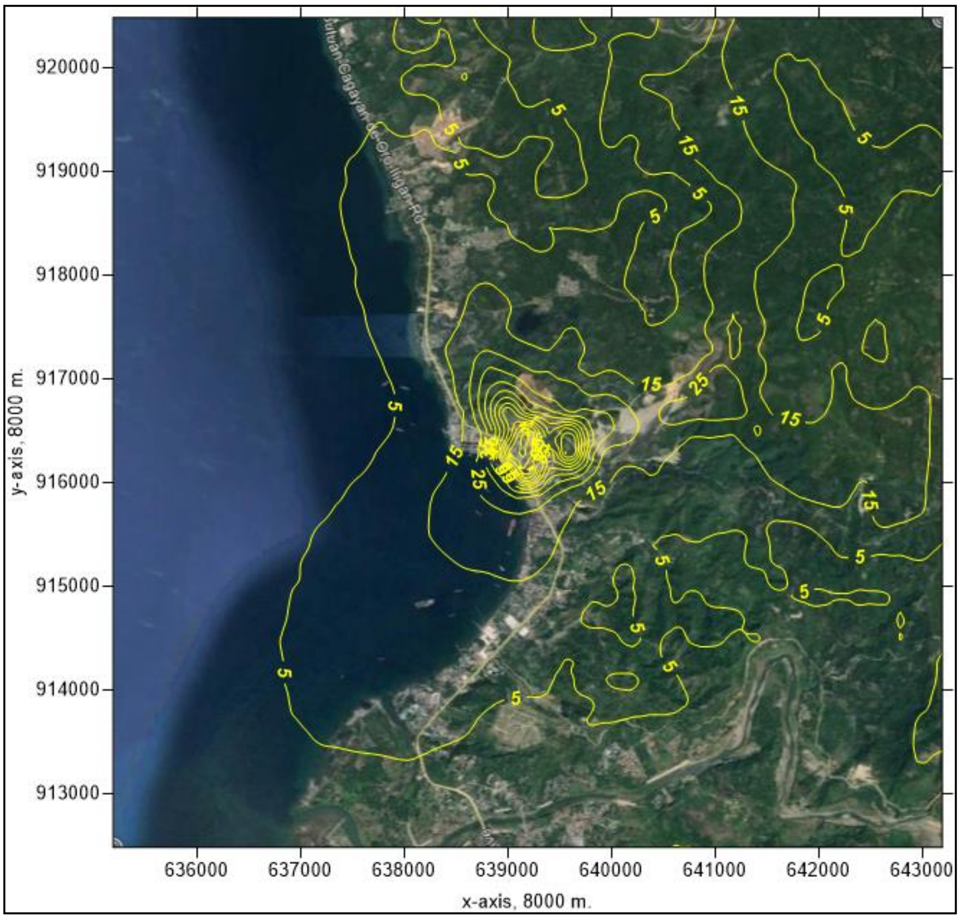


Figure 2.3-76. Predicted Ambient Ground Level TSP Concentration under Uncontrolled Scenario 1 at 1-hr Averaging Time 176th Percentile, ug/Ncm

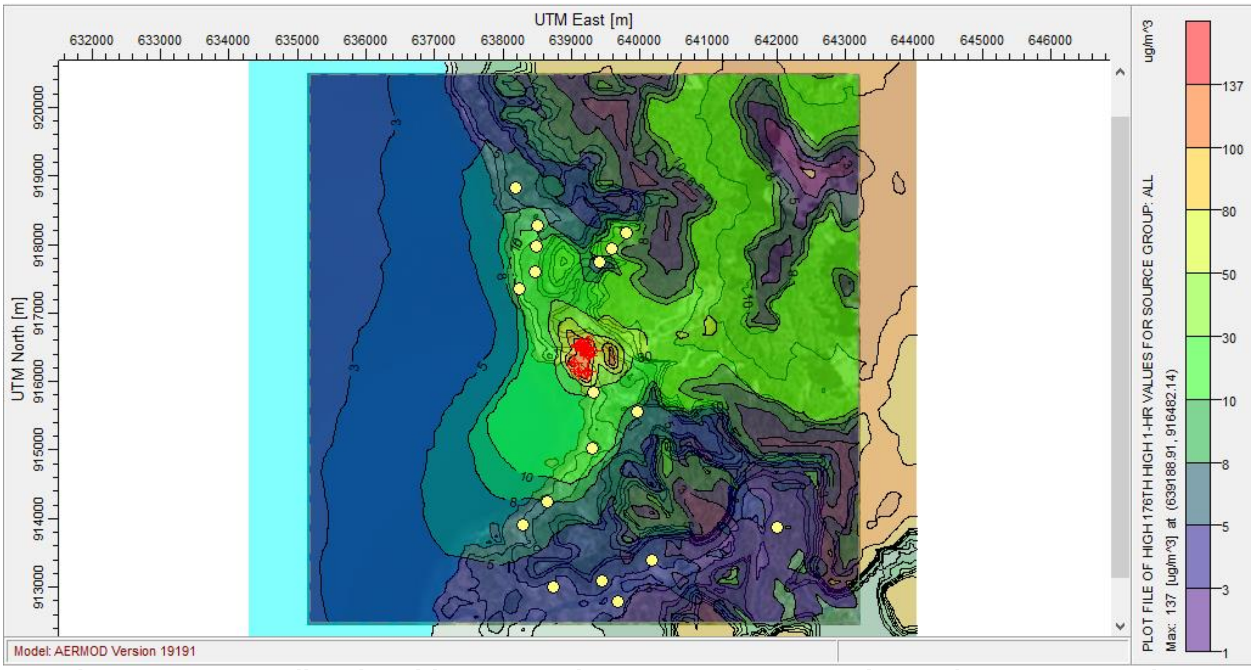


Figure 2.3-77. Predicted Ambient Ground Level TSP Concentration under Uncontrolled Scenario 1 at 1-hr Averaging Time 176th Percentile (with color scale), ug/Ncm

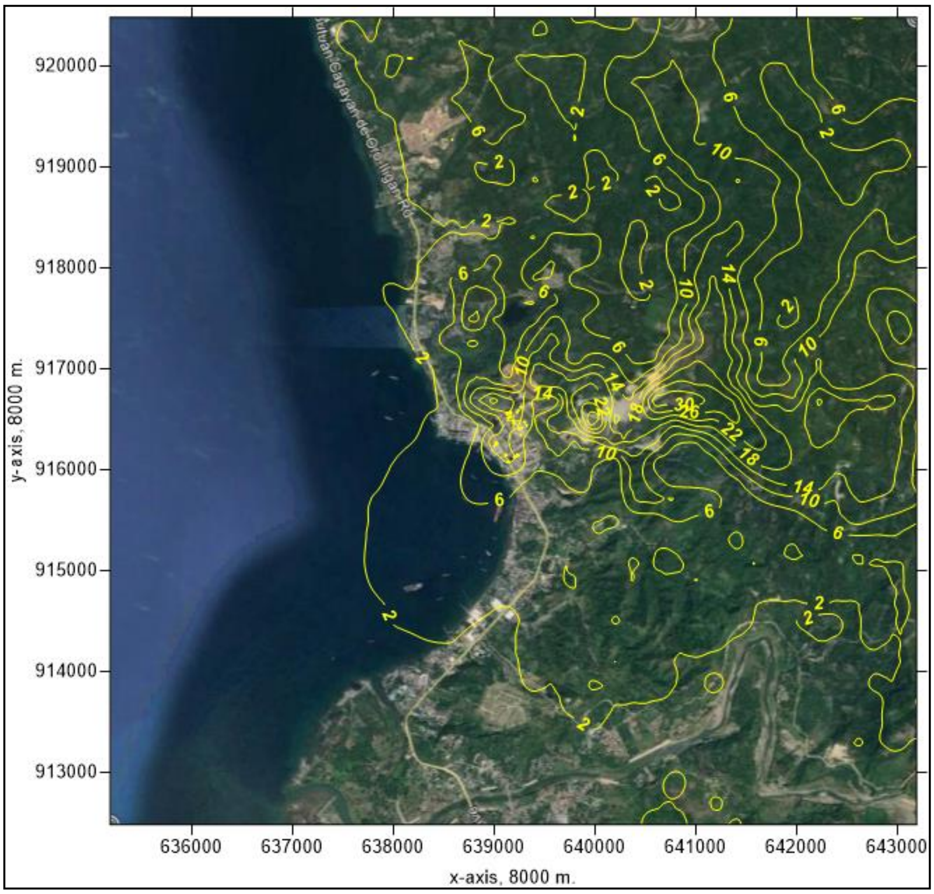


Figure 2.3-78. Predicted Ambient Ground Level PM10 Concentration under Uncontrolled Scenario 1 at 24-hr Averaging Time 98th Percentile, ug/Ncm

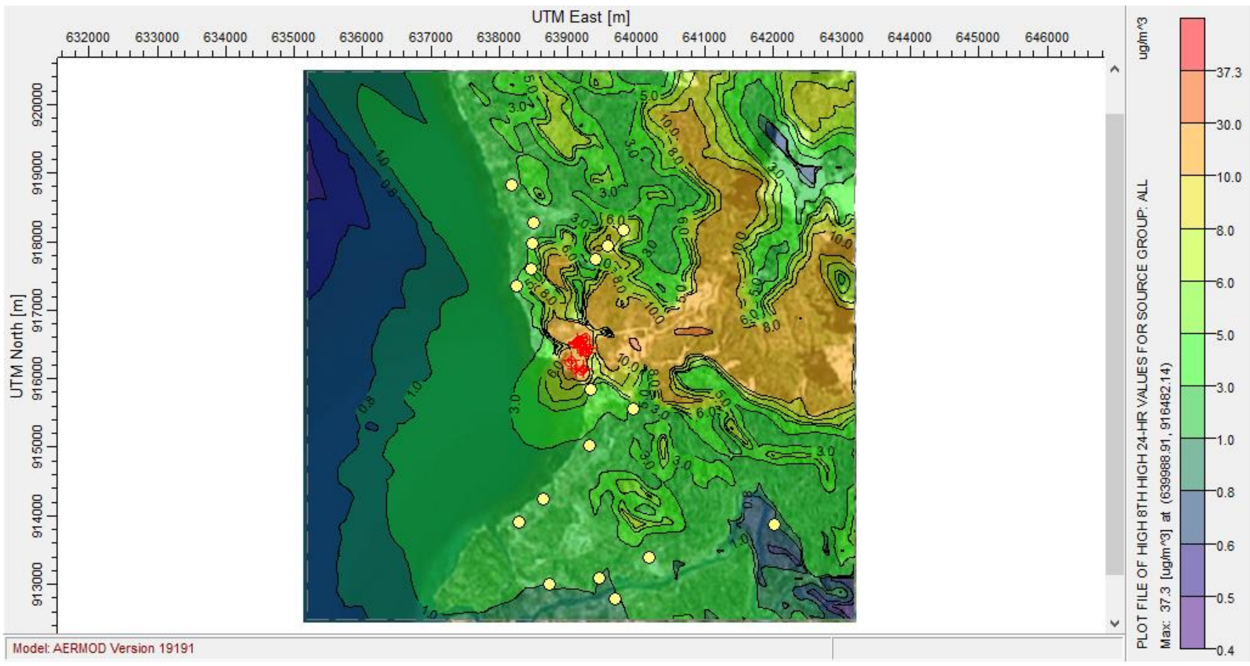


Figure 2.3-79. Predicted Ambient Ground Level PM10 Concentration under Uncontrolled Scenario 1 at 24-hr Averaging Time 98th Percentile (with color scale), ug/Ncm

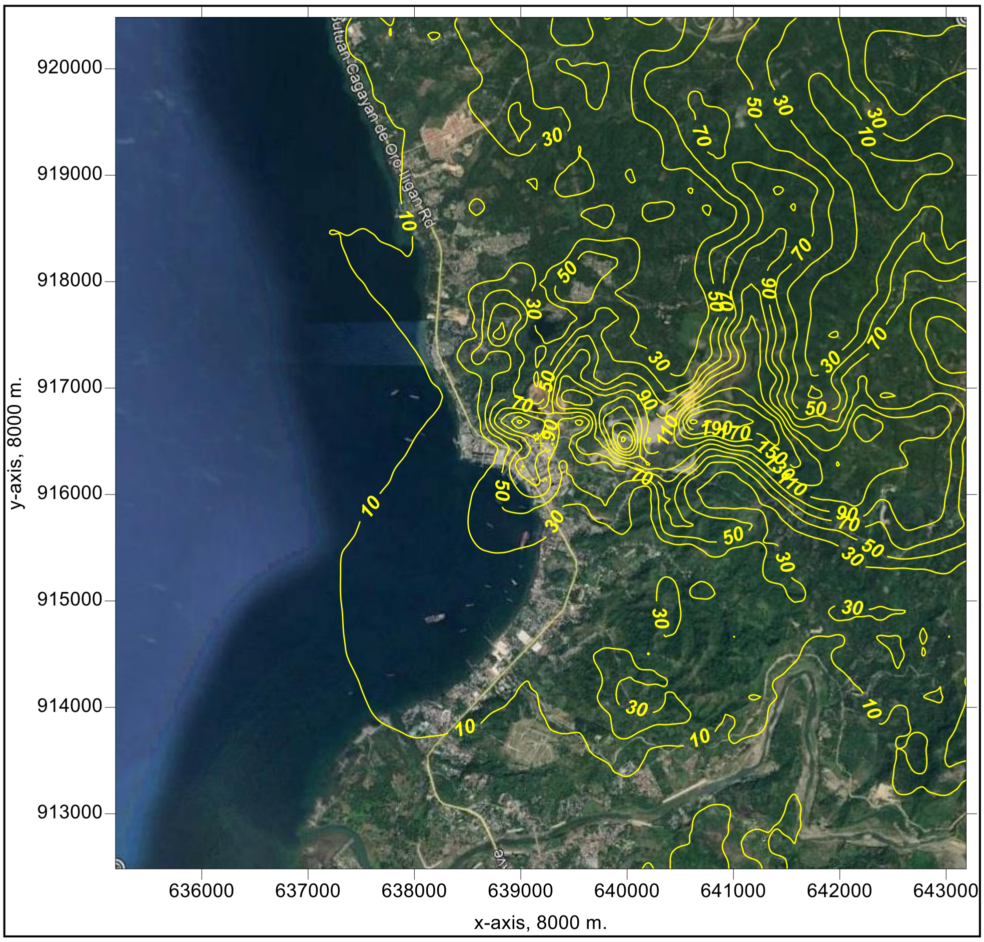


Figure 2.3-80. Predicted Ambient Ground Level PM10 Concentration under Uncontrolled Scenario 1 at 24-hr Averaging Time 98th Percentile, ug/Ncm

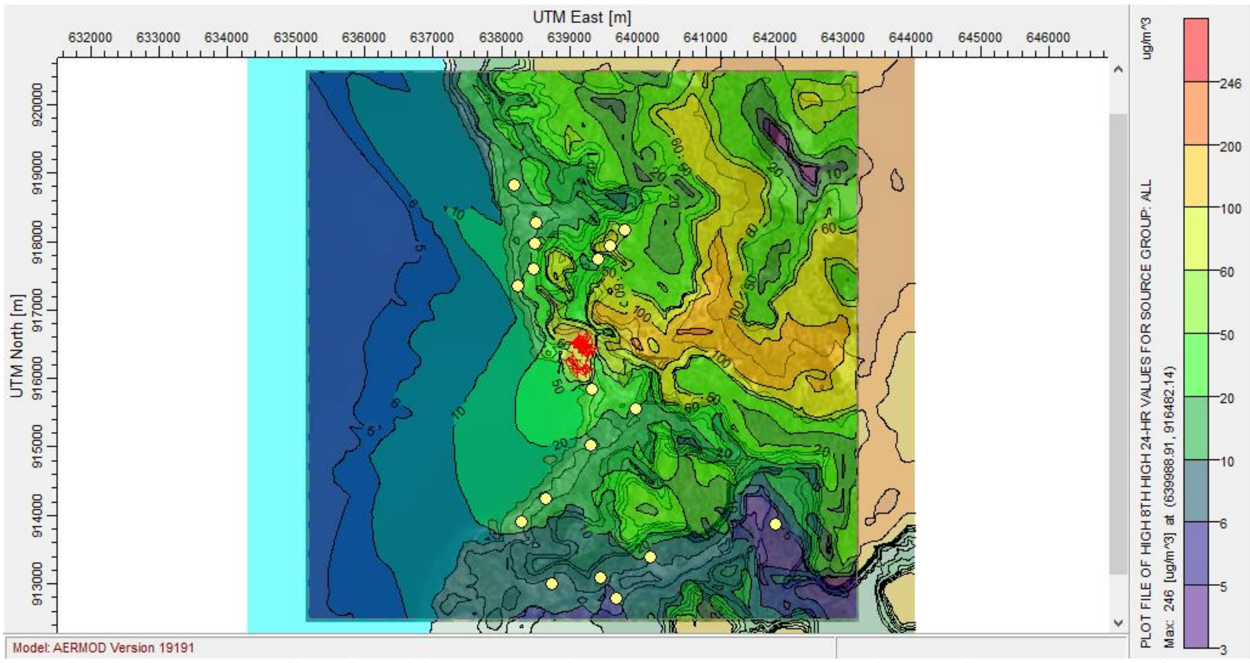


Figure 2.3-81. Predicted Ambient Ground Level PM10 Concentration under Uncontrolled Scenario 1 at 24-hr Averaging Time 98th Percentile (with color scale), ug/Ncm

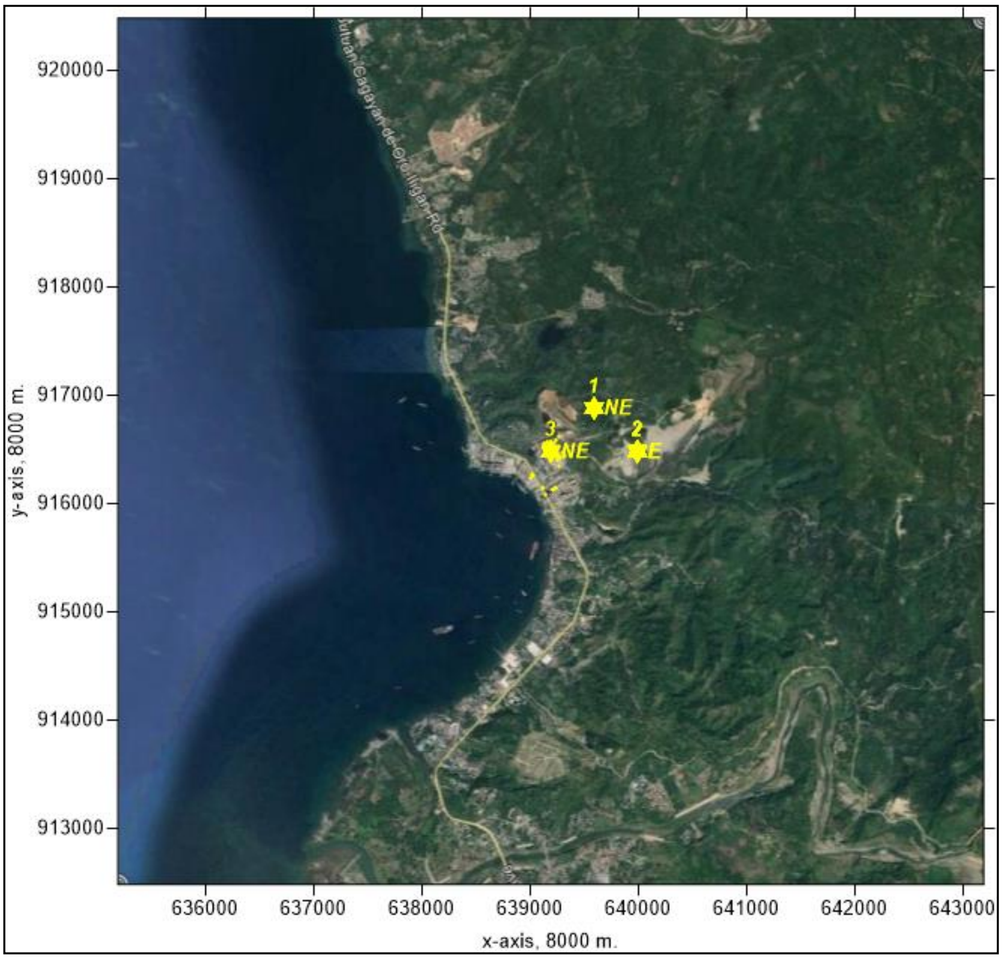


Figure 2.3-82. Predicted Location of Maximum GLC PM10 and TSP Concentration under Uncontrolled Scenario 1 at 1-hr and 24-hr Averaging Time, ug/Ncm

Scenario 1 - Controlled

Table 2.3-24 shows the comparison of the predicted maximum PM10 and TSP ambient ground level concentration with the DENR standards under controlled scenario 1 for 1-hr and 24-hr averaging times. **Table 2.3-25** shows the predicted ambient ground level PM10 and TSP under controlled scenario 1 at ASR's. **Figure 2.3-75** to **2.3-91** shows the predicted PM10 and TSP ambient ground level concentration under controlled scenario 1 condition. **Figure 2.3-91** shows the predicted location of maximum GLC PM10 and TSP concentration under controlled scenario 1 condition for 1-hr and 24-hr averaging times.

Table 2.3-27. Comparison of the Predicted Maximum PM10 and TSP Ground Level Concentration (GLC) with the DENR Standards for 1-HR and 24-HR Averaging Time Controlled

UTM COORDINATE, m.		Averaging Time	CRITERIA POLLUTANT	PREDICTED AMBIENT MAXIMUM Ground Level Concentration (GLC) CONC.	DENR AMBIENT STD.	Distance From Map Domain Center, m.	Direction from Map Domain Center, m,
X (m)	Y (m)			ug/Ncm	ug.Ncm		
640588.91	916682.14	1-HR	PM10	23.3		1414.2	E
640588.91	916682.14		TSP	180.0	300	565.7	NE
640588.91	916682.14	24-HR	PM10	3.9		2200.0	E
640588.91	916682.14		TSP	29.3	150	800.0	E

UTM COORDINATE, m.		Averaging Time	CRITERIA POLLUTANT	PREDICTED AMBIENT MAXIMUM Ground Level Concentration (GLC) CONC.	DENR AMBIENT STD.	Distance From Map Domain Center, m.	Direction from Map Domain Center, m,
X (m)	Y (m)			ug/Ncm	ug.Ncm		
640588.91	916682.14	**1-HR**	***PM10**	1.0		0.0	NE
640588.91	916682.14		***TSP**	6.9		0.0	NE
640588.91	916682.14	**24-HR**	****PM10**	1.6		1414.2	E
640588.91	916682.14		****TSP**	12.4		800.0	E
*-	176th						
**-	8th						

Table 2.3-28. SCENARIO 1 CONTROLLED ASR

UTM Coordinate		SCENARIO 1								ASR's
		pm10	tsp	pm10	tsp	pm10	tsp	pm10	tsp	
		1hr		24 hr		1hr		24hr		
x	y					176th percentile		8th percentile		
638484.29	917972.28	2.58	17.07	0.25	1.66	0.08	0.53	0.13	0.85	ASR1
638463.32	917592.32	3.24	21.45	0.37	2.47	0.10	0.72	0.26	1.71	ASR2
639406.68	917746.92	5.19	41.38	0.44	3.41	0.05	0.36	0.21	1.65	ASR3
639582.25	917940.84	8.89	70.71	0.71	5.53	0.07	0.57	0.44	3.48	ASR4
638497.53	918272.33	2.25	14.77	0.18	1.22	0.08	0.53	0.09	0.62	ASR5
638246.53	917353.67	2.45	16.14	0.28	1.82	0.08	0.54	0.13	0.86	ASR6
638180.90	918827.71	1.47	9.72	0.18	1.17	0.04	0.30	0.09	0.64	ASR7
639327.35	915839.98	4.78	31.46	0.39	2.59	0.22	1.49	0.24	1.59	ASR8
639959.64	915555.11	2.43	15.90	0.18	1.23	0.06	0.41	0.12	0.81	ASR9
639306.51	915020.09	2.64	17.33	0.29	1.88	0.09	0.67	0.11	0.76	ASR10
638639.48	914248.84	2.03	13.32	0.13	0.89	0.06	0.40	0.09	0.62	ASR11
638292.07	913908.38	2.04	13.37	0.14	0.95	0.05	0.32	0.08	0.55	ASR12
638729.81	913005.11	1.21	7.90	0.07	0.49	0.03	0.22	0.05	0.33	ASR13
639452.42	913088.49	1.41	9.23	0.13	0.88	0.03	0.18	0.05	0.31	ASR14
639681.71	912796.67	1.62	10.65	0.14	0.95	0.03	0.17	0.05	0.30	ASR15
640181.98	913387.26	1.25	8.19	0.07	0.48	0.02	0.17	0.06	0.40	ASR16
642004.16	913868.11	1.06	6.96	0.08	0.52	0.01	0.07	0.04	0.25	ASR17
639801.99	918167.72	7.62	60.57	0.52	4.11	0.06	0.49	0.31	2.47	ASR18

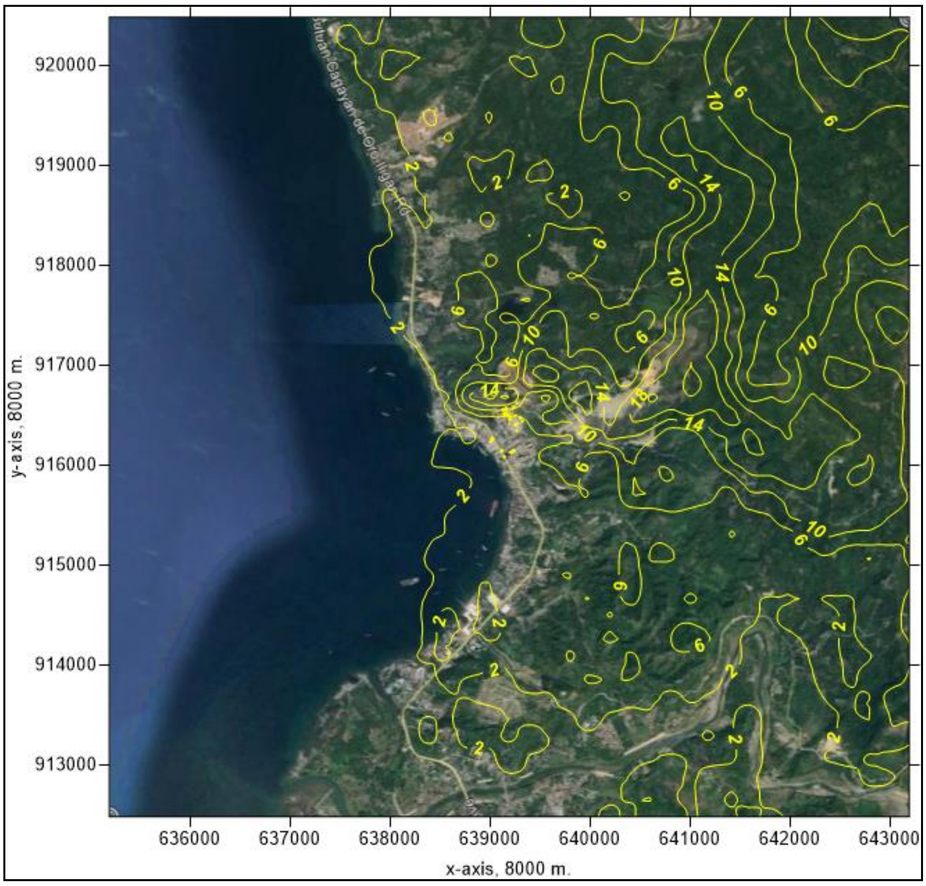


Figure 2.3-83. Predicted Ambient Ground Level PM10 Concentration under Controlled Scenario 1 at 1-hr Averaging Time, ug/Ncm

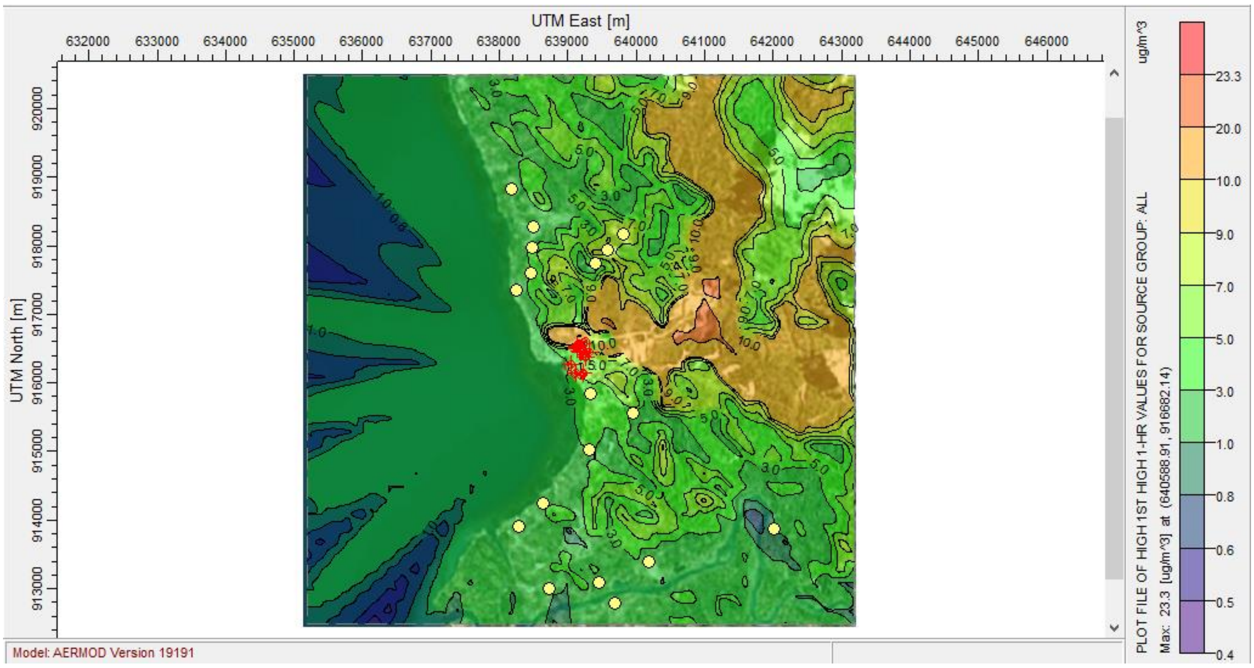


Figure 2.3-84. Predicted Ambient Ground Level PM10 Concentration under Controlled Scenario 1 at 1-hr Averaging Time (with color scale), ug/Ncm

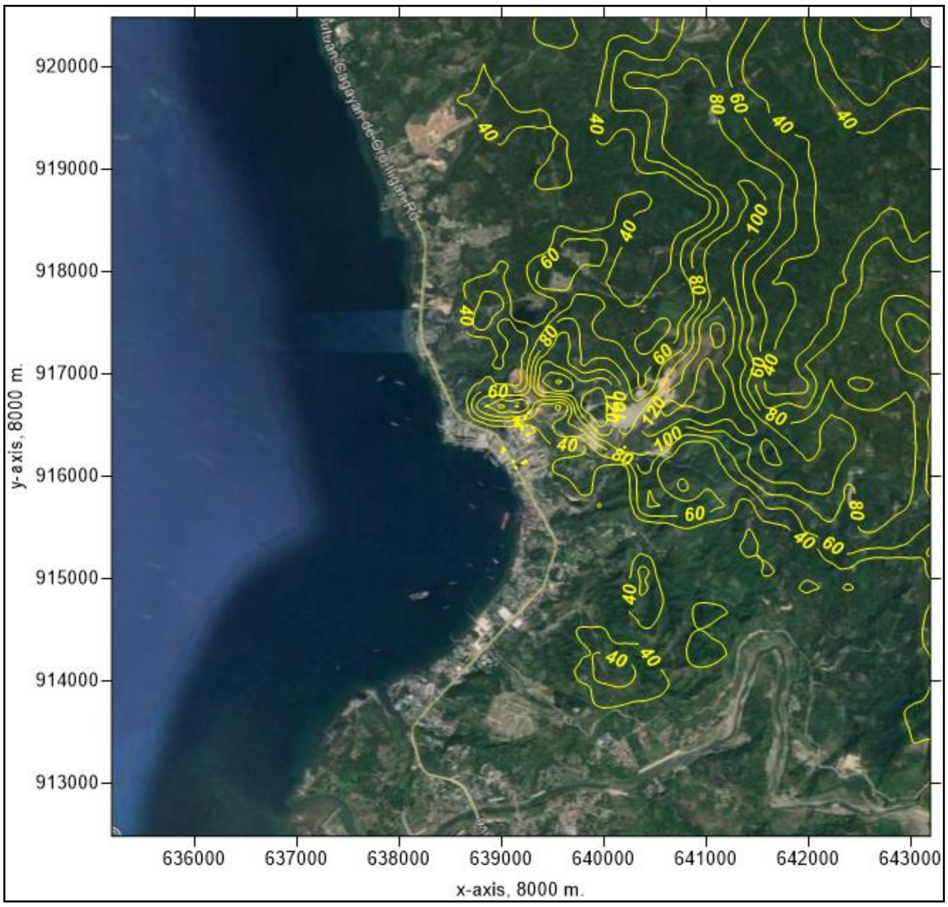


Figure 2.3-85. Predicted Ambient Ground Level TSP Concentration under Controlled Scenario 1 at 1-hr Averaging Time, ug/Ncm

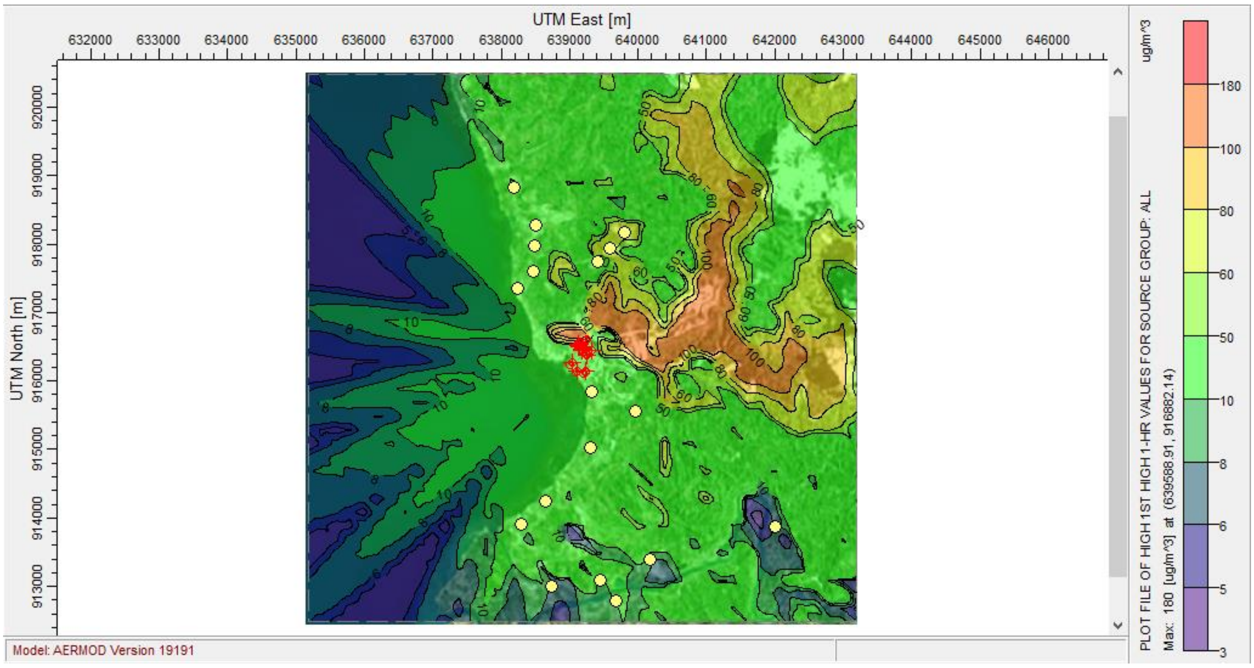


Figure 2.3-86. Predicted Ambient Ground Level TSP Concentration under Controlled Scenario 1 at 1-hr Averaging Time (with color scale), ug/Ncm

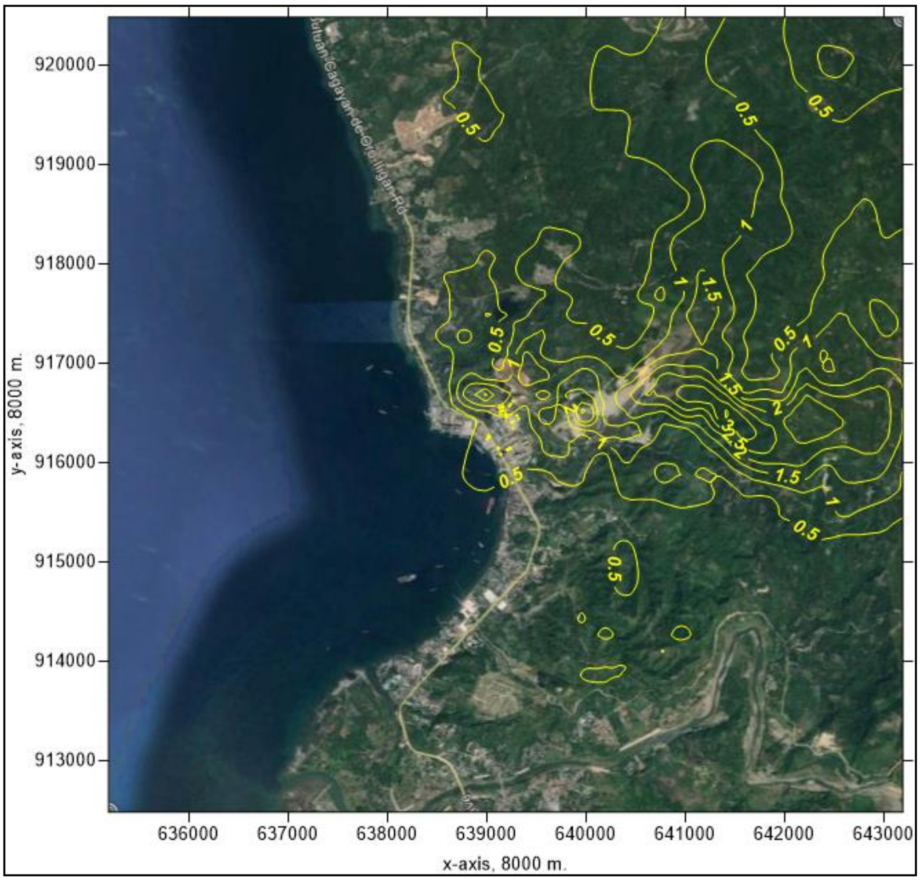


Figure 2.3-87. Predicted Ambient Ground Level PM10 Concentration under Controlled Scenario 1 at 24-hr Averaging Time, ug/Ncm

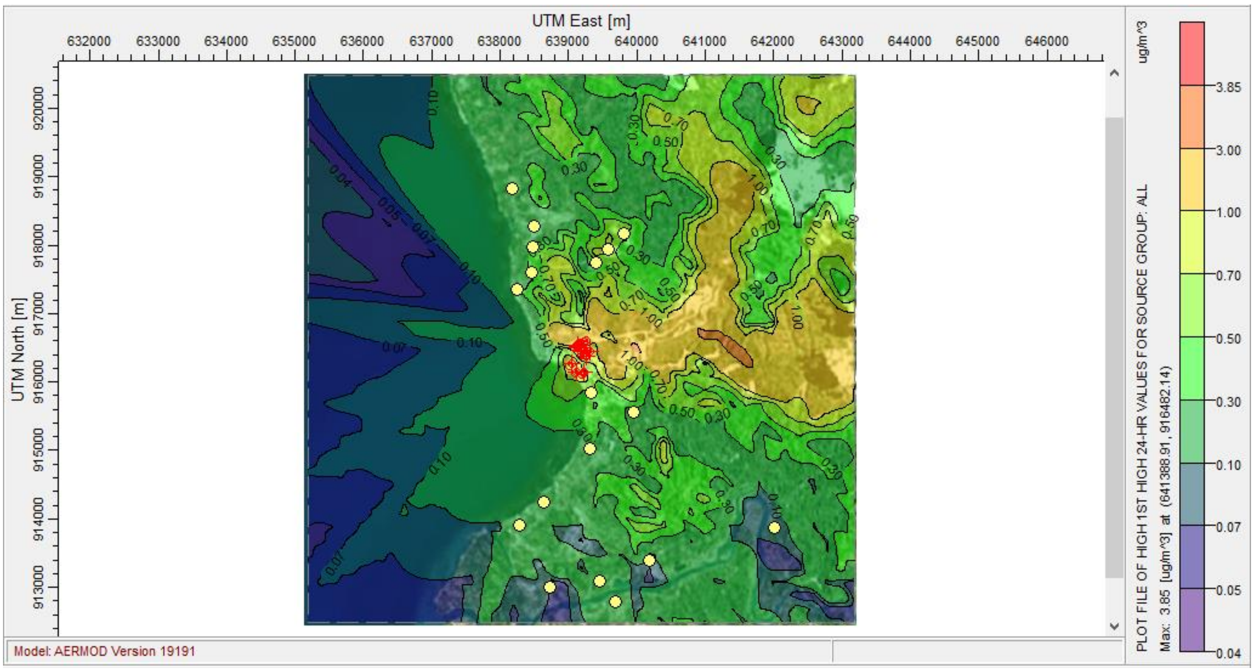


Figure 2.3-88. Predicted Ambient Ground Level PM10 Concentration under Controlled Scenario 1 at 24-hr Averaging Time (with color scale), ug/Ncm

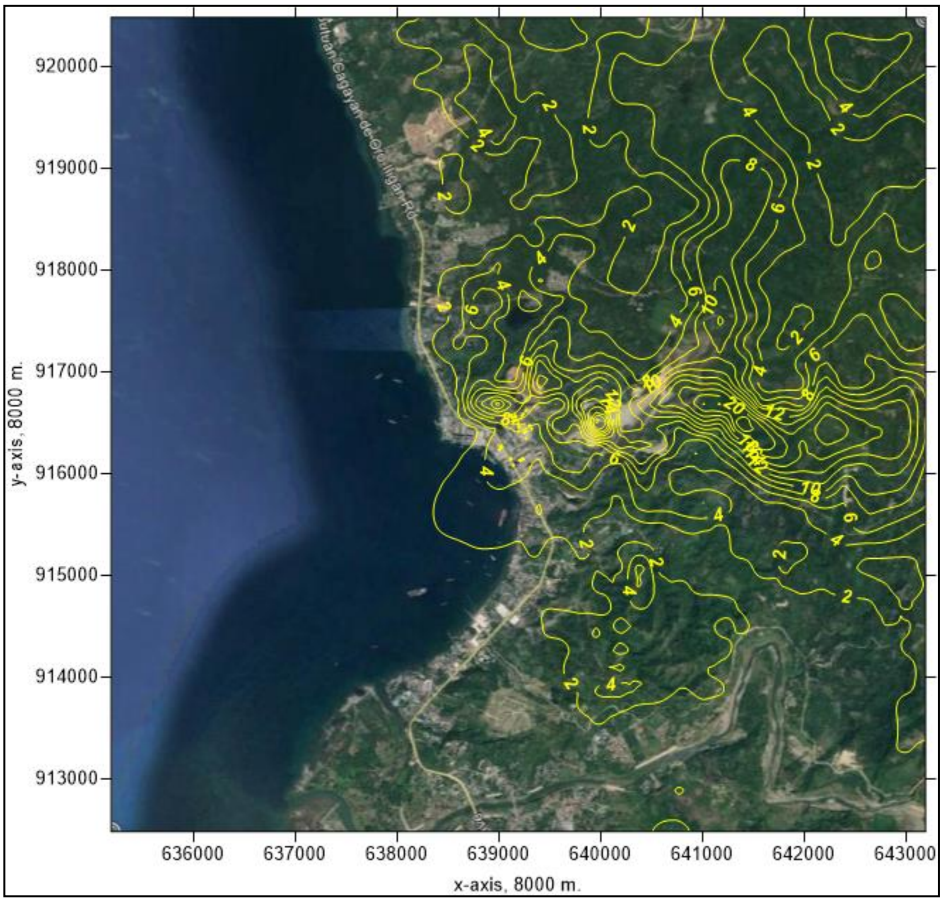


Figure 2.3-89. Predicted Ambient Ground Level TSP Concentration under Controlled Scenario 1 at 24-hr Averaging Time, ug/Ncm

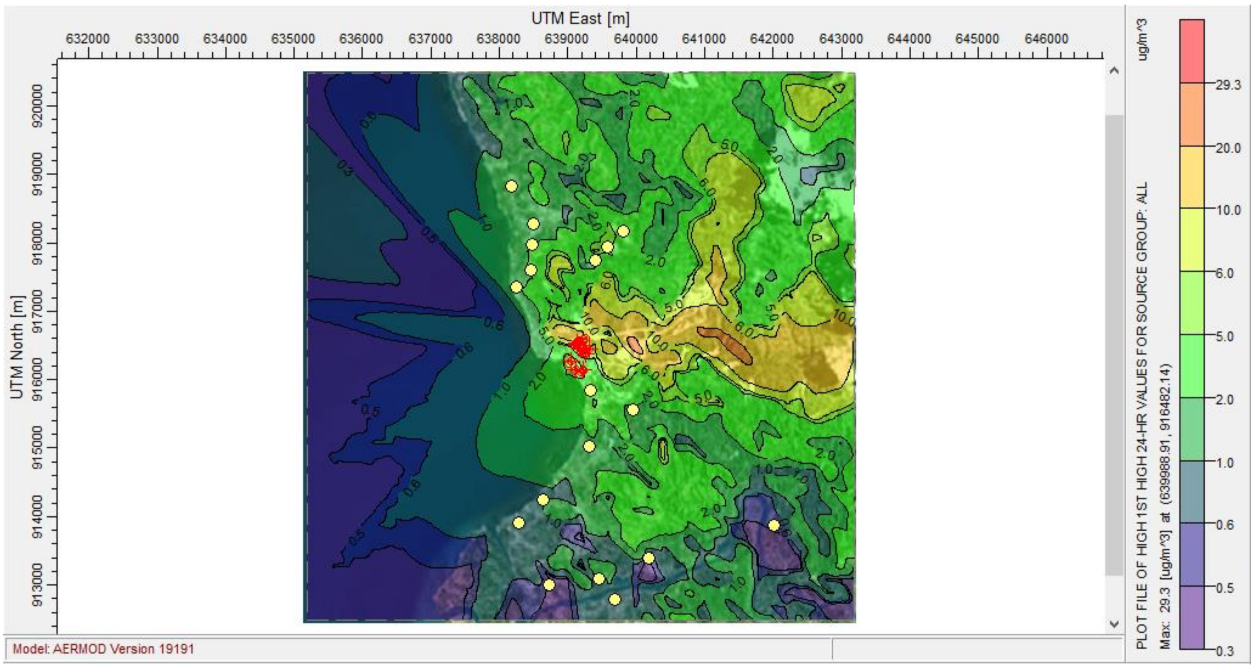


Figure 2.3-90. Predicted Ambient Ground Level TSP Concentration under Controlled Scenario 1 at 24-hr Averaging Time (with color scale), ug/Ncm

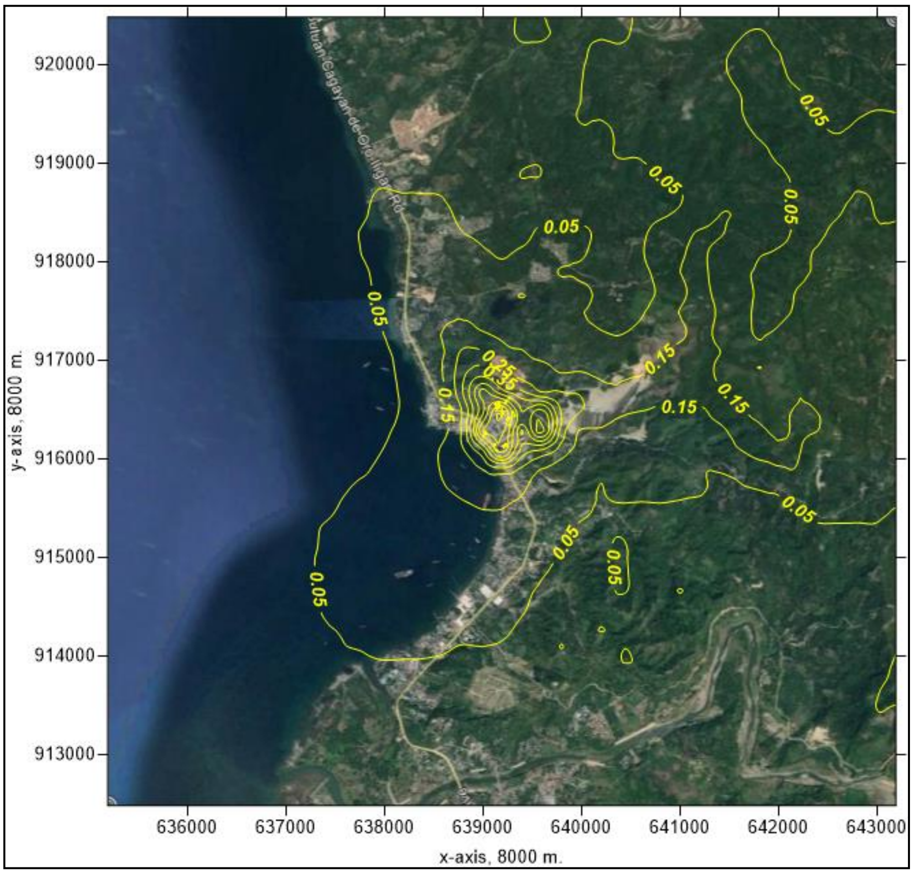


Figure 2.3-91. Predicted Ambient Ground Level PM10 Concentration under Controlled Scenario 1 at 1-hr Averaging Time 176th Percentile, ug/Ncm

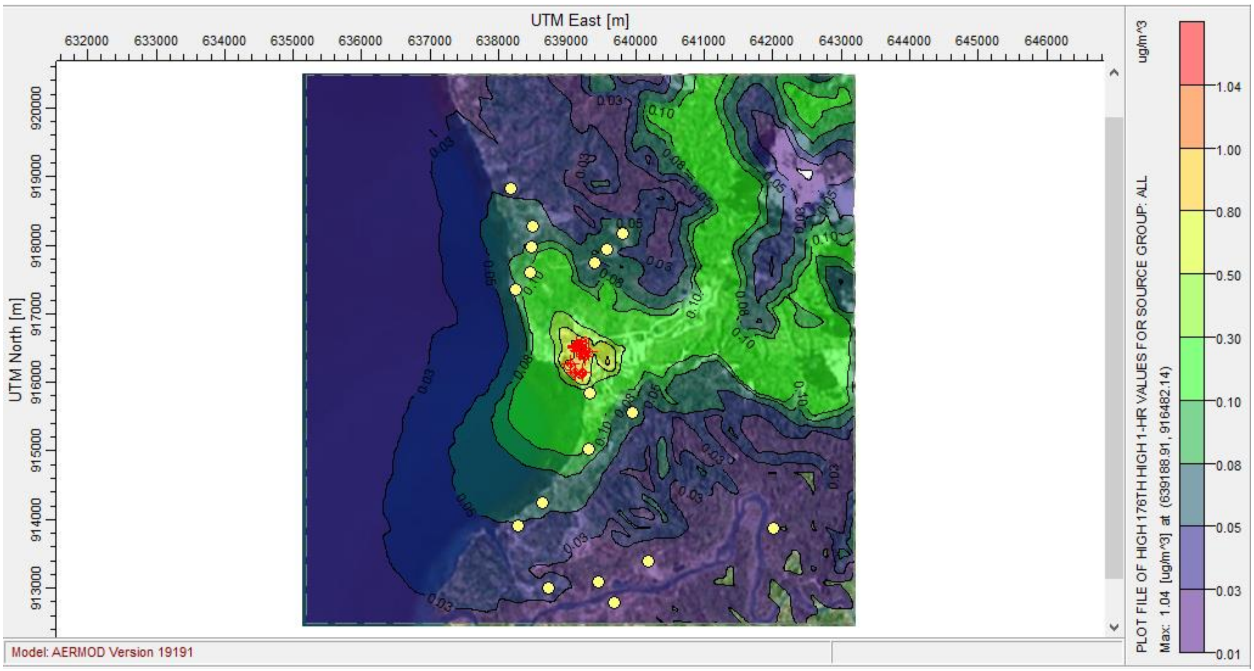


Figure 2.3-92. Predicted Ambient Ground Level PM10 Concentration under Controlled Scenario 1 at 1-hr Averaging Time 176th Percentile (with color scale), ug/Ncm

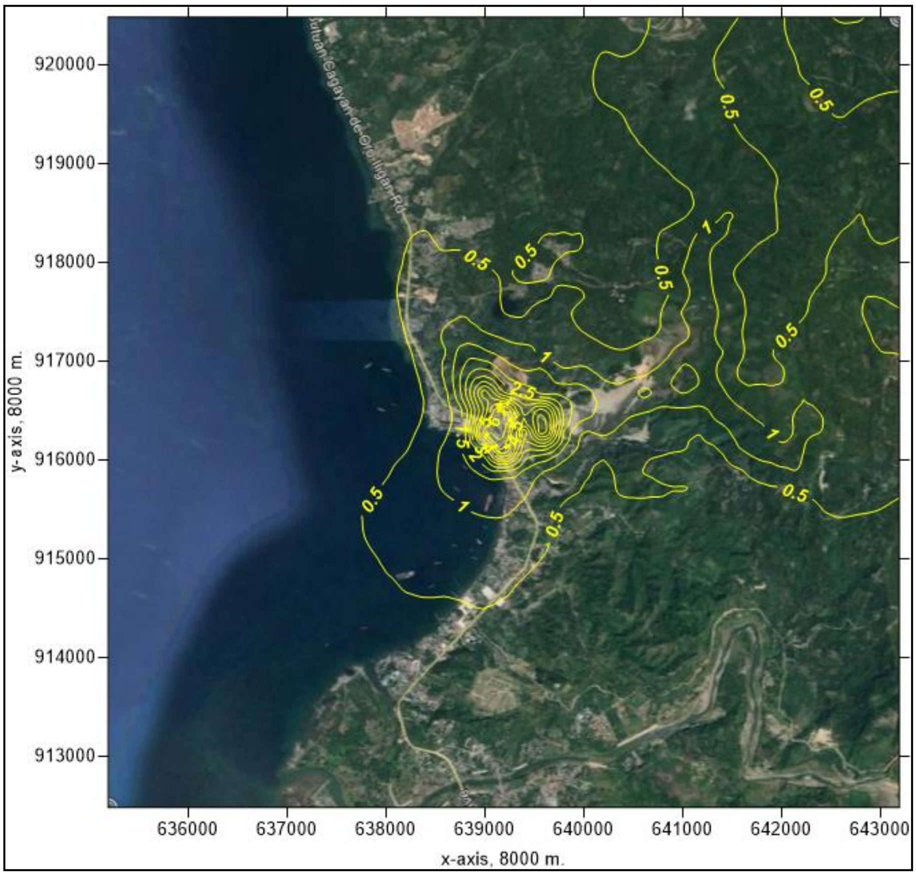


Figure 2.3-93. Predicted Ambient Ground Level TSP Concentration under Controlled Scenario 1 at 1-hr Averaging Time 176th Percentile, ug/Ncm

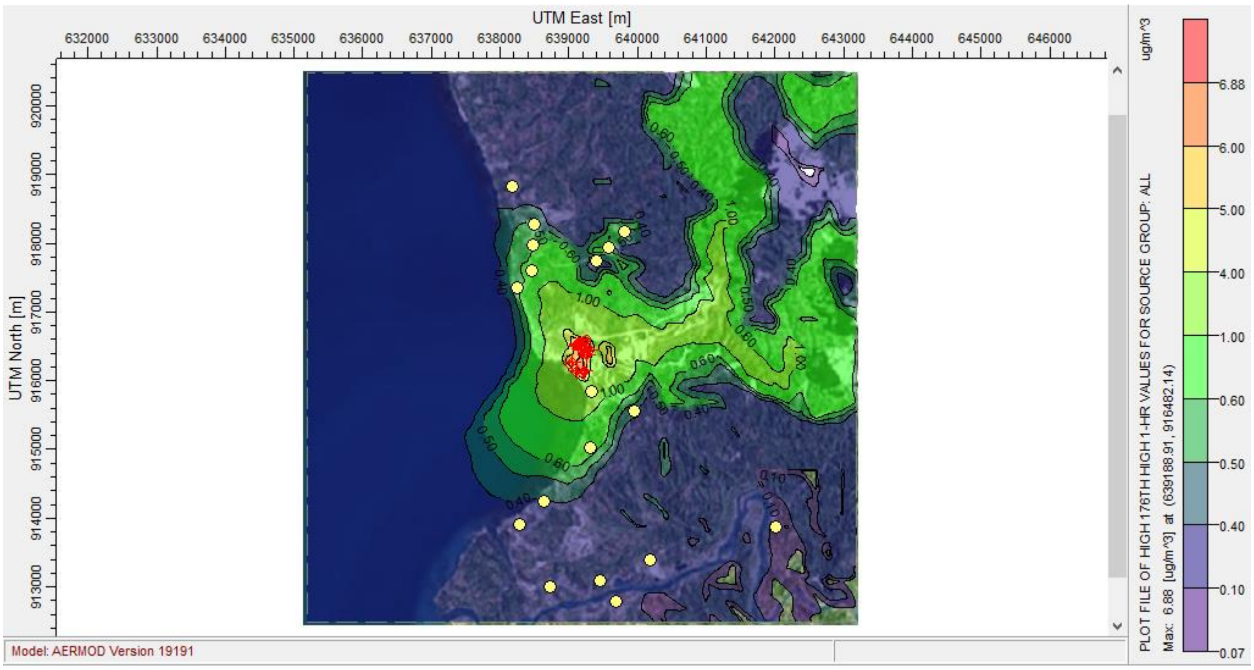


Figure 2.3-94. Predicted Ambient Ground Level TSP Concentration under Controlled Scenario 1 at 1-hr Averaging Time 176th Percentile (with color scale), ug/Ncm

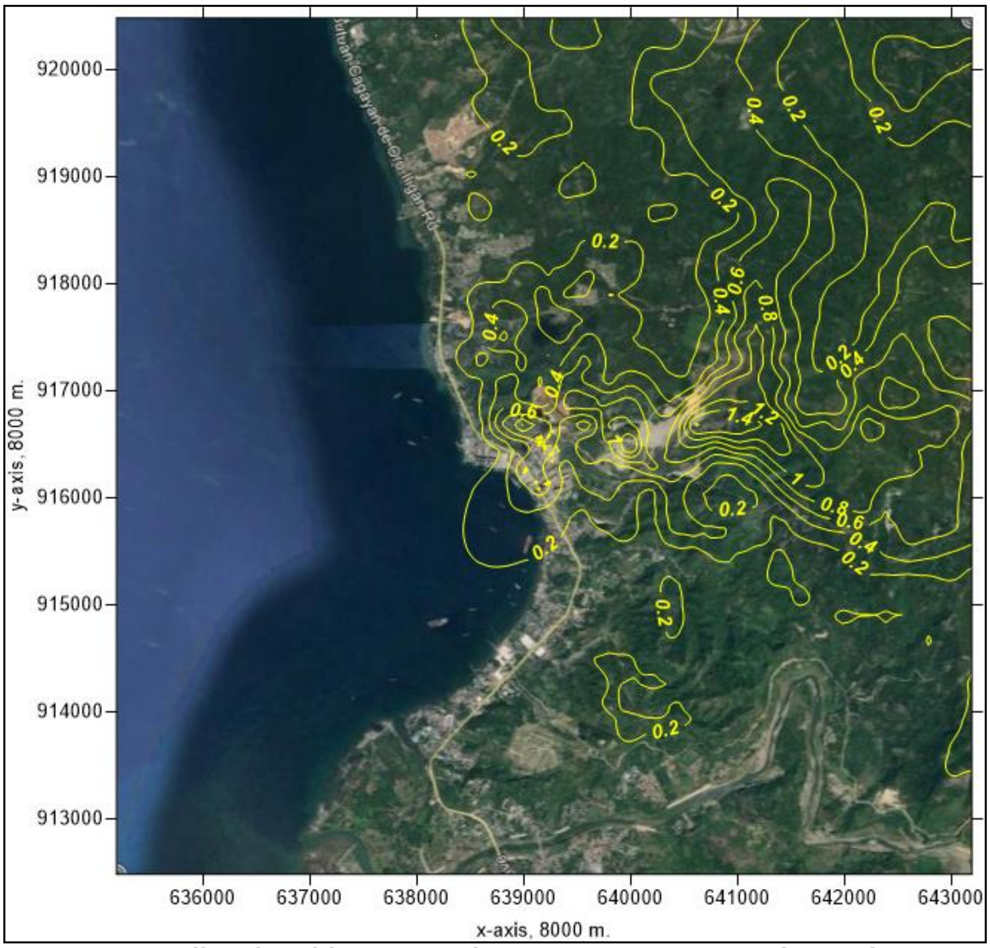


Figure 2.3-95. Predicted Ambient Ground Level PM10 Concentration under Controlled Scenario 1 at 24-hr Averaging Time 98th Percentile, ug/Ncm

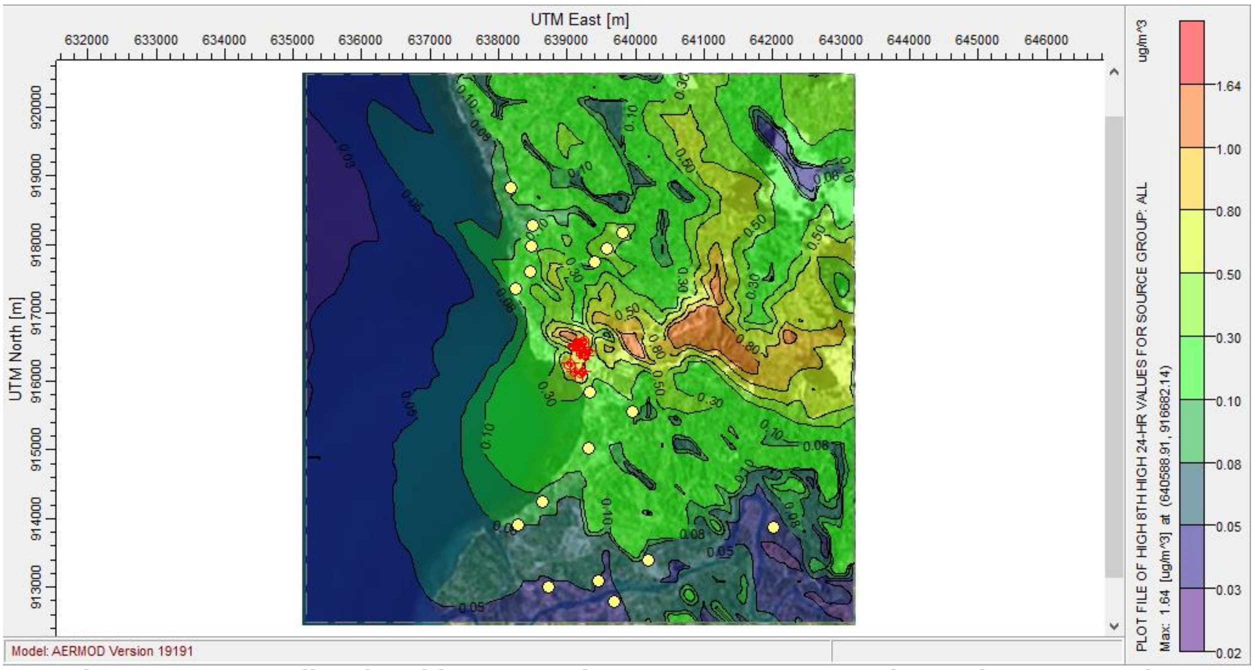


Figure 2.3-96. Predicted Ambient Ground Level PM10 Concentration under Controlled Scenario 1 at 24-hr Averaging Time 98th Percentile (with color scale), ug/Ncm

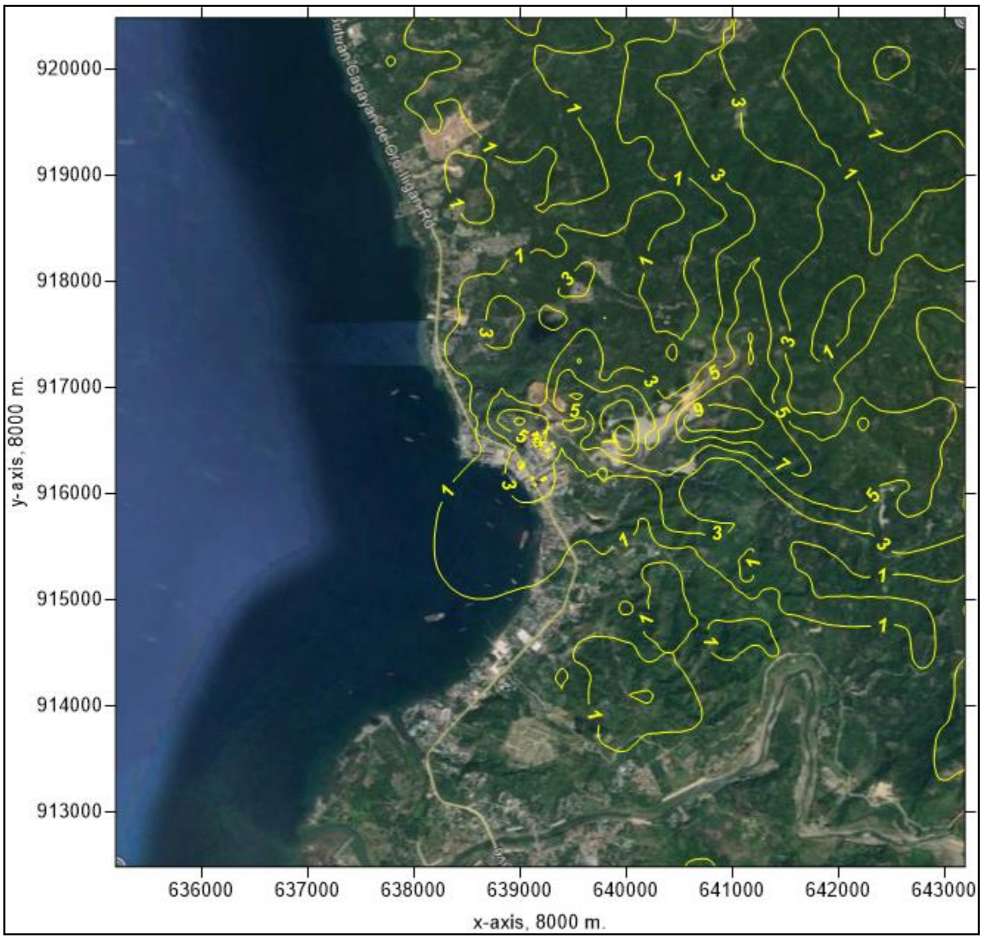


Figure 2.3-97. Predicted Ambient Ground Level PM10 Concentration under Controlled Scenario 2 at 24-hr Averaging Time 98th Percentile, ug/Ncm

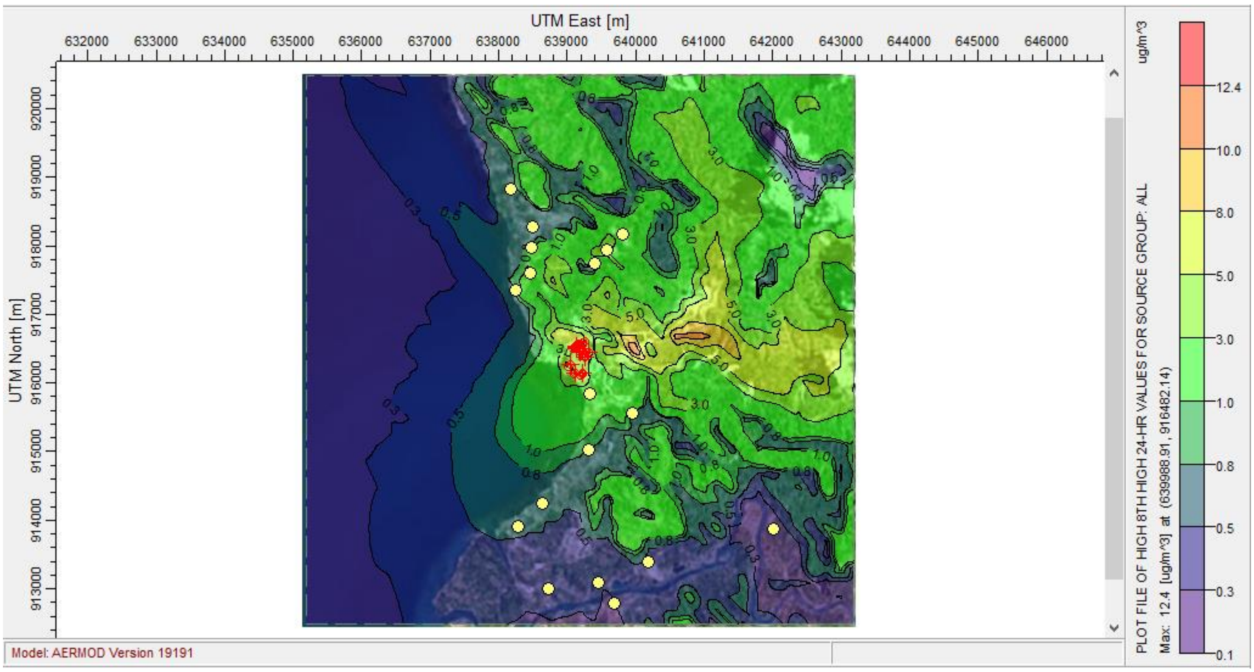


Figure 2.3-98. Predicted Ambient Ground Level PM10 Concentration under Controlled Scenario 2 at 24-hr Averaging Time 98th Percentile (with color scale), ug/Ncm

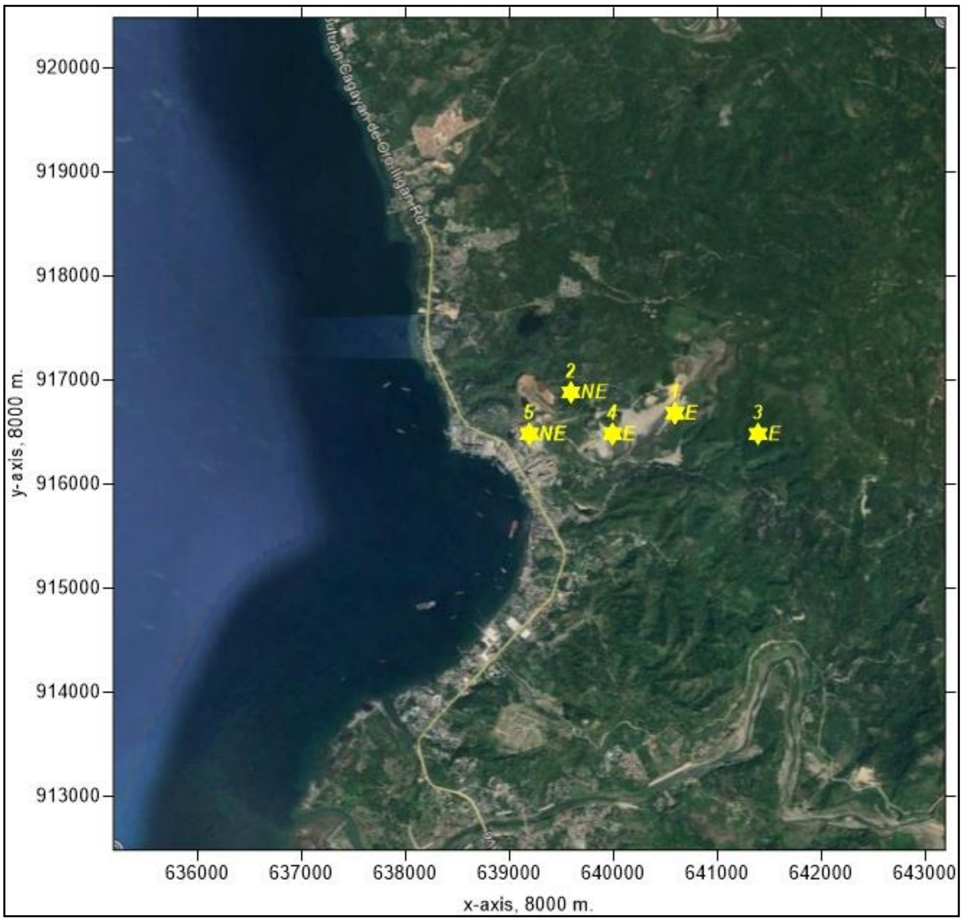


Figure 2.3-99. Predicted Location of Maximum GLC PM10 and TSP Concentration under Controlled Scenario 1 at 1-hr and 24-hr Averaging Time, ug/Ncm

SCENARIO 2 UNCONTROLLED

Figures 2.3-32 to **2.3-48 and Table 2.3-21** to **2.3-22** above are the results of the predicted ambient ground level concentration for criteria pollutants (PM10 and TSP) under scenario 2 uncontrolled condition.

PM10

For scenario 2 uncontrolled 1-Hour PM10 run, peak concentration (1st Rank) is 540.1 ug/Ncm located approximately 565.7 m NE from map domain center. For scenario 2 uncontrolled 24-Hour PM10 run, peak concentration (1st Rank) is 88.0 ug/Ncm located approximately 800 m E from map domain center. For 98 percentile (176th rank) scenario 2 uncontrolled 1-Hour PM10 run, concentration is 20.9 ug/Ncm located approximately 0 m NE from map domain center.

TSP

For scenario 2 uncontrolled 1-Hour TSP run, peak concentration (1st Rank) is 3566.4 ug/Ncm located approximately 565.7 m NE from map domain center. For scenario 2 uncontrolled 24-Hour TSP run, peak concentration (1st Rank) is 584.1 ug/Ncm located approximately 800 m NE from map domain center. For 98 percentile (176th rank) scenario 2 uncontrolled 1-Hour TSP run, concentration is 136.5 ug/Ncm located approximately 0 m NE from map domain center.

SCENARIO 2 CONTROLLED

Figures 2.3-49 to **2.3-65 and Table 2.3-23** to **2.3-24** above are the results of the predicted ambient ground level concentration for criteria pollutants (PM10 and TSP) under scenario 2 uncontrolled condition.

PM10

For scenario 2 controlled 1-Hour PM10 run, peak concentration (1st Rank) is 23.3 ug/Ncm located approximately 1414.2 m E from map domain center. For scenario 2 controlled 24-Hour PM10 run, peak concentration (1st Rank) is 3.9 ug/Ncm located approximately 2200 m E from map domain center. For 98 percentile (176th rank) scenario 2 controlled 1-Hour PM10 run, concentration is 1.0 ug/Ncm located approximately 0 m NE from map domain center.

TSP

For scenario 2 controlled 1-Hour TSP run, peak concentration (1^{st} Rank) is 180 ug/Ncm located approximately 565.7 m NE from map domain center. For scenario 2 controlled 24-Hour TSP run, peak concentration (1^{st} Rank) is 29.3 ug/Ncm located approximately 800 m E from map domain center. For 98 percentile (176^{th} rank) scenario 2 controlled 1-Hour TSP run, concentration is 6.9 ug/Ncm located approximately 0 m NE from map domain center.

SCENARIO 1 UNCONTROLLED

Figures 2.3-58 to **2.3-73 and Table 2.3-17** to **2.3-18** above are the results of the predicted ambient ground level concentration for criteria pollutants (PM10 and TSP) under scenario 1 uncontrolled condition.

PM10

For scenario 1 uncontrolled 1-Hour PM10 run, peak concentration (1^{st} Rank) is 540.1 ug/Ncm located approximately 565.7 m NE from map domain center. For scenario 1 uncontrolled 24-Hour PM10 run, peak concentration (1^{st} Rank) is 88.0 ug/Ncm located approximately 800 m E from map domain center. For 98 percentile (176^{th} rank) scenario 1 uncontrolled 1-Hour PM10 run, concentration is 20.9 ug/Ncm located approximately 0 m NE from map domain center.

TSP

For scenario 1 uncontrolled 1-Hour TSP run, peak concentration (1^{st} Rank) is 3566.4 ug/Ncm located approximately 565.7 m NE from map domain center. For scenario 1 uncontrolled 24-Hour TSP run, peak concentration (1^{st} Rank) is 581.1 ug/Ncm located approximately 800 m NE from map domain center. For 98 percentile (176^{th} rank) scenario 1 uncontrolled 1-Hour TSP run, concentration is 136.5 ug/Ncm located approximately 0 m NE from map domain center.

SCENARIO 1 CONTROLLED

Figures 2.3-75 to **2.3-90 and Table 2.3-19** to **2.3-20** above are the results of the predicted ambient ground level concentration for criteria pollutants (PM10 and TSP) under scenario 1 controlled condition.

PM10

For scenario 1 controlled 1-Hour PM10 run, peak concentration (1^{st} Rank) is 23.3 ug/Ncm located approximately 1414.2 m E from map domain center. For scenario 1 controlled 24-Hour PM10 run, peak concentration (1^{st} Rank) is 3.9 ug/Ncm located approximately 2200 m E from map domain center. For 98 percentile (176^{th} rank) scenario 1 controlled 1-Hour PM10 run, concentration is 1.0 ug/Ncm located approximately 0 m NE from map domain center.

TSP

For scenario 1 controlled 1-Hour TSP run, peak concentration (1st Rank) is 180 ug/Ncm located approximately 565.7 m NE from map domain center. For scenario 1 controlled 24-Hour TSP run, peak concentration (1st Rank) is 29.3 ug/Ncm located approximately 800 m E from map domain center. For 98 percentile (176th rank) scenario 1 controlled 1-Hour TSP run, concentration is 6.9 ug/Ncm located approximately 0 m NE from map domain center.

AREA Sensitive Receptors (ASR) Ground Level CONCENTRATIONS (GLC)

RECEPTORS NEAR PROJECT CEMENT PRODUCTION PLANT

USEPA has defined sensitive receptors as those which include, but are not limited to, hospitals, schools, daycare facilities, elderly housing and convalescent facilities. These are areas where the occupants are more susceptible to the adverse effects of exposure to contaminants such as air pollutants. Extra care must be taken when dealing with contaminants and pollutants in close proximity to areas recognized as sensitive receptors. There were approximately eighteen (18) area sensitive receptors identified surrounding the plant and adjacent boundary. **Tables 2.3-29** to **2.3-32** shows the summary of predicted ambient ground level PM10 and TSP concentration at the ASR's for scenario 2 (uncontrolled and controlled) and scenario 1 (uncontrolled and controlled), respectively. **Figures 2.3-100** to **2.3-115** show the summary of predicted ambient ground level PM10 and TSP concentration at the ASR's for scenario 2 at 1-hr and 24-hr averaging time. **Figure 2.3-116** to **2.3-131** show the summary of predicted ambient ground level PM10 and TSP concentration at the ASR's for scenario 1 at 1-hr and 24-hr averaging time.

Table 2.3-29. Maximum PM10 and TSP under Scenario 2 Uncontrolled Condition in Area Sensitive Receptor

UTM Coordinate		SCENARIO 2								ASR's
		pm10	tsp	pm10	tsp	pm10	tsp	pm10	tsp	
		1hr		24 hr		1hr		24hr		
x	y					176th percentile		8th percentile		
638484.29	917972.28	52.10	336.66	5.14	32.55	1.62	10.57	2.66	16.75	ASR1
638463.32	917592.32	69.82	422.28	7.91	48.62	2.22	14.41	5.53	34.09	ASR2
639406.68	917746.92	124.22	819.96	10.27	67.62	1.08	7.12	4.96	32.72	ASR3
639582.25	917940.84	212.24	1401.25	16.62	109.60	1.71	11.27	10.45	69.02	ASR4
638497.53	918272.33	47.11	294.64	3.84	24.43	1.55	9.88	1.94	12.06	ASR5
638246.53	917353.67	50.17	319.99	5.68	35.95	1.66	10.84	2.69	17.04	ASR6
638180.90	918827.71	29.85	191.48	3.67	23.03	0.87	5.48	1.99	12.77	ASR7
639327.35	915839.98	98.79	627.56	8.13	51.63	4.54	29.01	5.07	31.46	ASR8
639959.64	915555.11	53.22	320.67	3.87	24.49	1.24	8.11	2.48	16.28	ASR9
639306.51	915020.09	55.59	346.45	6.06	37.57	2.08	13.38	2.32	15.09	ASR10
638639.48	914248.84	42.44	265.13	2.81	17.65	1.24	8.09	1.89	12.32	ASR11
638292.07	913908.38	43.05	266.65	3.05	18.83	0.98	6.43	1.68	10.91	ASR12
638729.81	913005.11	25.52	157.35	1.59	9.83	0.68	4.46	1.00	6.51	ASR13
639452.42	913088.49	29.63	183.64	2.82	17.47	0.54	3.54	0.98	6.25	ASR14
639681.71	912796.67	34.40	212.33	3.06	18.85	0.54	3.44	0.97	6.01	ASR15
640181.98	913387.26	26.46	163.14	1.54	9.57	0.51	3.25	1.24	7.90	ASR16
642004.16	913868.11	23.18	138.81	1.64	10.43	0.22	1.41	0.81	4.98	ASR17
639801.99	918167.72	181.82	1200.40	12.36	81.49	1.46	9.65	7.40	48.88	ASR18

Table 2.3-30. Maximum PM10 and TSP under Scenario 2 Controlled Condition in Area Sensitive Receptor

UTM Coordinate		SCENARIO 2								ASR's
		pm10	tsp	pm10	tsp	pm10	tsp	pm10	tsp	
		1hr		24 hr		1hr		24hr		
x	y					176th percentile		8th percentile		
638484.29	917972.28	2.58	17.07	0.25	1.66	0.08	0.53	0.13	0.86	ASR1
638463.32	917592.32	3.54	21.72	0.39	2.50	0.11	0.72	0.27	1.73	ASR2
639406.68	917746.92	5.19	41.38	0.44	3.41	0.05	0.36	0.21	1.65	ASR3
639582.25	917940.84	8.89	70.71	0.71	5.53	0.07	0.57	0.44	3.48	ASR4
638497.53	918272.33	2.27	14.80	0.18	1.23	0.08	0.53	0.10	0.62	ASR5
638246.53	917353.67	2.45	16.16	0.27	1.82	0.08	0.54	0.13	0.86	ASR6
638180.90	918827.71	1.47	9.72	0.18	1.17	0.04	0.30	0.10	0.64	ASR7
639327.35	915839.98	4.72	31.46	0.39	2.59	0.21	1.49	0.24	1.60	ASR8
639959.64	915555.11	2.38	15.90	0.19	1.23	0.06	0.41	0.12	0.81	ASR9
639306.51	915020.09	2.64	17.34	0.29	1.88	0.10	0.67	0.11	0.76	ASR10
638639.48	914248.84	2.05	13.35	0.13	0.89	0.06	0.41	0.09	0.62	ASR11
638292.07	913908.38	2.06	13.40	0.14	0.95	0.05	0.32	0.08	0.55	ASR12
638729.81	913005.11	1.22	7.91	0.08	0.49	0.03	0.22	0.05	0.33	ASR13
639452.42	913088.49	1.42	9.25	0.13	0.88	0.03	0.18	0.05	0.31	ASR14
639681.71	912796.67	1.64	10.68	0.15	0.95	0.03	0.17	0.05	0.30	ASR15
640181.98	913387.26	1.26	8.21	0.07	0.48	0.02	0.17	0.06	0.40	ASR16
642004.16	913868.11	1.08	6.99	0.08	0.53	0.01	0.07	0.04	0.25	ASR17
639801.99	918167.72	7.62	60.57	0.53	4.11	0.06	0.49	0.31	2.47	ASR18

Table 2.3-31. Maximum PM10 and TSP under Scenario 1 Uncontrolled Condition in Area Sensitive Receptor

UTM Coordinate		SCENARIO 1								ASR's
		pm10	tsp	pm10	tsp	pm10	tsp	pm10	tsp	
		1hr		24 hr		1hr		24hr		
x	y					176th percentile		8th percentile		
638484.29	917972.28	52.10	336.65	5.14	32.55	1.62	10.57	2.66	16.75	ASR1
638463.32	917592.32	69.46	422.05	7.89	48.60	2.22	14.41	5.53	34.07	ASR2
639406.68	917746.92	124.22	819.96	10.27	67.62	1.08	7.12	4.96	32.72	ASR3
639582.25	917940.84	212.24	1401.25	16.62	109.60	1.71	11.27	10.45	69.02	ASR4
638497.53	918272.33	47.09	294.61	3.84	24.43	1.55	9.88	1.94	12.05	ASR5
638246.53	917353.67	50.16	319.97	5.68	35.94	1.66	10.84	2.69	17.04	ASR6
638180.90	918827.71	29.85	191.47	3.66	23.03	0.87	5.48	1.99	12.77	ASR7
639327.35	915839.98	98.85	627.56	8.14	51.63	4.55	29.01	5.07	31.45	ASR8
639959.64	915555.11	53.27	320.67	3.86	24.49	1.24	8.11	2.48	16.28	ASR9
639306.51	915020.09	55.59	346.43	6.06	37.57	2.08	13.38	2.32	15.09	ASR10
638639.48	914248.84	42.42	265.10	2.81	17.65	1.24	8.08	1.89	12.32	ASR11
638292.07	913908.38	43.03	266.62	3.05	18.82	0.98	6.43	1.68	10.91	ASR12
638729.81	913005.11	25.51	157.33	1.59	9.82	0.68	4.46	1.00	6.51	ASR13
639452.42	913088.49	29.63	183.63	2.82	17.47	0.54	3.54	0.98	6.24	ASR14
639681.71	912796.67	34.38	212.30	3.06	18.85	0.54	3.44	0.97	6.01	ASR15
640181.98	913387.26	26.45	163.13	1.54	9.57	0.51	3.25	1.24	7.90	ASR16
642004.16	913868.11	23.16	138.77	1.64	10.43	0.22	1.41	0.81	4.98	ASR17
639801.99	918167.72	181.82	1200.40	12.36	81.49	1.46	9.65	7.40	48.88	ASR18

Table 2.3-32. Maximum PM10 and TSP under Scenario 1 Controlled Condition in Area Sensitive Receptor

UTM Coordinate		SCENARIO 1								ASR's
		pm10	tsp	pm10	tsp	pm10	tsp	pm10	tsp	
		1hr		24 hr		1hr		24hr		
x	y					176th percentile		8th percentile		
638484.29	917972.28	2.58	17.07	0.25	1.66	0.08	0.53	0.13	0.85	ASR1
638463.32	917592.32	3.24	21.45	0.37	2.47	0.10	0.72	0.26	1.71	ASR2
639406.68	917746.92	5.19	41.38	0.44	3.41	0.05	0.36	0.21	1.65	ASR3
639582.25	917940.84	8.89	70.71	0.71	5.53	0.07	0.57	0.44	3.48	ASR4
638497.53	918272.33	2.25	14.77	0.18	1.22	0.08	0.53	0.09	0.62	ASR5
638246.53	917353.67	2.45	16.14	0.28	1.82	0.08	0.54	0.13	0.86	ASR6
638180.90	918827.71	1.47	9.72	0.18	1.17	0.04	0.30	0.09	0.64	ASR7
639327.35	915839.98	4.78	31.46	0.39	2.59	0.22	1.49	0.24	1.59	ASR8
639959.64	915555.11	2.43	15.90	0.18	1.23	0.06	0.41	0.12	0.81	ASR9
639306.51	915020.09	2.64	17.33	0.29	1.88	0.09	0.67	0.11	0.76	ASR10
638639.48	914248.84	2.03	13.32	0.13	0.89	0.06	0.40	0.09	0.62	ASR11
638292.07	913908.38	2.04	13.37	0.14	0.95	0.05	0.32	0.08	0.55	ASR12
638729.81	913005.11	1.21	7.90	0.07	0.49	0.03	0.22	0.05	0.33	ASR13
639452.42	913088.49	1.41	9.23	0.13	0.88	0.03	0.18	0.05	0.31	ASR14
639681.71	912796.67	1.62	10.65	0.14	0.95	0.03	0.17	0.05	0.30	ASR15
640181.98	913387.26	1.25	8.19	0.07	0.48	0.02	0.17	0.06	0.40	ASR16
642004.16	913868.11	1.06	6.96	0.08	0.52	0.01	0.07	0.04	0.25	ASR17
639801.99	918167.72	7.62	60.57	0.52	4.11	0.06	0.49	0.31	2.47	ASR18

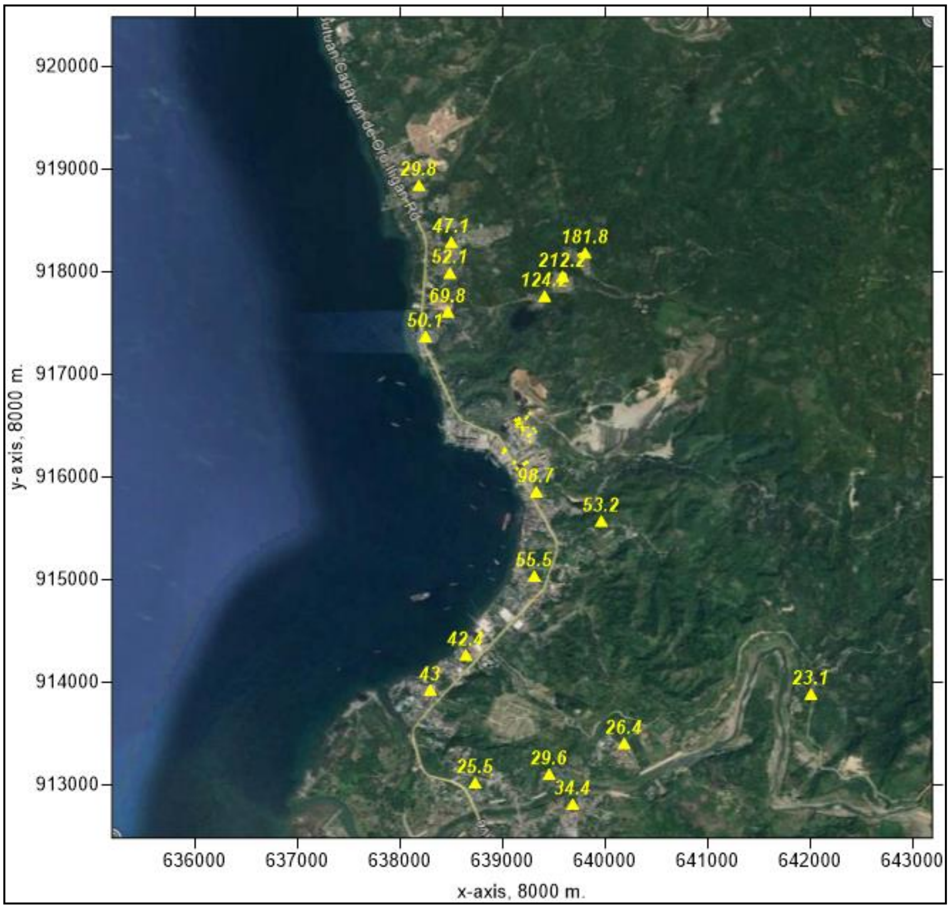


Figure 2.3-100. Predicted Ambient Ground Level PM10 Concentration under Uncontrolled Scenario 2 at 1-hr Averaging Time at ASR, ug/Ncm

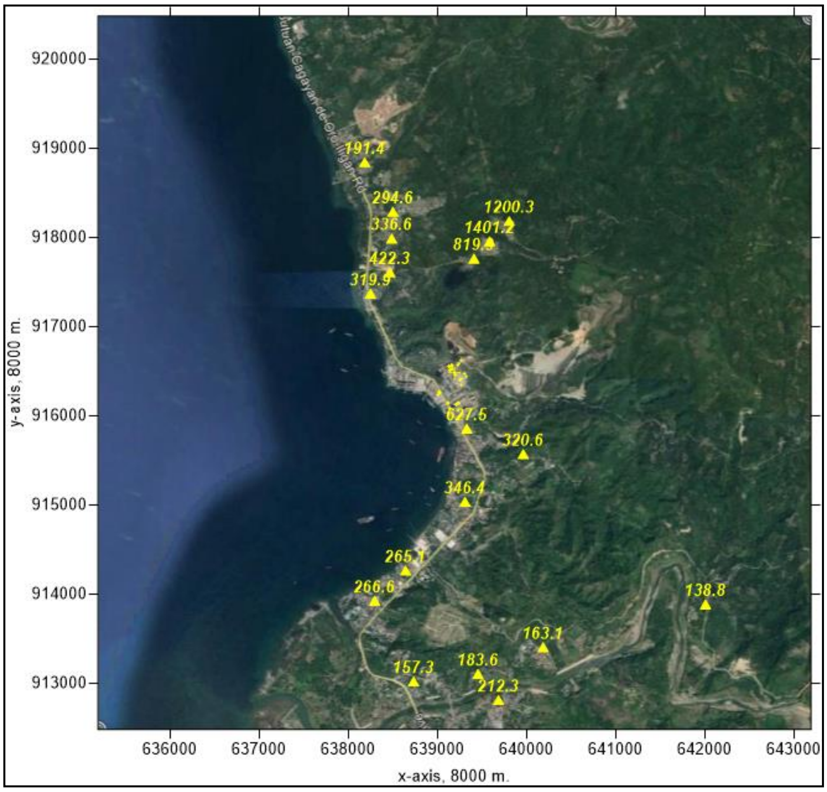


Figure 2.3-101. **Predicted Ambient Ground Level TSP Concentration under Uncontrolled Scenario 2 at 1-hr Averaging Time at ASR, ug/Ncm**

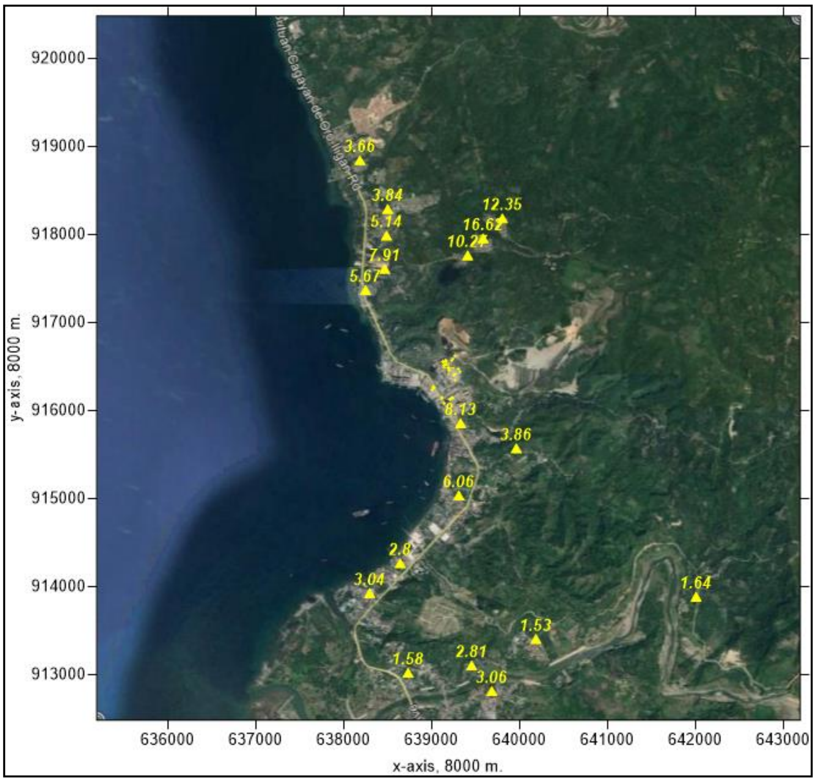


Figure 2.3-102. **Predicted Ambient Ground Level PM10 Concentration under Uncontrolled Scenario 2 at 24-hr Averaging Time at ASR, ug/Ncm**

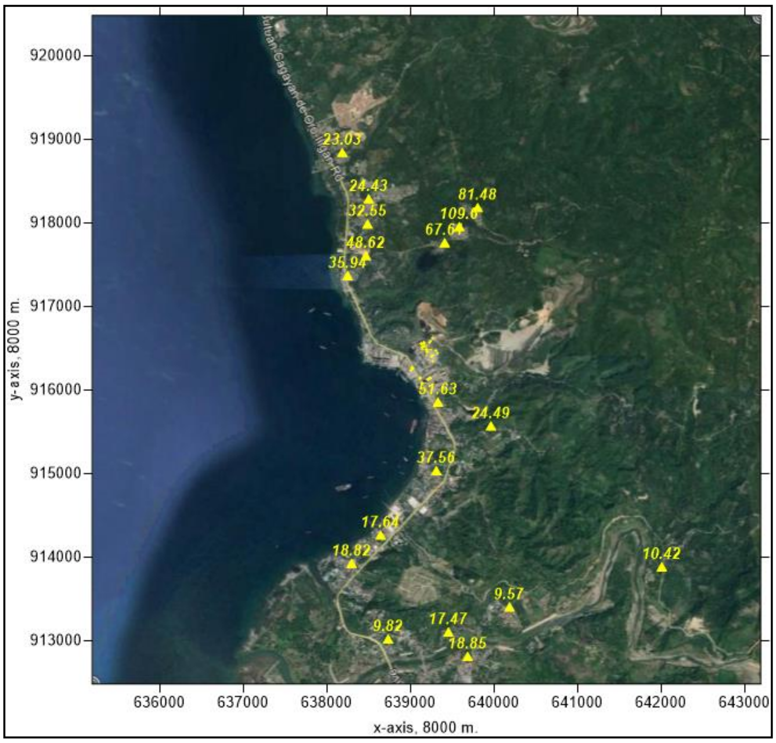


Figure 2.3-103. Predicted Ambient Ground Level TSP Concentration under Uncontrolled Scenario 2 at 24-hr Averaging Time at ASR, ug/Ncm

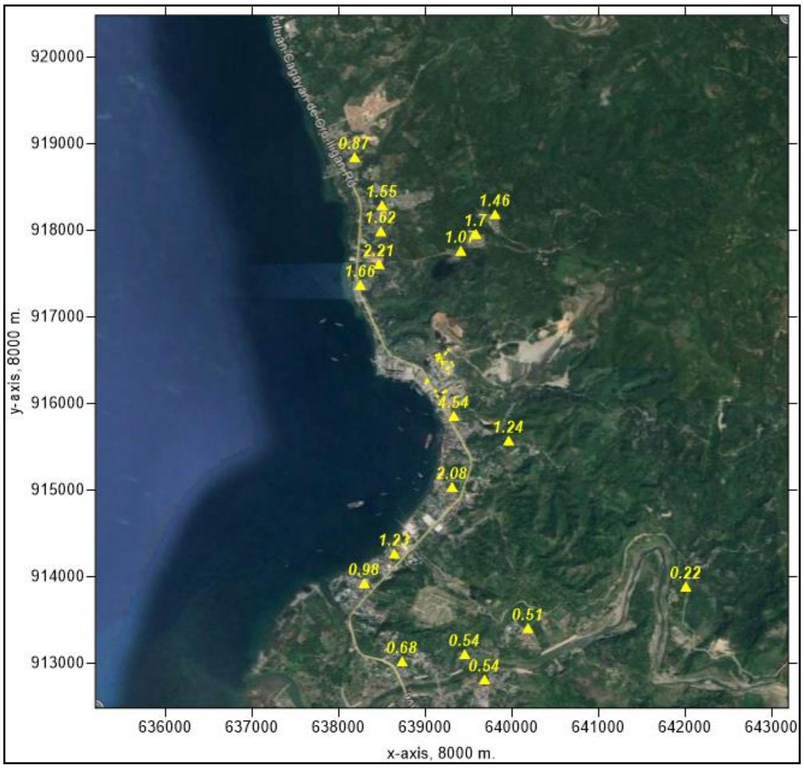


Figure 2.3-104. Predicted Ambient Ground Level PM10 Concentration under Uncontrolled Scenario 2 at 1-hr Averaging Time at ASR (176th percentile), ug/Ncm

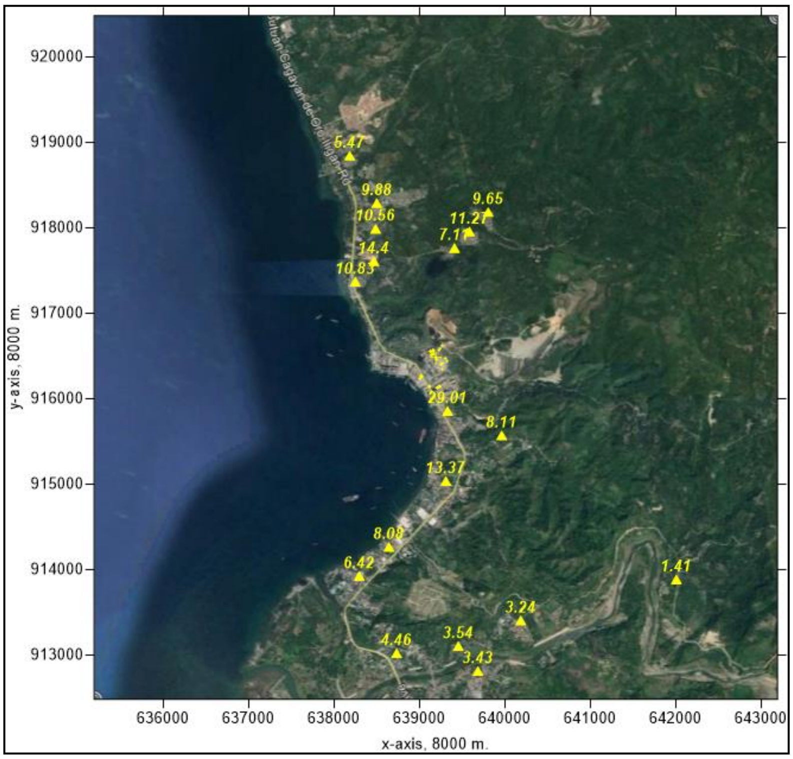


Figure 2.3-105. **Predicted Ambient Ground Level TSP Concentration under Uncontrolled Scenario 2 at 1-hr Averaging Time at ASR (176th percentile), ug/Ncm**

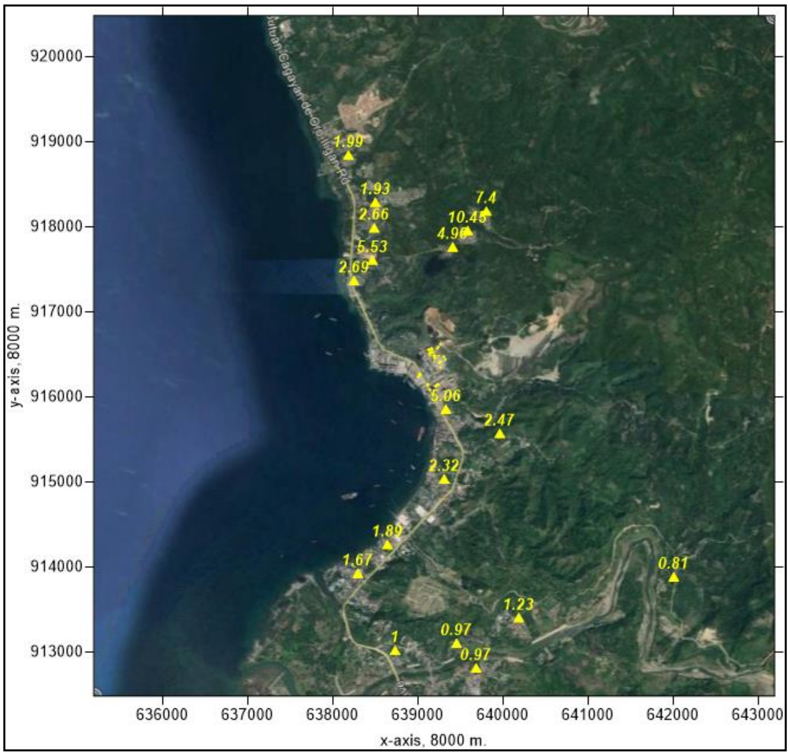


Figure 2.3-106. **Predicted Ambient Ground Level PM10 Concentration under Uncontrolled Scenario 2 at 24-hr Averaging Time at ASR (98th percentile), ug/Ncm**

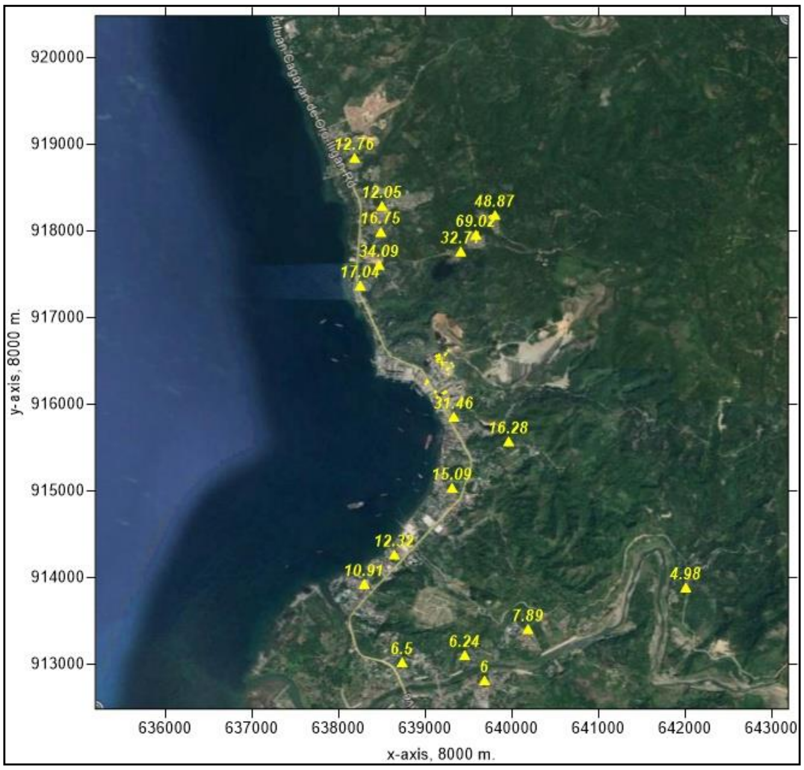


Figure 2.3-107. **Predicted Ambient Ground Level TSP Concentration under Uncontrolled Scenario 2 at 24-hr Averaging Time at ASR (98th percentile), ug/Ncm**

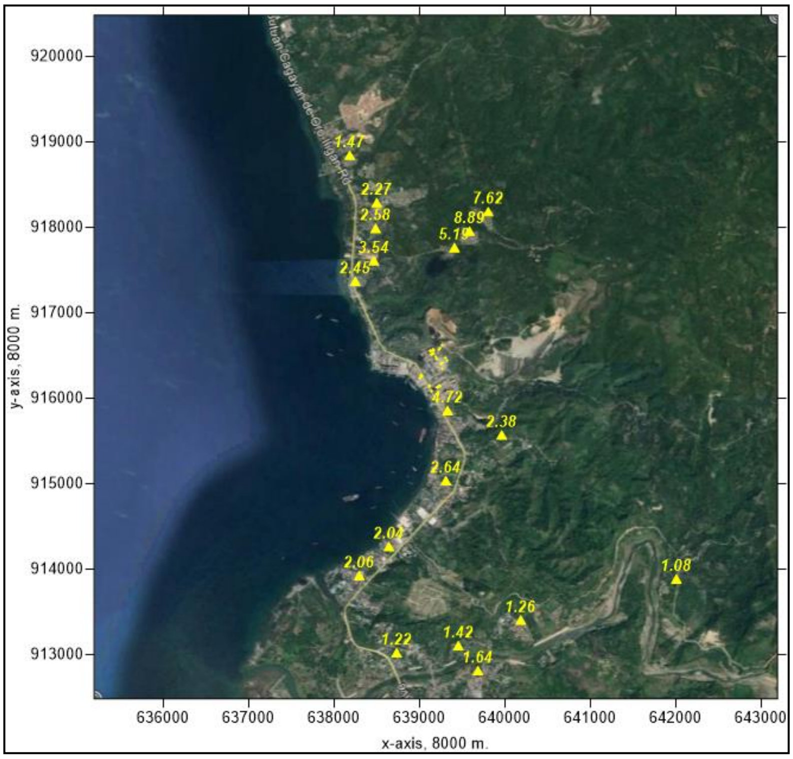


Figure 2.3-108. **Predicted Ambient Ground Level PM10 Concentration under Controlled Scenario 2 at 1-hr Averaging Time at ASR, ug/Ncm**

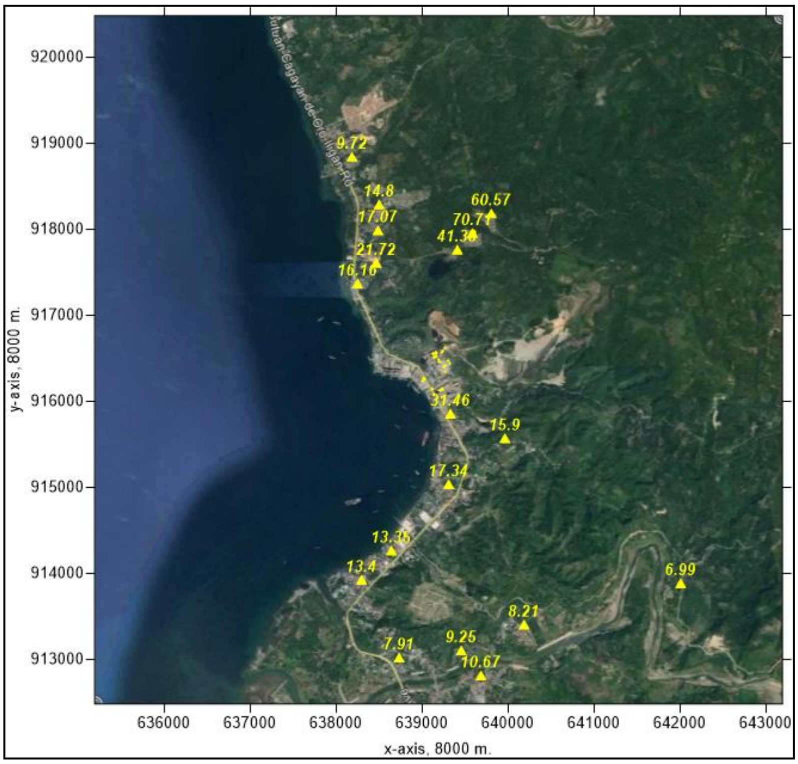


Figure 2.3-109. **Predicted Ambient Ground Level TSP Concentration under Controlled Scenario 2 at 1-hr Averaging Time at ASR, ug/Ncm**

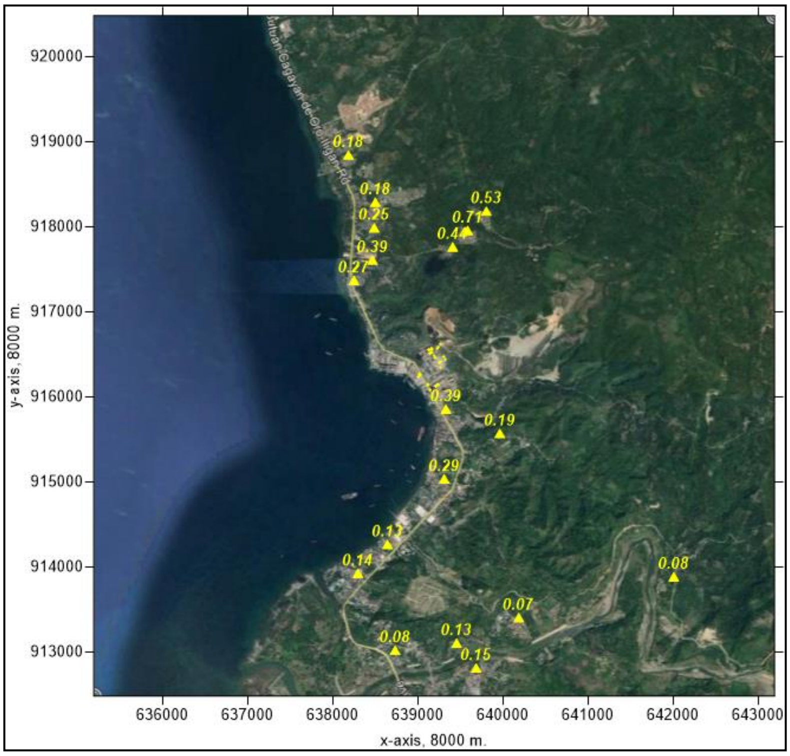


Figure 2.3-110. **Predicted Ambient Ground Level PM10 Concentration under Controlled Scenario 2 at 24-hr Averaging Time at ASR, ug/Ncm**

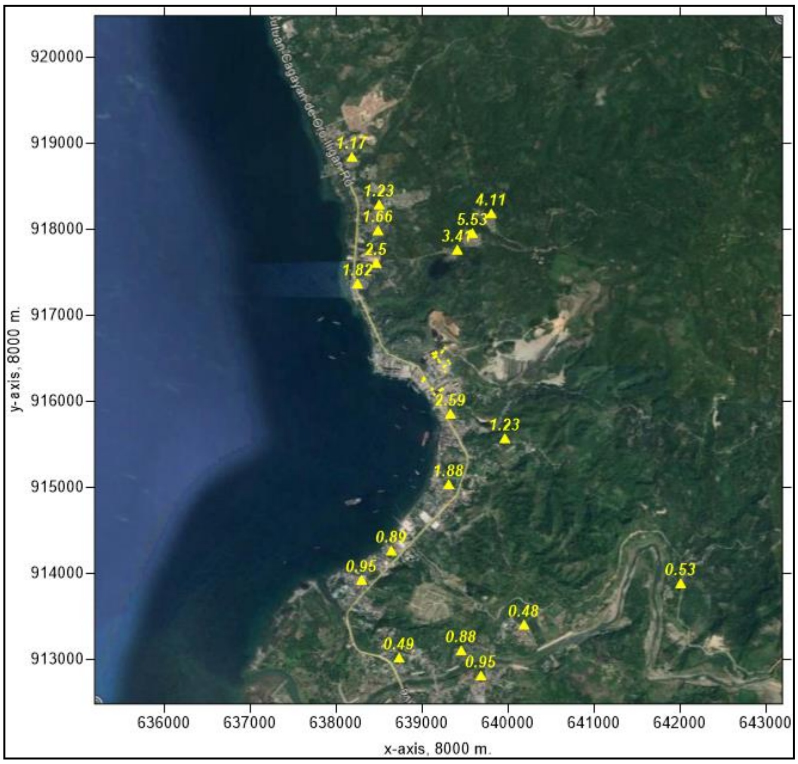


Figure 2.3-111. **Predicted Ambient Ground Level TSP Concentration under Controlled Scenario 2 at 24-hr Averaging Time at ASR, ug/Ncm**

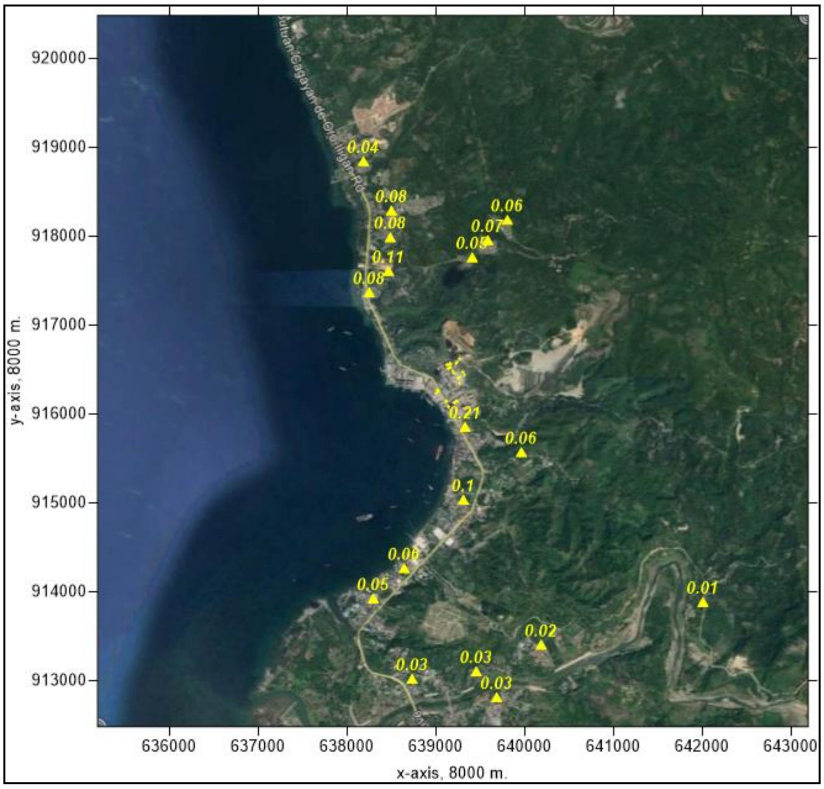


Figure 2.3-112. **Predicted Ambient Ground Level PM10 Concentration under Controlled Scenario 2 at 1-hr Averaging Time at ASR (176th percentile), ug/Ncm**

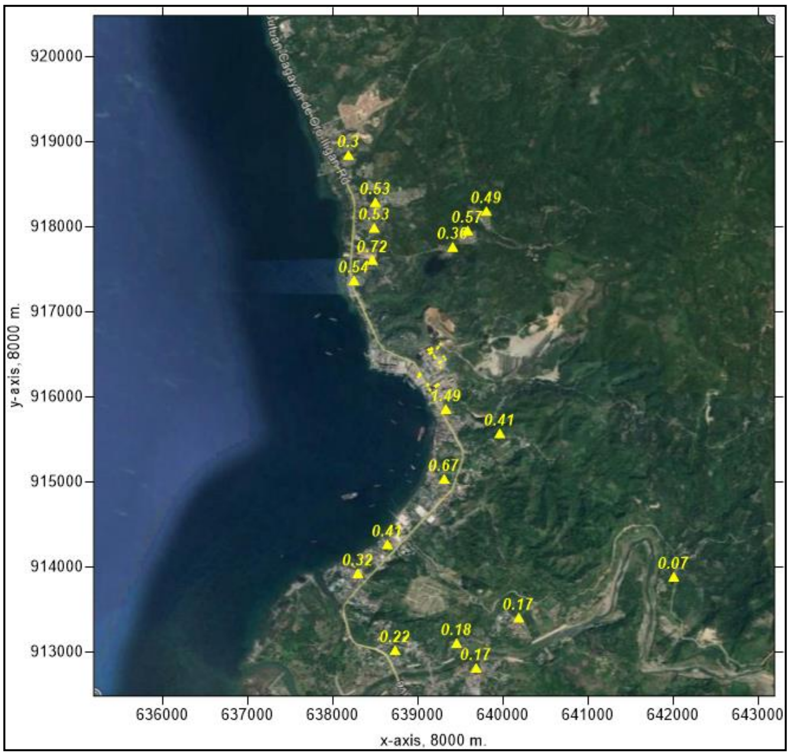


Figure 2.3-113. Predicted Ambient Ground Level TSP Concentration under Controlled Scenario 2 at 1-hr Averaging Time at ASR (176th percentile), ug/Ncm

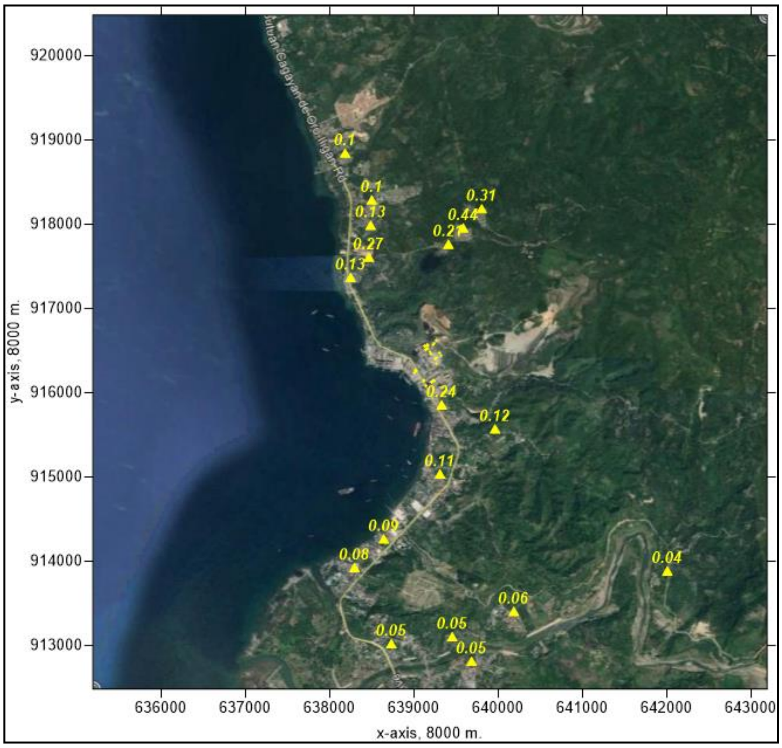


Figure 2.3-114. Predicted Ambient Ground Level PM10 Concentration under Controlled Scenario 2 at 24-hr Averaging Time at ASR (98th percentile), ug/Ncm

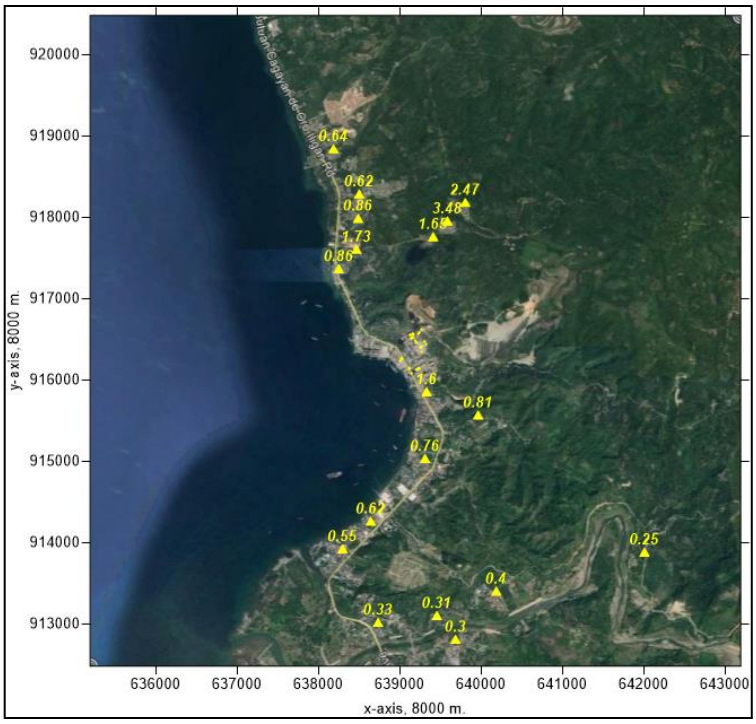


Figure 2.3-115. Predicted Ambient Ground Level TSP Concentration under Controlled Scenario 2 at 24-hr Averaging Time at ASR (98th percentile), ug/Ncm

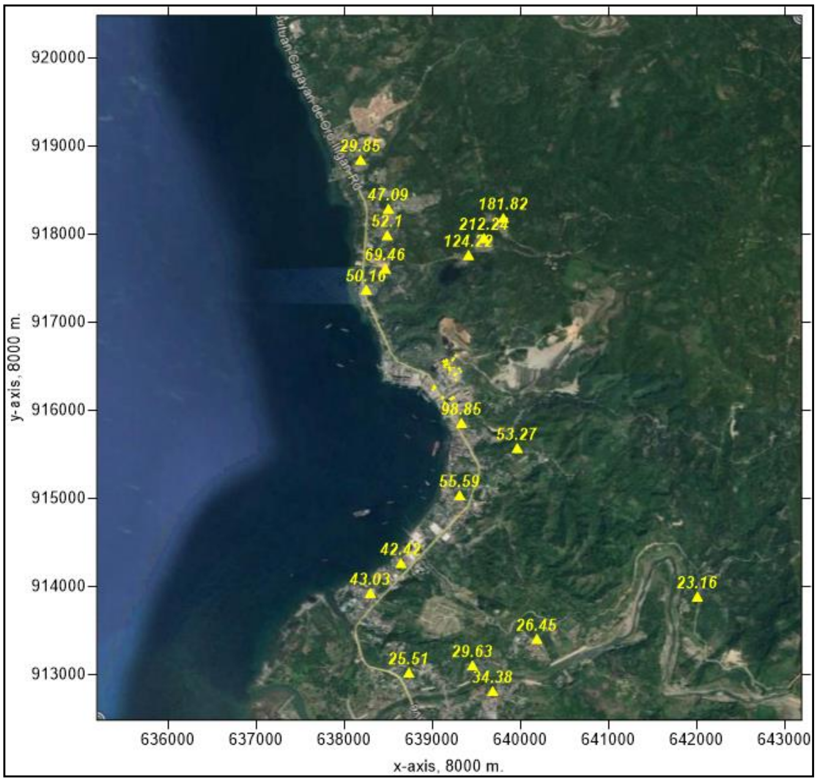


Figure 2.3-116. Predicted Ambient Ground Level PM10 Concentration under Uncontrolled Scenario 1 at 1-hr Averaging Time at ASR, ug/Ncm

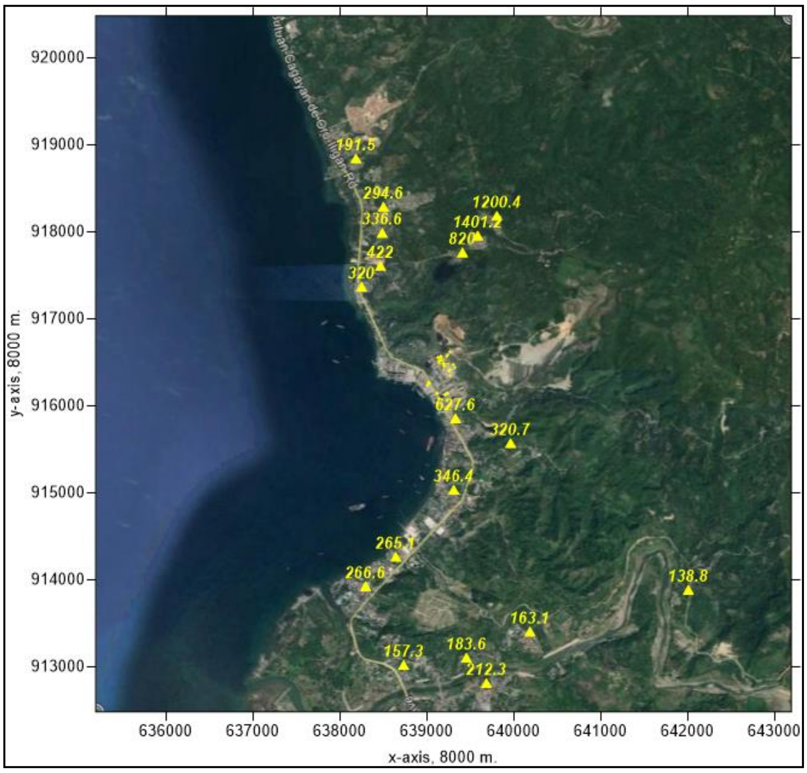


Figure 2.3-117. Predicted Ambient Ground Level TSP Concentration under Uncontrolled Scenario 1 at 1-hr Averaging Time at ASR, ug/Ncm

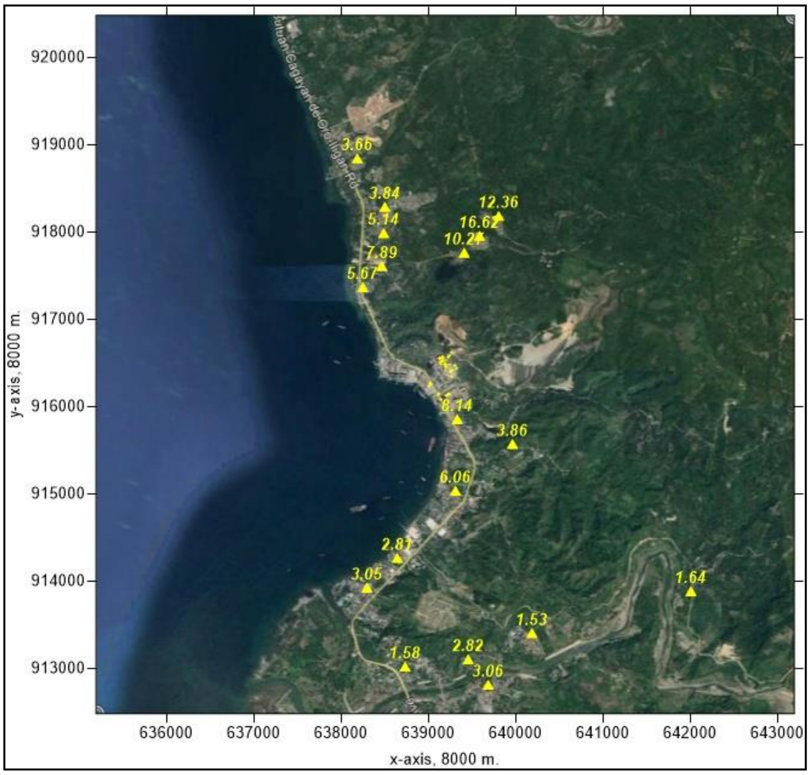


Figure 2.3-118. Predicted Ambient Ground Level PM10 Concentration under Uncontrolled Scenario 1 at 24-hr Averaging Time at ASR, ug/Ncm

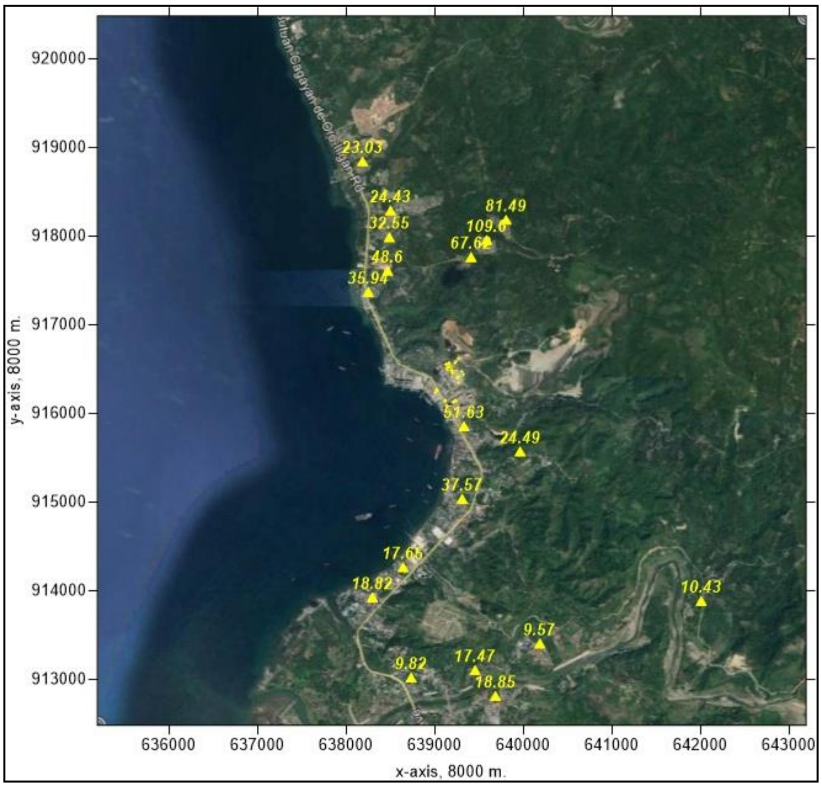


Figure 2.3-119. Predicted Ambient Ground Level TSP Concentration under Uncontrolled Scenario 1 at 24-hr Averaging Time at ASR, ug/Ncm

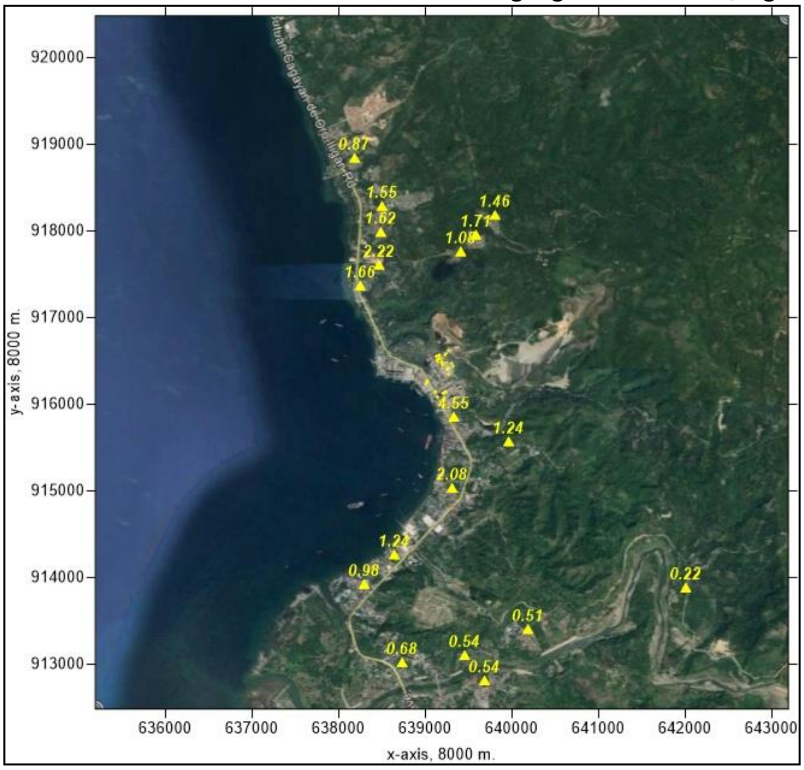


Figure 2.3-120. Predicted Ambient Ground Level PM10 Concentration under Uncontrolled Scenario 1 at 1-hr Averaging Time at ASR (176th percentile), ug/Ncm

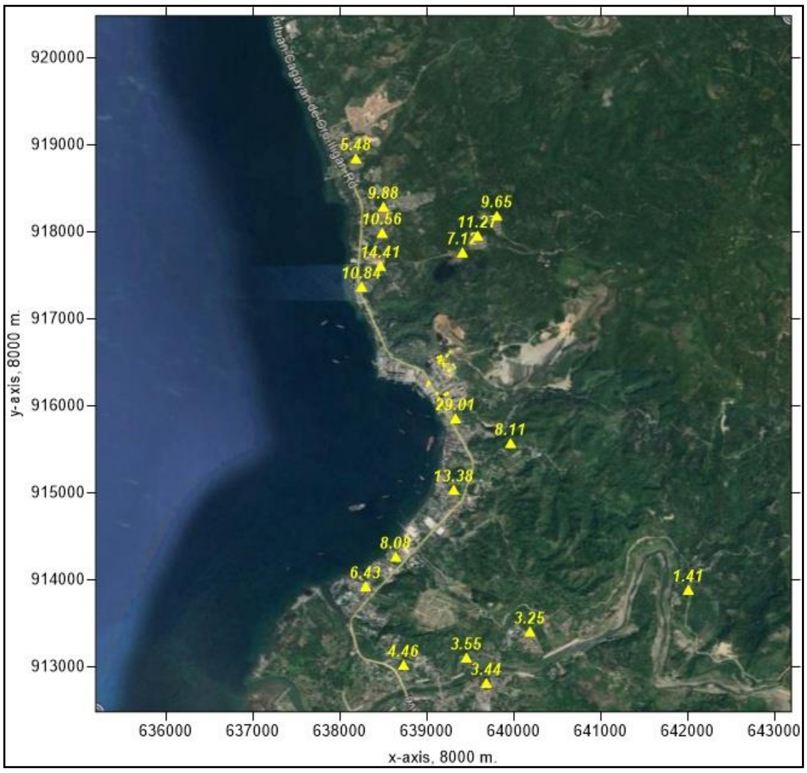


Figure 2.3-121. Predicted Ambient Ground Level TSP Concentration under Uncontrolled Scenario 1 at 1-hr Averaging Time at ASR (176th percentile), ug/Ncm

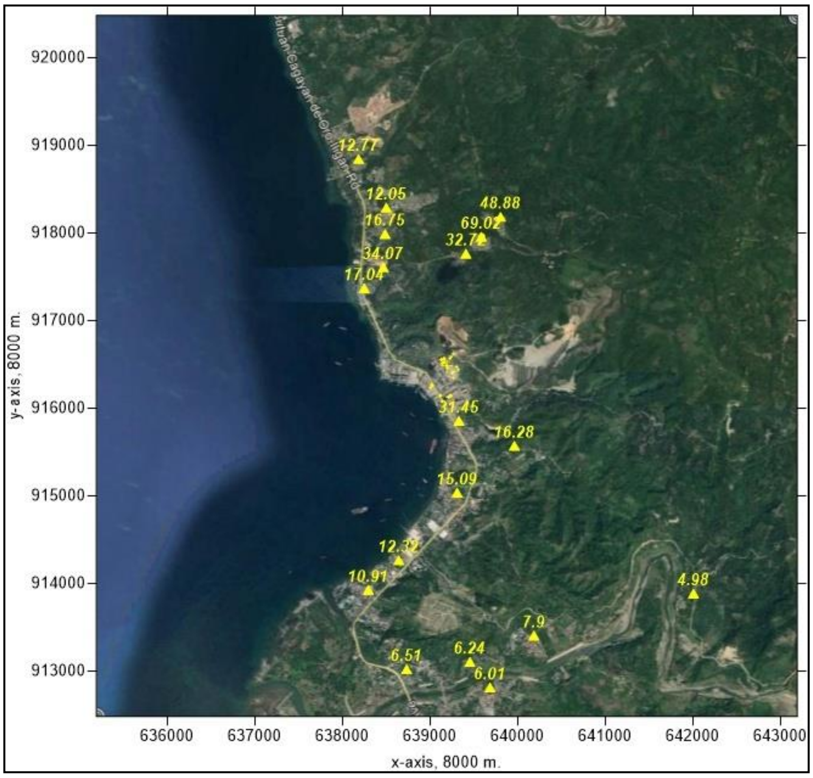


Figure 2.3-122. Predicted Ambient Ground Level PM10 Concentration under Uncontrolled Scenario 1 at 24-hr Averaging Time at ASR (98th percentile), ug/Ncm

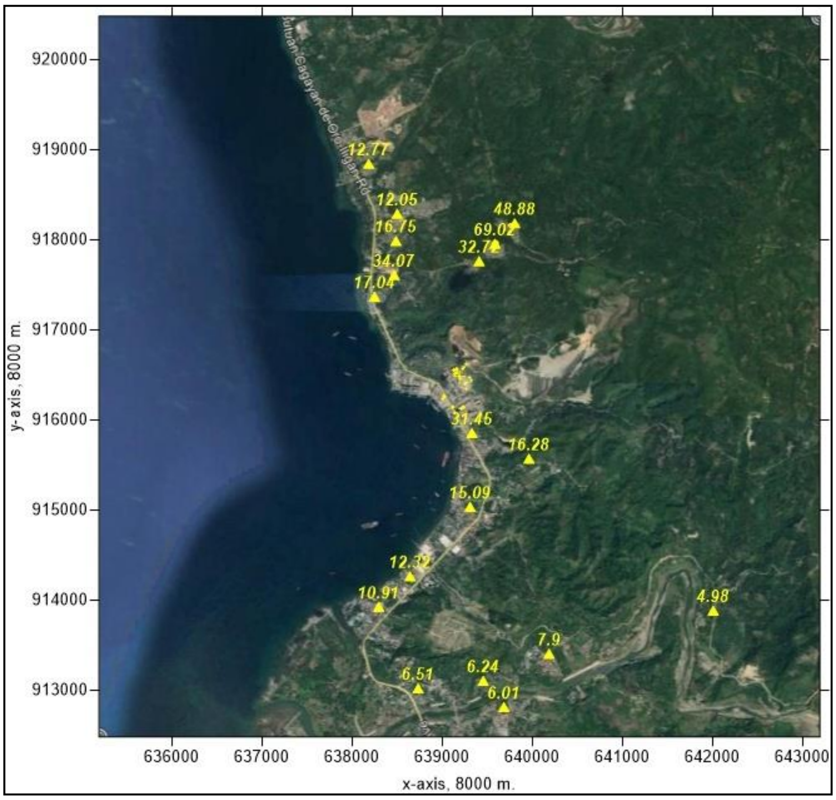


Figure 2.3-123. Predicted Ambient Ground Level TSP Concentration under Uncontrolled Scenario 1 at 24-hr Averaging Time at ASR (98th percentile), ug/Ncm

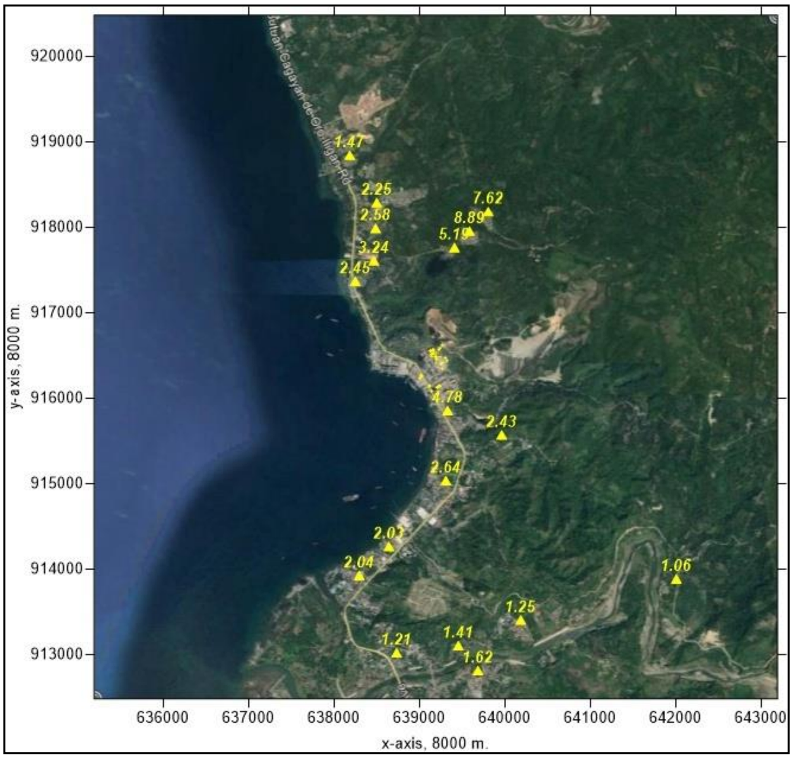


Figure 2.3-124. Predicted Ambient Ground Level PM10 Concentration under Controlled Scenario 1 at 1-hr Averaging Time at ASR, ug/Ncm

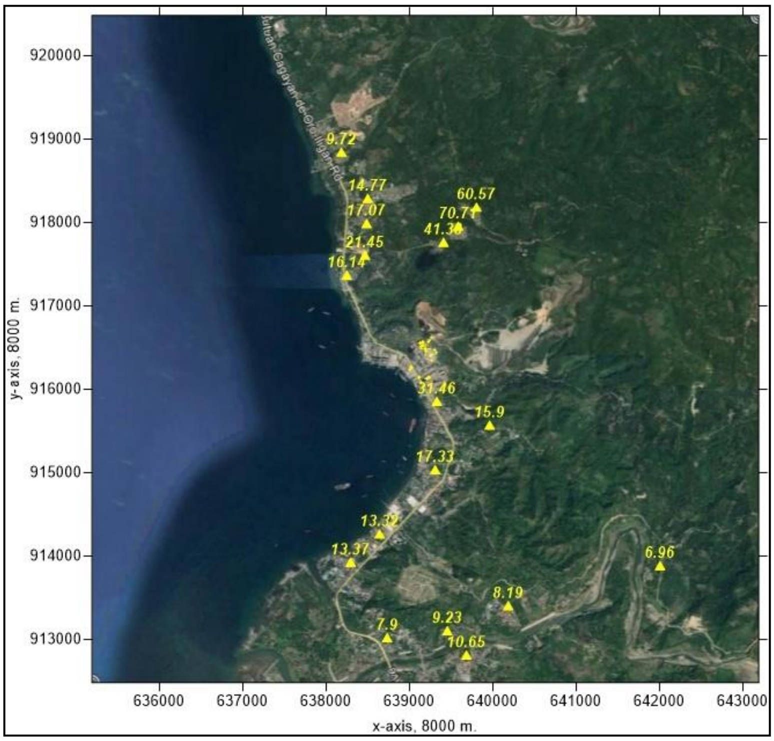


Figure 2.3-125. **Predicted Ambient Ground Level TSP Concentration under Controlled Scenario 1 at 1-hr Averaging Time at ASR, ug/Ncm**

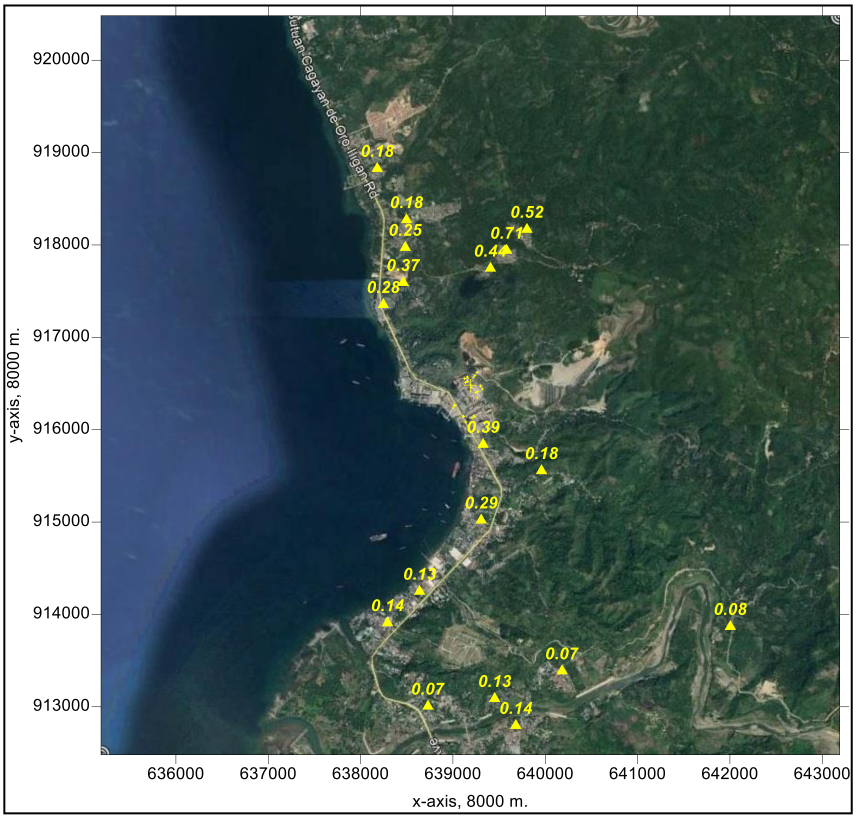


Figure 2.3-126. **Predicted Ambient Ground Level PM10 Concentration under Controlled Scenario 1 at 24-hr Averaging Time at ASR, ug/Ncm**

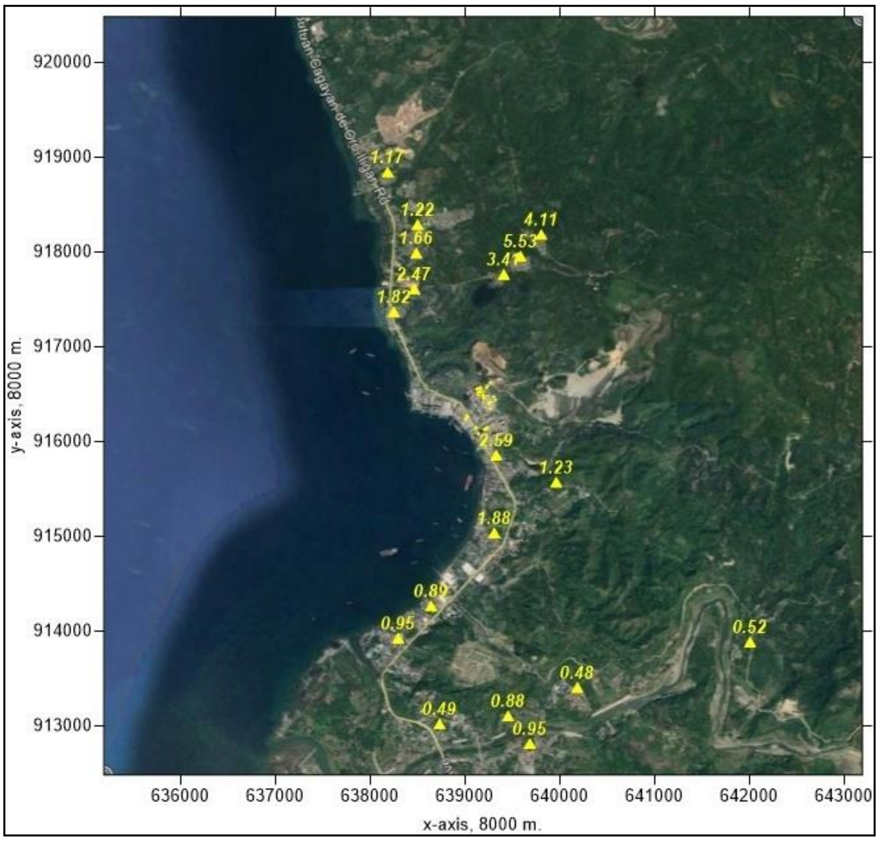


Figure 2.3-127. **Predicted Ambient Ground Level TSP Concentration under Controlled Scenario 1 at 24-hr Averaging Time at ASR, ug/Ncm**

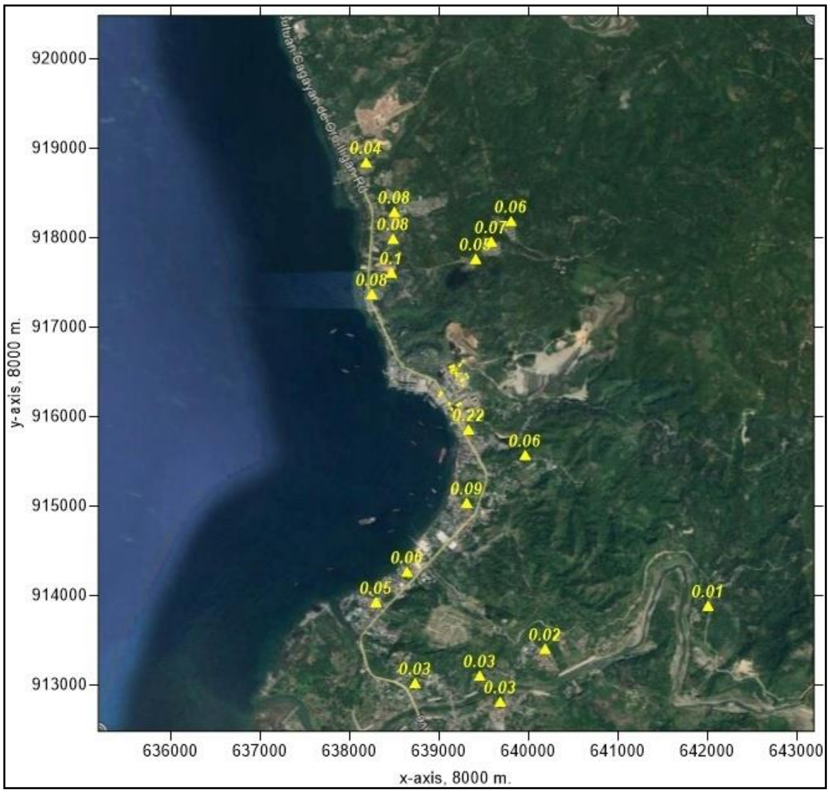


Figure 2.3-128. **Predicted Ambient Ground Level PM10 Concentration under Controlled Scenario 1 at 1-hr Averaging Time at ASR (176th percentile), ug/Ncm**

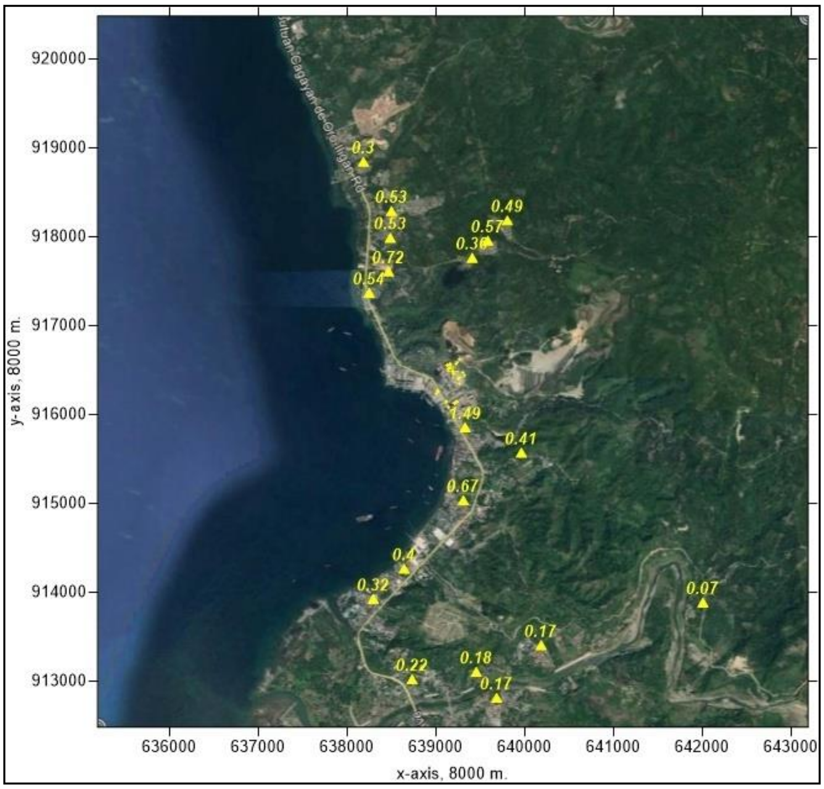


Figure 2.3-129. Predicted Ambient Ground Level TSP Concentration under Controlled Scenario 1 at 1-hr Averaging Time at ASR (176th percentile), ug/Ncm

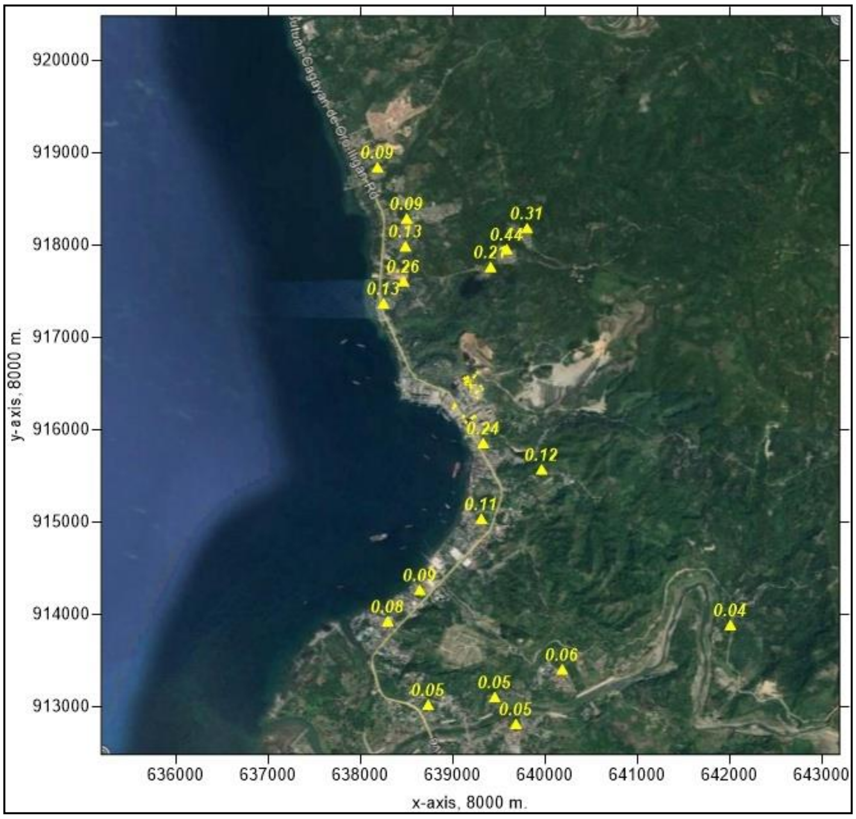


Figure 2.3-130. Predicted Ambient Ground Level PM10 Concentration under Controlled Scenario 1 at 24-hr Averaging Time at ASR (98th percentile), ug/Ncm

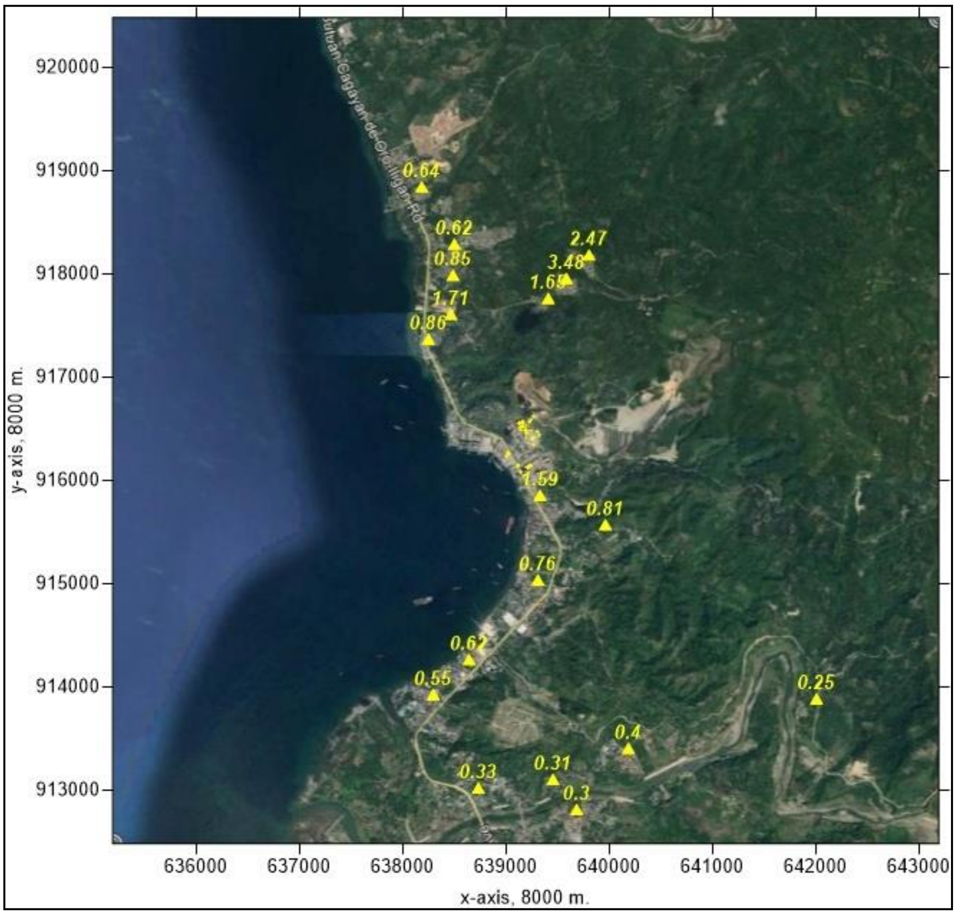


Figure 2.3-131. Predicted Ambient Ground Level TSP Concentration under Controlled Scenario 1 at 24-hr Averaging Time at ASR (98th percentile), ug/Ncm

Based on the above results, the highest predicted ground level concentrations (GLC) in Area Sensitive Receptors (ASRs) for PM10 are in compliance with the National Ambient Air Quality Guideline Values and National Ambient Air Quality Standards for Source Specific Air Pollutants for scenario 2 (uncontrolled and controlled condition) and 2 (uncontrolled and controlled condition). Except for Scenario 2 and 1 (uncontrolled condition) for Total Suspended Particulates (TSP) in some ASRs for 1 hour, are above the standards. All other gaseous air pollutants in all ASRs are below the ambient air quality standards and guideline values. See tables above for the summary of peak predicted values in Area sensitive receptor location.

2.3.3.4.1 General Findings and Recommendations

General results for the controlled TSP and PM-10 emission in the dispersion model run for 1 hour and 24 hour averaging time are below the ambient air quality standards guideline values under the Implementing Rules and Regulations (DAO 200-81) of the Philippine Clean Air Act (RA8749). For gaseous air pollutants, results are below the following standards and guideline values: (1) TSP- 300 ug/Ncm(1 hr) ; PM-10- 200 ug/Ncm (1 hr) and 230 ug/Ncm (24 hours) ; , 150 ug/Ncm (24hour) National Air Quality guideline Values for (24 Hours); ; (3) NOx :260ug/Ncm (1 Hour) , 150 ug/Ncm (24hour). Uncontrolled scenario depicts worst case situation when the ESP is not working well. Validation of the dispersion model run by way of actual ambient air quality sampling may bias high in low moisture season due to contribution of other sources such as Area, Mobile and Volume sources.

Result of the uncontrolled scenario in the dispersion model run shows exceedance of TSP at 1-hr averaging time from the National Ambient Air Quality Standards for Source Specific Air Pollutants from Industrial Sources/Operations (NAAQSSSAP) only. Proper maintenance of control facilities such as electro static precipitators (ESP) and baghouse filters is recommended. Likewise, water sprinkling in the cement facilities is recommended to prevent resuspension of fugitive dusts.

With respect to fugitive dusts management and mitigation, although the project site is distant from the populated area control measures will be adopted including the areas outside the facility especially the quarry area. These include the periodic watering of roads thus minimizing generation and resuspension of dust particles. This will involve the use of dedicated water tank trucks.

Planting of vegetation/tree cover as embodied in the NGP will enhance the green buffer zone .and control dust resuspension. Trucks carrying ores will be covered with tarpaulin. Enforcement of speed limits to reduce airborne fugitive dust from the vehicular traffic

Other cleaner production measures are also recommended. Installation of portable met station at the plant is recommended to monitor actual site meteorological data.

Other Mitigating Measures for Management of Air Pollutants

- Immediate filling of the low-lying areas with the topsoil so that the excavated earth will not create fugitive dust dispersal if this were instead to be stockpiled for long periods.
- Dust bag house controlled system is critical in the cement finish milling operation. High ground level concentrations are were controlled using baghouse filter control facility for (1) 1 Unit 130 MT/hr Kiln; (2) 200 MT/hr Dryer; (3) 102 MT/hr clinker cooler; (4) Coal Mill; (5) 2 Units 80 MT/hr Finishing Mill resulting to compliance of TSP, pm10, pm 2.5 ambient concentration for 1 hr and 24hr averaging time under the clean air act standards. Actual ambient air quality monitoring may increase due to contribution from background sources such as mobile, area and other sources.
- Ground level concentrations, both highest and 98th percentile values for uncontrolled without the bag house filter control facility for (1) 1 Unit 130 MT/hr Kiln; (2) 200 MT/hr Dryer; (3) 102 MT/hr clinker cooler; (4) Coal Mill; (5) 2 Units 80 MT/hr Finishing Mill resulting to compliance of TSP, PM10, PM 2.5 ambient concentration for 1hr and 24 hr averaging time under the clean air act standards. Actual ambient air quality monitoring may increase due to contribution from background success such as mobile, area and other sources.
- The PM-10 and PM-2.5 is still within the ambient 1hr standards considering the approximate apportionment to total suspended particulates (TSP) ate 15% and 11% respectively based on USEPA Emission Factors.
- Evaluation of predicted concentrations with regards to geographical location are primary zone direct impact area to indirect area from 50 to 2500 m WNW and ESE from the site. Area sensitive receptors (ARS) are mostly residential areas.

2.3.3.4.2 Recommendations Arising from the Results of the Air Dispersion Modelling (Including those already cited above)

Result of the **uncontrolled** scenario in the dispersion model run shows exceedance of TSP at 1-hr averaging time from the National Ambient Air Quality Standards for Source Specific Air Pollutants from Industrial Sources/Operations (NAAQSSSAP) only. However, this is not deemed to be a major concern because, the operations may be immediately and temporarily suspended until normal return to operations. Proper maintenance of control facilities such as electro static precipitators (ESP) and baghouse filters is recommended. Likewise, water sprinkling in the cement facilities is recommended to prevent resuspension of fugitive dusts. **Annex 2.3.5** provides the maintenance program.

Control measures outside the facility especially the quarry area is recommended such as periodic watering of roads, minimizing generation and resuspension of dust particles. Area source dust abatement such as water sprinkling and planting vegetations as green buffer zone in the cement manufacturing operation is also recommended to control dust resuspension. Other cleaner production measures are also recommended. Installation of portable met station at the plant is recommended to monitor actual site meteorological data.

Cement Manufacturing equipment should be regularly maintained while structure of the stack, ducts, silo conveyors and hoppers should be regularly checked to avoid particulate build up causing fugitive dust and particulate accumulation. Alternative fuel and raw materials (AFR's) should be characterized properly to avoid emission of unwanted hazardous metals and other pollutants. Coal fuels should also be dried to eliminate moisture to eliminate precursor to incomplete combustion which is among major contributors to particulate matter(PM) formation and Carbon Monoxide (CO). Control devise such as bag house filters are recommended for regular checkup and maintenance.

Other control measures outside the facility are also recommended which include, periodic watering of roads for minimizing generation and suspension of dust particles. Forestation and planting in perimeter buffer areas are other effective controls. These areas will be protected by the vegetation walls from dispersion of air pollutants.

Other cleaner production measures are recommended sequestration program, dust and gaseous control, vegetation, etc.

The sequestration program will be integrated in a Carbon Sink program **(Discussed in Annex 2.3.3)** that the DENR is expected to more actively pursue in the light of its Climate Change initiatives.

It is noted significantly that the Permits to Operate ({PTOs) will be the ultimate determinant of compliances to air quality standards. Air Dispersion Modeling (ADM) and the EPRMP report are most useful planning and predictive tools but it will be the PTOs that will give the EMB/DENR the final basis for allowing (or disallowing) the continued operation of the APSEs and the APCDs.

Recommended ambient monitoring sites particularly for TSP, NOx and SO_2 and other required parameters are those identified Area Sensitive Receptor (ASRs) and Hot Spot Areas near the quarry area. **Figure 2.3-132** shows the identified locations of ASRs and hot spots (HP).

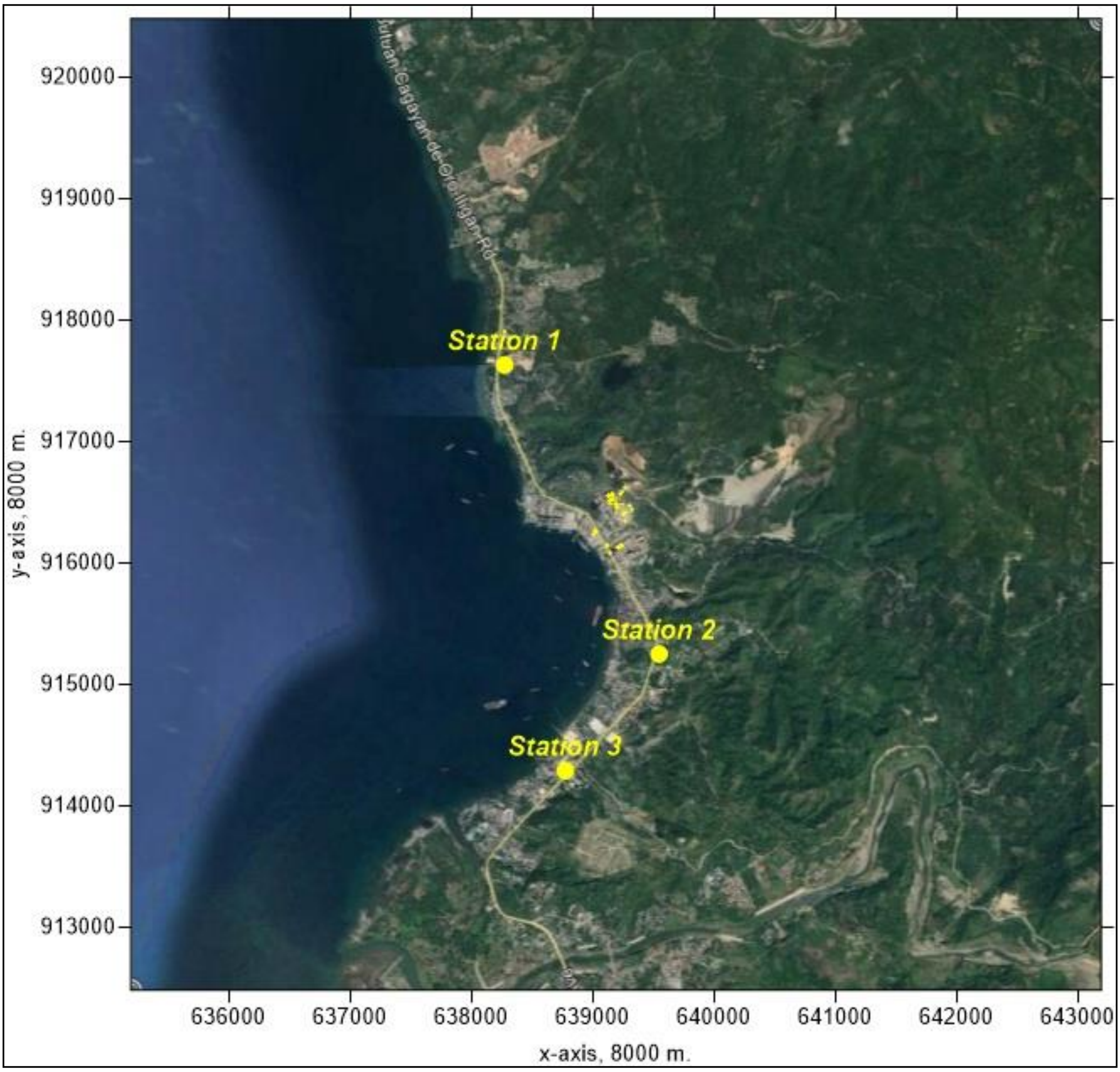


Figure 2.3-132. Recommended Air Quality Monitoring Stations

SECTION 2.4 PEOPLE

INTRODUCTION:

The significance of the "People" module are the following:

- The securing of an Environmental Compliance Certificate (ECC) is strongly influenced by the communities directly and indirectly affected by the proposed project. The support and opposition of the communities to the proposed project is vital aspect in the Philippine EIS System.
- This module serves as a relevant baseline for the City of Iligan particularly the directly affected barangays. Thus, this module will also serve as a guideline to the impacts of the proposed project and how the proponent will provide its mitigating measures.
- This module is relevant to the Corporate Social Responsibility (CSR) of the project proponent. The programs of the CSR can be harmonized with the perceived needs and impact of the proposed project and affected communities.
- "People" factor could be key to the success of a project.

Methodology and Limitations

Baselines presented in this module are gathered and conducted for the discussion of the proposed project. Primary data were obtained through household Socio-Economic perception surveys was conducted last May 2019 in Barangays Kiwalan and Dalipuga, Iligan City. Secondary data presented are derived from the Comprehensive Land Use Plan (CLUP) of the City of Iligan 2013-2022. Please note that the data shown from CLUP only cover until the year 2010 and will be updated by year 2022 by the Local Government Unit (LGU).

Background

The proposed project is situated in Barangays Kiwalan, Dalipuga, Acmac, Bonbonon and Bunawan, Iligan City, Province of Lanao del Norte.

The host city, **Iligan** is a first class highly urbanized city in Northern Mindanao. It is geographically within the province of Lanao del Norte but administered independently from the province. It was once part of Central Mindanao (region 12) until the province was moved under Northern Mindanao (Region 10) in 2001. Iligan is approximately 90 km away from the capital of the province, Tubod, and approximately 800 km from the capital of the Philippines, Manila.

- <u>**Land Area**</u>

The City of Iligan has a total land area of 81,337 hectares. The City is politically subdivided into forty four (44) barangays. See table below.

Table 2.4-1. Land Area and Population Density by Barangay, Urban-Rural; 2015

BARANGAY	DISTANCE from City Proper (km)	AREA (Hectare)	POPULATION 2015	DENSITY (Pop./Ha.)
ILIGAN CITY		**81,337.00**	**342,618**	**4.21**
Urban		**9,131.84**	**284,579**	**31.16**
1. Acmac	**7.45**	**109.78**	**6,471**	**58.95**
2. Bagong Silang	2.25	45.83	6,978	152.26
3. Buru-un	10.20	1,000.72	15,164	15.15
4. Dalipuga	**11.38**	**971.06**	**19,721**	**20.31**

BARANGAY	DISTANCE from City Proper (km)	AREA (Hectare)	POPULATION 2015	DENSITY (Pop./Ha.)
5. Del Carmen	2.70	163.00	8,423	51.67
6. Ditucalan	13.83	77.56	3,385	43.64
7. Hinaplanon	3.15	551.54	12,346	22.38
8. Kiwalan	**7.78**	**914.23**	**7,464**	**8.16**
9. Luinab	4.59	293.07	8,603	29.35
10. Mahayhay	1.33	30.45	9,179	301.44
11. Ma. Cristina	6.99	675.19	11,383	16.86
12. Pala-o	1.69	372.27	9,600	25.79
13. Poblacion	0.85	68.00	3,470	51.03
14. Puga-an	4.56	1,043.47	7,460	7.15
15. San Miguel	1.78	59.39	4,955	83.43
16. Santiago	3.20	110.42	8,814	79.82
17. Saray-Tibanga	1.16	107.29	10,171	94.80
18. Sta.Filomena	6.28	503.92	6,615	13.13
19. Sto. Rosario	2.37	24.26	2,174	89.61
20. Suarez	7.23	338.43	16,657	49.22
21. Tambacan	1.02	48.18	17,616	365.63
22. Tibanga	1.60	45.00	9,595	213.22
23. Tipanoy	5.32	514.51	14,730	28.63
24. Tomas Cabili	3.83	264.38	8,780	33.21
25. Tubod	2.18	320.67	31,913	99.52
26. Ubaldo Laya	1.11	255.04	11,950	46.86
27. Upper Hinaplanon	5.01	190.93	5,464	28.62
28. Villaverde	0.59	33.25	5,498	165.35
Rural		**72,205.16**	**58,039**	**0.80**
1. Abuno	6.30	664.87	5,423	8.16
2. Bonbonon	**9.93**	**424.13**	**1,786**	**4.21**
3. Bunawan	**17.13**	**2,195.20**	**2,218**	**1.01**
4. Digkila-an	15.66	1,346.85	5,208	3.87
5. Dulag	21.43	3,000.00	1,216	0.41
6. Hindang	22.18	2,275.00	913	0.40
7. Kabacsanan	15.12	594.45	2,123	3.57
8. Kalilangan	25.06	3,500.00	1,442	0.41
9. Lanipao	16.49	3,000.00	2,759	0.92
10. Mainit	30.11	7,325.00	2,588	0.35
11. Mandulog	10.54	1,002.74	3,867	3.86
12. Panoroganan	41.67	10,500.00	4,806	0.46
13. Rogongon	31.79	35,555.29	5,786	0.16
14. San Roque	4.07	131.62	4,740	36.01
15. Sta. Elena	5.83	289.48	9,735	33.63
16. Upper Tominobo	10.19	400.53	3,429	8.56

Source: Philippine Statistics Authority, 2015 Census of Population

- **Urban-Rural Distribution**

The urban population in Iligan City increased by 3,166 percent in 2015 over the 1970 figure of 8,989. Rural population increase was only from 1970 to 1990 with a 164% increase. The following censal years, people from the rural areas had been moving to the urban areas. Urban-rural population distribution in 1970 was 1:9 and in 2015 was 5:1. See **Table 2.4-2**.

The top ten most populated barangays as of 2015 are Tubod, Dalipuga, Tambacan, Suarez, Buruun, Tipanoy, Hinaplanon, Ubaldo Laya, Ma. Cristina and Saray. The catalyzing factor is the proximity of these areas to industries, central business districts, schools and other major institutions.

Shown in Table 2.4-1 are the barangays under urban and rural areas. Among the host barnagays for the Project, Acmac, Dalipuga and Kiwalan are urban while Bonbonon and Bunawan are rural.

Table 2.4-2. Urban-Rural Population Distribution

YEAR	TOTAL	URBAN	% to TOTAL	RURAL	% TOTAL
1970	104,493	8,989	8.6	95,504	91.4
1975	118,778	10,367	8.7	108,411	91.3
1980	167,358	21,424	12.8	145,934	87.2
1990	225,935	69,087	30.6	156,848	69.4
1995	273,004	203,566	74.6	59,438	25.4
2000	285,061	240,943	84.5	44,118	15.5
2010	322,821	277,469	86.0	45,362	14.0
2015	342,618	284,579	83.1	58,039	16.9

Source: Philippine Statistics Authority, 2015 Census of Population

- **Tempo of Urbanization**

Tempo of urbanization is the difference between urban and rural growth rates. The tempo of urbanization in Iligan, as shown in the table below, revealed that it rose fast from 1970 to 1995 and made a sharp drop to negative 5.24% in 2000, -1.34 in 2010, and -4.55 in 2015. These are abrupt changes in the distribution of population, which could be attributed to the creation of new barangays from rural barangays and were not able to retain its status. Highest urbanization rate was achieved in 1990 with 11.70 percent. See table and figure below.

Table 2.4-3. Tempo of Urbanization (1970 to 2015)

CENSAL YEARS	POPULATION		GEOMETRIC GROWTH		
	URBAN	RURAL	URBAN	RURAL	Tempo of Urbanization
1970	8,989	95,504	-	-	-
1975	10,367	108,411	2.89	2.57	0.32
1980	21,424	145,934	15.62	6.12	9.50
1990	69,087	156,848	12.42	0.72	11.70
1995	203,566	69,438	23.94	-15.05	8.89
2000	240,943	44,118	3.43	-8.67	-5.24
2010	277,469	45,352	1.42	2.76	-1.34
2015	284,579	58,039	0.51	5.06	-4.55

Source: Philippine Statistics Authority, 2015 Census of Population

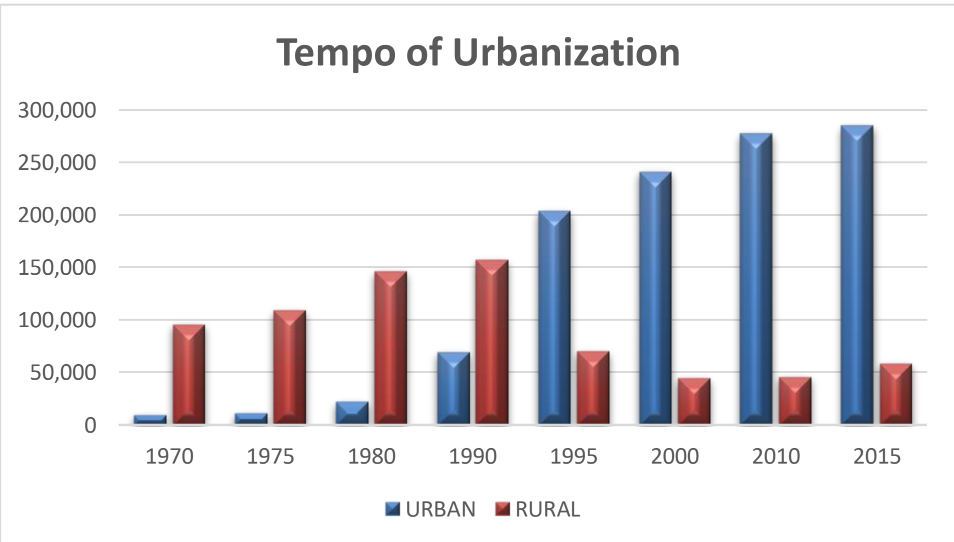


Figure 2.4-1. Tempo of Urbanization

Demographic Profile

- **Number of Household and Household Size**

Table 2.4-4 shows that within the 42 year period, population increased only by 3.3 times while the number of household grew 4.6 times higher. Ideally, the number of households should grow parallel to the population. This gap is due to the increase in the rate of household formation. Household size steadily dwindled from 6.3 in 1970 to 4.47 in 2015. This may also indicate that more people deviated from extended family traditions.

Table 2.4-4. Number of Household and Household Size

Period Covered	Population	Household Number	Household Size
1970	104,493	16,631	6.30
1975	113,778	19,364	6.10
1980	167,358	28,779	5.77
1900	225,935	41,791	5.41
1995	273,004	51,629	5.25
2000	285,061	57,179	4.98
2010	322,821	67,965	4.73
2015	342,618	76,593	4.47

Source: Philippine Statistics Authority, 2015 Census of Population

- **Population By Barangay**

The five most populated barangays of Iligan City based on 2015 censal period (arranged in decreasing order) are: 1. Tubod; 2. Dalipuga; 3. Tambacan; 4. Suarez; and 5. Buru-un. Barangay Tubod has a total population of 31,913. It is consistently the barangay with the highest number of people though it increased by only 4,505 from 2000 to 2010, and decreased by 370 in 2015. Tambacan ranks 3rd when it used to be 6th in 2000 and 4th in 2010. Its proximity to the Central Business District, presence of public elementary and high school facilities and sufficient water supply could be the factors affecting its population increase.

The barangays that posted an over-1,000 increase in population from 2010 to 2015, arranged in decreasing order, are Sta. Elena, Buru-un, Tipanoy, Dalipuga and Kiwalan. The most probable cause for this is the movement of people from one barangay to another. Note that 2 of these 5 barangays are Dalipuga and Kiwalan where the plant and quarry sites are located. This may be attributed to in-migration for employment and business opportunities and likewise indicate that **RCMI is prioritizing local employment**. The barangays that posted negative growth (annual average rate) in 2015 are: Barangays Hindang (3.77); Upper Hinaplanon (3.27); Hinaplanon (2.78); Sta. Filomena (2.09); Suarez (1.01); Santiago (0.86); Tomas Cabili (0.5); Villaverde (0.43); Tubod (0.23); and Saray-Tibanga (0.11). It is interesting to note that barangays Upper Hinaplanon, Hinaplanon, Sta. Filomena, Tubod and Santiago were among the 10 hardest hit barangays in terms of the number of damaged houses when Typhoon Sendong affected the City in December 2011. It is highly possible that after the disaster, families opted to transfer to safer areas.

Table 2.4-5. Population Distribution and Rank By Barangay; 2010 & 2015

Barangay	2010			2015			Annual Average Rate of Increase (Decrease)
	Population	% to Total	Rank	Population	% to Total	Rank	
TOTAL	**322,821**	**100**		**342,618**	**100**		**1.23**
Abuno	4,703	1.46	27	5,423	1.58	27	3.06
Acmac	5,784	1.79	23	6,471	1.89	23	2.38
Bagong Silang	6,152	1.91	21	6,978	2.04	21	2.69
Bonbonon	1,489	0.46	41	1,786	0.52	41	3.99
Bunawan	2,182	0.68	37	2,218	0.65	38	0.33
Buru-un	12,991	4.02	6	15,164	4.43	5	3.35
Dalipuga	18,191	5.62	2	19,721	5.76	2	1.68

Barangay	2010			2015			Annual Average Rate of Increase (Decrease)
	Population	% to Total	Rank	Population	% to Total	Rank	
Del Carmen	8,305	2.57	16	8,423	2.46	18	0.28
Digkila-an	4,238	1.31	28	5,208	1.52	28	4.58
Ditucalan	3,337	1.03	33	3,385	0.99	35	0.29
Dulag	1,069	0.33	44	1,216	0.35	43	2.75
Hinaplanon	14,340	4.44	5	12,346	3.60	7	-2.78
Hindang	1,125	0.35	43	913	0.27	44	-3.77
Kabacsanan	1,947	0.6	38	2,123	0.62	40	1.81
Kalilangan	1,159	0.36	42	1,442	0.42	42	4.88
Kiwalan	5,955	1.84	36	7,464	2.18	19	5.07
Lanipao	2,348	0.73	35	2,759	0.81	36	3.50
Luinab	8,114	2.51	17	8,603	2.51	17	1.21
Mahayahay	8,998	2.79	15	9,179	2.68	14	0.40
Mainit	2,480	0.77	35	2,588	0.76	37	0.87
Mandulog	3,103	0.96	34	3,867	1.13	32	4.92
Ma. Cristina	10,751	3.33	9	11,383	3.32	9	1.18
Pala-o	9,544	2.96	11	9,600	2.80	12	0.12
Panoroganan	4,035	1.25	30	4,806	1.40	30	3.82
Poblacion	3,924	1.22	31	3,470	1.01	33	-2.31
Puga-an	7,398	2.29	18	7,460	2.18	20	0.17
Rogongon	4,870	1.51	26	5,786	1.69	24	3.76
San Miguel	4,117	1.28	29	4,955	1.45	29	4.07
San Roque	3,860	1.2	32	4,740	1.38	31	4.56
Santiago	9,211	2.85	12	8,814	2.57	15	-0.86
Saray-Tibanga	10,225	3.17	10	10,171	2.97	10	-0.11
Sta. Elena	5,119	1.59	25	9,735	2.84	11	18.03
Sta. Filomena	7,387	2.29	19	6,615	1.93	22	-2.09
Sto. Rosario	2,155	0.67	39	2,174	0.63	39	0.18
Suarez	17,544	5.43	3	16,657	4.86	4	-1.01
Tambacan	16,701	5.17	4	17,616	5.14	3	1.10
Tibanga	9,042	2.8	13	9,595	2.80	13	1.22
Tipanoy	12,904	4	7	14,730	4.30	6	2.83
Tomas Cabili	9,005	2.76	14	8,780	2.56	16	-0.50
Tubod	32,283	10	1	31,913	9.31	1	-0.23
Ubaldo Laya	10,961	3.4	8	11,950	3.49	8	1.80
Upper Hinaplanon	6,531	2.02	20	5,464	1.59	26	-3.27
Upper Tominobo	1,625	0.5	40	3,429	1.00	34	22.20
Villaverde	5,619	1.74	24	5,498	1.60	25	-0.43

Source: National Statistics Office and CPDO

- **Population Size and Growth Rate**

When Iligan became a city in 1950, its population was approximately 30,000 As of the latest 2015 Census of Population and Housing, there are about 342,618 persons residing in the city.

Industrialization in the 1960s caused the population to increase at the rate of 7.48 percent, the highest since Iligan became a city. The Asian economic crisis that started in 1998 has affected the city, especially the industries, which resulted to job losses and people leaving the city. Fifteen years later, Iligan City achieved a population growth rate of 1.14 percent during the Censal period 2010-2015. See **Table 2.4-5**.

Table 2.4-5. Population Size and Growth Rate, Iligan City; 1903-2015

CENSAL PERIOD	TOTAL POPULATION	INCREASE (DECREASE)	ANNUAL *GGL	NUMBER OF YEARS
1903 March 2	2,872	-	-	-
1918 December 31	10,078	7,206	8.25	14.83
1939 January 31	28,273	18,195	5.29	20.00
1948 October 1	25,725	(2,548)	(0.96)	8.74
1960 February 15	58,433	32,708	7.48	11.57
1970 May 6	104,493	46,060	5.85	9.21
1975 May 1	118,778	14,285	2.60	4.99
1980 May 1	167,358	48,580	7.10	5.00
1990 May 1	225,935	59,210	3.08	10.00
2000 May 1	285,061	12,057	2.32	5.00
2010 May 1	322,821	14,775	1.25	10.00
2015 Aug 1	342,618	19,797	1.14	5.25

Source: Philippine Statistics Authority, 2015 Census of Population

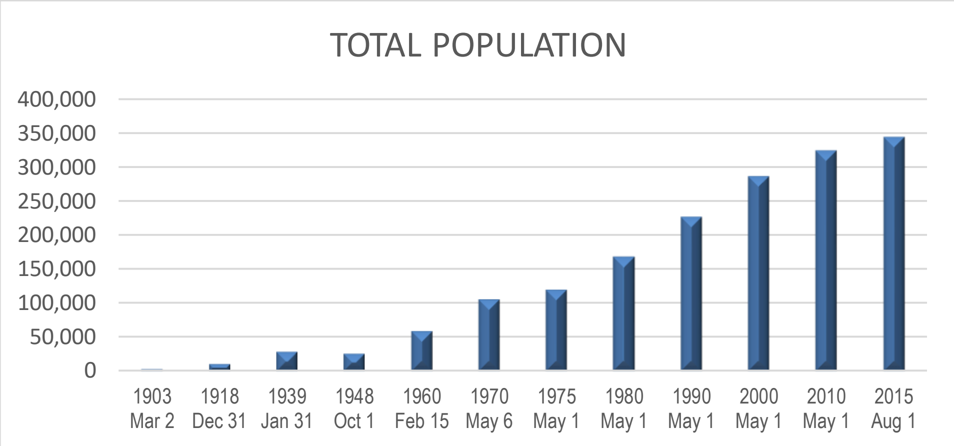


Figure 2.4-2. Historical Growth of Population

- **Population Projection By Barangay**

Based on the 2015 Census on Population and Housing, population is projected to increase at 1.14 growth rate. From the 2015 figure of 342,618, it is expected to grow to 383,742 in the year 2025. See table below.

For the 5 host barangays (shaded green in **Table 2.4-6**), the 2015 population is 37,660 and is projected to be at about 42,180 by the year 2025.

Table 2.4-6. Current and Projected Population by Barangay; 2015-2025

Barangay	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
TOTAL	**342,618**	**346,524**	**350,474**	**354,470**	**358,511**	**362,598**	**366,731**	**370,912**	**375,140**	**379,417**	**383,742**
Abuno	5,423	5,485	5,547	5,611	5,675	5,739	5,805	5,871	5,938	6,005	6,074
Acmac	6,471	6,545	6,619	6,695	6,771	6,848	6,926	7,005	7,085	7,166	7,248
Bagong Silang	6,978	7,058	7,138	7,219	7,302	7,385	7,469	7,554	7,640	7,727	7,816
Bonbonon	1,786	1,806	1,827	1,848	1,869	1,890	1,912	1,933	1,956	1,978	2,000
Bunawan	2,218	2,243	2,269	2,295	2,321	2,347	2,374	2,401	2,429	2,456	2,484
Buru-un	15,164	15,337	15,512	15,689	15,867	16,048	16,231	16,416	16,603	16,793	16,984
Dalipuga	19,721	19,946	20,173	20,403	20,636	20,871	21,109	21,350	21,593	21,839	22,088
Del Carmen	8,423	8,519	8,616	8,714	8,814	8,914	9,016	9,119	9,223	9,328	9,434
Digkila-an	5,208	5,267	5,327	5,388	5,450	5,512	5,575	5,638	5,702	5,767	5,833
Ditucalan	3,385	3,424	3,463	3,502	3,542	3,582	3,623	3,665	3,706	3,749	3,791
Dulag	1,216	1,230	1,244	1,258	1,272	1,287	1,302	1,316	1,331	1,347	1,362
Hinaplanon	12,346	12,487	12,629	12,773	12,919	13,066	13,215	13,366	13,518	13,672	13,828
Hindang	913	923	934	945	955	966	977	988	1,000	1,011	1,023

Barangay	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Kabacsanan	2,123	2,147	2,172	2,196	2,221	2,247	2,272	2,298	2,325	2,351	2,378
Kalilangan	1,442	1,458	1,475	1,492	1,509	1,526	1,543	1,561	1,579	1,597	1,615
Kiwalan	7,464	7,549	7,635	7,722	7,810	7,899	7,989	8,080	8,173	8,266	8,360
Lanipao	2,759	2,790	2,822	2,854	2,887	2,920	2,953	2,987	3,021	3,055	3,090
Luinab	8,603	8,701	8,800	8,901	9,002	9,105	9,208	9,313	9,420	9,527	9,636
Mahayahay	9,179	9,284	9,389	9,497	9,605	9,714	9,825	9,937	10,050	10,165	10,281
Mainit	2,588	2,618	2,647	2,678	2,708	2,739	2,770	2,802	2,834	2,866	2,899
Mandulog	3,867	3,911	3,956	4,001	4,046	4,093	4,139	4,186	4,234	4,282	4,331
Ma. Cristina	11,383	11,513	11,644	11,777	11,911	12,047	12,184	12,323	12,464	12,606	12,749
Pala-o	9,600	9,709	9,820	9,932	10,045	10,160	10,276	10,393	10,511	10,631	10,752
Panoroganan	4,806	4,861	4,916	4,972	5,029	5,086	5,144	5,203	5,262	5,322	5,383
Poblacion	3,470	3,510	3,550	3,590	3,631	3,672	3,714	3,757	3,799	3,843	3,887
Puga-an	7,460	7,545	7,631	7,718	7,806	7,895	7,985	8,076	8,168	8,261	8,355
Rogongon	5,786	5,852	5,919	5,986	6,054	6,123	6,193	6,264	6,335	6,407	6,480
San Miguel	4,955	5,011	5,069	5,126	5,185	5,244	5,304	5,364	5,425	5,487	5,550
San Roque	4,740	4,794	4,849	4,904	4,960	5,016	5,074	5,131	5,190	5,249	5,309
Santiago	8,814	8,914	9,016	9,119	9,223	9,328	9,434	9,542	9,651	9,761	9,872
Saray-Tibanga	10,171	10,287	10,404	10,523	10,643	10,764	10,887	11,011	11,136	11,263	11,392
Sta. Elena	9,735	9,846	9,958	10,072	10,187	10,303	10,420	10,539	10,659	10,781	10,903
Sta. Filomena	6,615	6,690	6,767	6,844	6,922	7,001	7,081	7,161	7,243	7,325	7,409
Sto. Rosario	2,174	2,199	2,224	2,249	2,275	2,301	2,327	2,354	2,380	2,407	2,435
Suarez	16,657	16,847	17,039	17,233	17,430	17,628	17,829	18,033	18,238	18,446	18,656
Tambacan	17,616	17,817	18,020	18,225	18,433	18,643	18,856	19,071	19,288	19,508	19,730
Tibanga	9,595	9,704	9,815	9,927	10,040	10,155	10,270	10,387	10,506	10,626	10,747
Tipanoy	14,730	14,898	15,068	15,240	15,413	15,589	15,767	15,946	16,128	16,312	16,498
Tomas Cabili	8,780	8,880	8,981	9,084	9,187	9,292	9,398	9,505	9,613	9,723	9,834
Tubod	31,913	32,277	32,645	33,017	33,393	33,774	34,159	34,548	34,942	35,341	35,744
Ubaldo Laya	11,950	12,086	12,224	12,363	12,504	12,647	12,791	12,937	13,084	13,233	13,384
Upper Hinaplanon	5,464	5,526	5,589	5,653	5,717	5,783	5,849	5,915	5,983	6,051	6,120
Upper Tominobo	3,429	3,468	3,508	3,548	3,588	3,629	3,670	3,712	3,754	3,797	3,841
Villaverde	5,498	5,561	5,624	5,688	5,753	5,819	5,885	5,952	6,020	6,089	6,158

Source: National Statistics Office & CPDO * Censal Years 2010-2015 Growth rate – 1.14%

- **Population Projection By Age Group**

For the next ten years (2015-2025) Iligan City's population is projected to increase by 41,124 or a total of 383,742.

The following are projections for broad age groups up to year 2025 rounded in thousands:

For the year 2021: The number of children aging 0 to 4 would be approximately 39 thousand; five to fourteen years old, 76 thousand; fifteen to sixty-four years old, 236 thousand; and, sixty-five and above, 15 thousand.

For the year 2025: Under 1 year old to four, 41,000; five to fourteen, 80,000; fifteen to sixty-four, 247,000; and, sixty-five and above, 16,000.

Please refer to **Table 2.4-7**.

Table 2.4-7. Projected Population by Age Group (2015-2025)

Age Group	2015	2020	2021	2022	2023	2024	2025
All Ages	**342,618**	**362,598**	**366,731**	**370,912**	**375,140**	**379,417**	**383,742**
Under 1 Year	6,972	7,379	7,463	7,548	7,634	7,721	7,809
1-4	29,371	31,084	31,438	31,797	32,159	32,526	32,896
5-9	36,197	38,308	38,745	39,186	39,633	40,085	40,542
0-14	34,991	37,031	37,454	37,881	38,312	38,749	39,191
15-19	38,607	40,858	41,324	41,795	42,272	42,754	43,241

Age Group	2015	2020	2021	2022	2023	2024	2025
20-24	33,997	35,980	36,390	36,805	37,224	37,648	38,078
25-29	27,633	29,244	29,578	29,915	30,256	30,601	30,950
30-34	23,412	24,777	25,060	25,345	25,634	25,927	26,222
35-39	21,694	22,959	23,221	23,486	23,753	24,024	24,298
40-44	19,272	20,396	20,628	20,864	21,101	21,342	21,585
45-49	17,652	18,681	18,894	19,110	19,328	19,548	19,771
50-54	15,676	16,590	16,779	16,971	17,164	17,360	17,558
55-59	12,982	13,739	13,896	14,054	14,214	14,376	14,540
60-64	9,848	10,422	10,541	10,661	10,783	10,906	11,030
65-69	6,278	6,644	6,720	6,796	6,874	6,952	7,032
70-74	3,572	3,780	3,823	3,867	3,911	3,956	4,001
75-79	2,392	2,531	2,560	2,590	2,619	2,649	2,679
80 & Over	2,072	2,193	2,218	2,243	2,269	2,295	2,321

Source: Philippine Statistics Authority, 2015 Census of Population
Base Year is 2015

The working male population would be approximately 118,000 in 2021; 119,000 in 2022; 120,000 in 2023; 122,000 in 2024; and, 123,000 in 2025.

Table 2.4-7a. Projected Population by Age Group; Male (2015-2025)

Age Group	2015	2020	2021	2022	2023	2024	2025
All Ages	**171,804**	**181,823**	**183,895**	**185,992**	**188,112**	**190,257**	**192,426**
Under 1	3,653	3,866	3,910	3,955	4,000	4,045	4,091
1-4	15,269	16,159	16,344	16,530	16,718	16,909	17,102
5-9	18,824	19,922	20,149	20,379	20,611	20,846	21,083
0-14	17,844	18,885	19,100	19,318	19,538	19,761	19,986
15-19	19,312	20,438	20,671	20,907	21,145	21,386	21,630
20-24	16,933	17,920	18,125	18,331	18,540	18,752	18,965
25-29	13,923	14,735	14,903	15,073	15,245	15,418	15,594
30-34	11,880	12,573	12,716	12,861	13,008	13,156	13,306
35-39	10,921	11,558	11,690	11,823	11,958	12,094	12,232
40-44	9,614	10,175	10,291	10,408	10,527	10,647	10,768
45-49	8,626	9,129	9,233	9,338	9,445	9,552	9,661
50-54	7,635	8,080	8,172	8,266	8,360	8,455	8,551
55-59	6,434	6,809	6,887	6,965	7,045	7,125	7,206
60-64	4,743	5,020	5,077	5,135	5,193	5,252	5,312
65-69	2,987	3,161	3,197	3,234	3,271	3,308	3,346
70-74	1,536	1,626	1,644	1,663	1,682	1,701	1,720
75-79	967	1,023	1,035	1,047	1,059	1,071	1,083
80 & Over	703	744	752	761	770	779	787

Source: Philippine Statistics Authority, 2015 Census of Population
Base Year is 2015

The working female population, on the other hand, would be approximately 119,000 in 2021; 120,000 in 2022; 121,000 in 2023; 123,000 in 2024; and, 124,000 in 2025.

Table 2.4-7b. Projected Population by Age Group; Female (2015-2025)

Age Group	2015	2020	2021	2022	2023	2024	2025
All Ages	**170,814**	**180,775**	**182,836**	**184,920**	**187,028**	**189,160**	**191,317**
< 1 Year	3,319	3,513	3,553	3,593	3,634	3,675	3,717
1-4	14,102	14,924	15,094	15,267	15,441	15,617	15,795
5-9	17,373	18,386	18,596	18,808	19,022	19,239	19,458
0-14	17,147	18,147	18,354	18,563	18,775	18,989	19,205
15-19	19,295	20,420	20,653	20,888	21,127	21,367	21,611
20-24	17,064	18,059	18,265	18,473	18,684	18,897	19,112
25-29	13,710	14,509	14,675	14,842	15,011	15,183	15,356
30-34	11,532	12,204	12,344	12,484	12,627	12,771	12,916

Age Group	2015	2020	2021	2022	2023	2024	2025
35-39	10,773	11,401	11,531	11,663	11,796	11,930	12,066
40-44	9,658	10,221	10,338	10,456	10,575	10,695	10,817
45-49	9,026	9,552	9,661	9,771	9,883	9,995	10,109
50-54	8,041	8,510	8,607	8,705	8,804	8,905	9,006
55-59	6,548	6,930	7,009	7,089	7,170	7,251	7,334
60-64	5,105	5,403	5,464	5,527	5,590	5,653	5,718
65-69	3,291	3,483	3,523	3,563	3,603	3,644	3,686
70-74	2,036	2,155	2,179	2,204	2,229	2,255	2,280
75-79	1,425	1,508	1,525	1,543	1,560	1,578	1,596
80 & Over	1,369	1,449	1,465	1,482	1,499	1,516	1,533

Source: Philippine Statistics Office
Base Year is 2015
Details may not add to total due to rounding of numbers
Growth Rate is 1.14%

- **Projected Number of Households**

By 2025, the projected number of households is 85,786 or an increase by 9,193 from its 2015 figure of 76,593.

Table 2.4-8. Projected Number of Households; 2015-2025

Barangay	2015	2020	2021	2022	2023	2024	2025
Total	**76,593**	**81,059**	**81,984**	**82,918**	**83,863**	**84,819**	**85,786**
Abuno	1,258	1,331	1,347	1,362	1,377	1,393	1,409
Acmac	**1,454**	**1,539**	**1,556**	**1,574**	**1,592**	**1,610**	**1,629**
Bagong Silang	1,545	1,635	1,654	1,673	1,692	1,711	1,730
Bonbonon	**380**	**402**	**407**	**411**	**416**	**421**	**426**
Bunawan	478	**506**	**512**	**517**	**523**	**529**	**535**
Buru-un	3,366	3,562	3,603	3,644	3,686	3,728	3,770
Dalipuga	**4,505**	**4,768**	**4,822**	**4,877**	**4,933**	**4,989**	**5,046**
Del Carmen	1,695	1,794	1,814	1,835	1,856	1,877	1,898
Digkila-an	1,216	1,287	1,302	1,316	1,331	1,347	1,362
Ditucalan	768	813	822	831	841	850	860
Dulag	271	287	290	293	297	300	304
Hinaplanon	3,012	3,188	3,224	3,261	3,298	3,336	3,374
Hindang	201	213	215	218	220	223	225
Kabacsanan	494	523	529	535	541	547	553
Kalilangan	275	291	294	298	301	305	308
Kiwalan	**1,705**	**1,804**	**1,825**	**1,846**	**1,867**	**1,888**	**1,910**
Lanipao	605	640	648	655	662	670	678
Luinab	1,867	1,976	1,998	2,021	2,044	2,068	2,091
Ma. Cristina	2,641	2,795	2,827	2,859	2,892	2,925	2,958
Mahayahay	1,982	2,098	2,121	2,146	2,170	2,195	2,220
Mainit	568	601	608	615	622	629	636
Mandulog	855	905	915	926	936	947	958
Palao	2,086	2,208	2,233	2,258	2,284	2,310	2,336
Panoroganan	920	974	985	996	1,007	1,019	1,030
Poblacion	822	870	880	890	900	910	921
Pugaan	1,676	1,774	1,794	1,814	1,835	1,856	1,877
Rogongon	1,163	1,231	1,245	1,259	1,273	1,288	1,303
San Miguel	908	961	972	983	994	1,006	1,017
San Roque	1,077	1,140	1,153	1,166	1,179	1,193	1,206
Santiago	1,861	1,970	1,992	2,015	2,038	2,061	2,084
Saray-Tibanga	2,377	2,516	2,544	2,573	2,603	2,632	2,662
Sta. Elena	2,202	2,330	2,357	2,384	2,411	2,439	2,466
Sta. Filomena	1,656	1,753	1,773	1,793	1,813	1,834	1,855
Sto. Rosario	530	561	567	574	580	587	594
Suarez	3,745	3,963	4,009	4,054	4,100	4,147	4,195
Tambacan	4,013	4,247	4,295	4,344	4,394	4,444	4,495
Ttibanga	2,076	2,197	2,222	2,247	2,273	2,299	2,325

Barangay	2015	2020	2021	2022	2023	2024	2025
Tipanaoy	3,262	3,452	3,492	3,531	3,572	3,612	3,654
Tomas Cabili	2,159	2,285	2,311	2,337	2,364	2,391	2,418
Tubod	7,097	7,511	7,596	7,683	7,771	7,859	7,949
Ubaldo Laya	2,620	2,773	2,804	2,836	2,869	2,901	2,934
Upper Hinaplanon	1,320	1,397	1,413	1,429	1,445	1,462	1,478
Upper Tominobo	490	519	524	530	537	543	549
Villaverde	1,392	1,473	1,490	1,507	1,524	1,542	1,559

Source: Philippine Statistics Authority, 2015 Census of Population
Based on 1:14 Growth Rate

- **Population Density**

Table 2.4-1 shows the gross population density as of 2015 is 4.21 persons per hectare or about 421 persons per square kilometer. Urban barangays have a total area of 9,131.84 hectares and have a total population of 284,579. Gross urban density is 31.16 or about 31 people per hectare and average of 78.40. According to planning standards prescribed by Housing and Land Use Regulatory Board (HLURB), the area is considered as low density area since it has a density less than 150 persons per hectare. Among the urban barangays, Tambacan has the highest population density of 365.63 persons/hectare.

The rural areas have a gross density population of 0.80 person per hectare and average of 6.62. Barangay San Roque has the highest population density of 36.01. This is because San Roque's land area is the smallest among the rural barangays, and yet, a housing subdivision exists thereat.

- **Population Age-Sex Structure**

Table 2.4-9 shows a cross-section of the 2015 age and sex structure of the population. The population is composed of 171,804 males and 170,814 females. Male over female ratio is about 1.01 or 990 males more than females.

A slight male dominance is evident among the young people, 0-14 years old. This broad age group constitutes 31.39% of the total population. The 15-64 broad age group constitutes the population's labor force and makes up 64.44% of the total population wherein females outnumbered males with ratio of 99 males per 100 females. The elderly (65 and over), which is about 4.18% of the total population is still female dominated with ratio of 76 male per 100 female.

Table 2.4-9. Population by Age-Sex Distribution

Age Group	Both Sexes	% to Total	Male	% to Total	Female	% to Total
All Ages	342,618	100	171,804	50.14	170,814	49.86
Under 1 Year	6,972	2.03	3,653	1.07	3,319	0.97
1-4	29,371	8.57	15,269	4.46	14,102	4.12
5-9	36,197	10.56	18,824	5.49	17,373	5.07
0-14	34,991	10.21	17,844	5.21	17,147	5.00
15-19	38,607	11.27	19,312	5.64	19,295	5.63
20-24	33,997	9.92	16,933	4.94	17,064	4.98
25-29	27,633	8.07	13,923	4.06	13,710	4.00
30-34	23,412	6.83	11,880	3.47	11,532	3.37
35-39	21,694	6.33	10,921	3.19	10,773	3.14
40-44	19,272	5.62	9,614	2.81	9,658	2.82
45-49	17,652	5.15	8,626	2.52	9,026	2.63
50-54	15,676	4.58	7,635	2.23	8,041	2.35
55-59	12,982	3.79	6,434	1.88	6,548	1.91
60-64	9,848	2.87	4,743	1.38	5,105	1.49
65-69	6,278	1.83	2,987	0.87	3,291	0.96
70-74	3,572	1.04	1,536	0.45	2,036	0.59

Age Group	Both Sexes	% to Total	Male	% to Total	Female	% to Total
75-79	2,392	0.70	967	0.28	1,425	0.42
80 & Over	2,072	0.60	703	0.21	1,369	0.40

Source: Philippine Statistics Authority, 2015 Census of Population

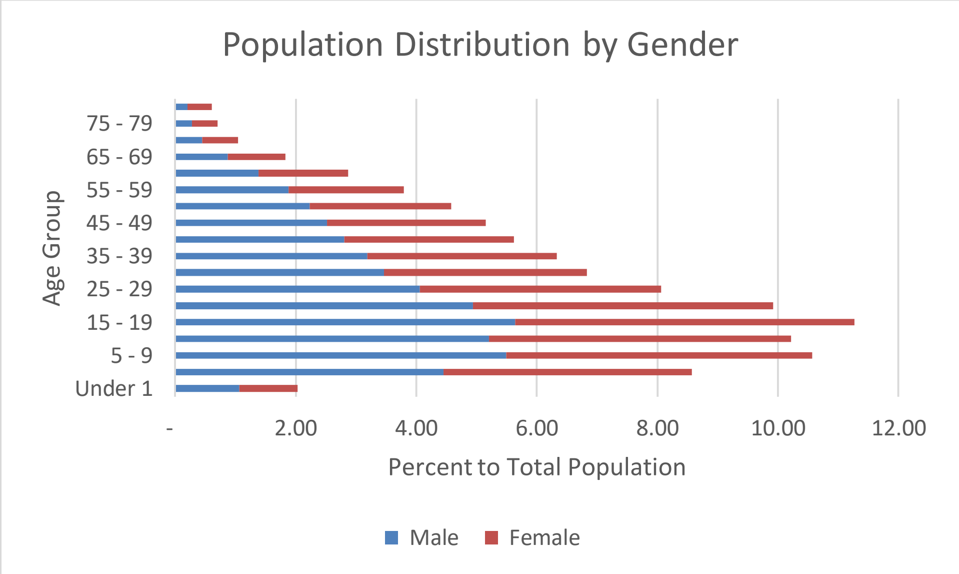


Figure 2.4-3. Population Distribution by Gender, 2015

- <u>**Education**</u>

Only 22 of the city's 44 barangays have elementary schools. All primary schools have been proposed to be expanded to elementary schools and day care centers are required to be established in every barangay. Twenty four (24) barangays have secondary schools occupying a total land area of 48.55 hectares. An additional of two more secondary schools are planned to be established - one in Barangay Bonbonon and one in Kabacsanan.

There are six barangays that have complete educational facilities from elementary to post-secondary, namely: Buruun, Mahayahay, Palao, Poblacion, Suarez, Tibanga

Socio-Cultural Profile

Employment

As of April 2015, total number of persons aging over 15 years is 235,087 where 49.43 percent are males and 50.57 females. Of these, only 54.3 percent or 127,652 are employed and 93.121 or 45.7% unemployed. The males dominate the employment with 64.90% over that of the females, which makes up only 35.10% of the gainfully employed.

Table 2.4-10. Labor Force by Sex; As of April 2015

Sex	Population15 years & over	Employed	Employment Rate	Unemployed	Unemployment Rate
Male	116,214	82,846	71.29	33,368	28.71
Female	118,873	44,806	37.69	74,067	62.31
Both Sexes	235,087	127,652	54.30	107,435	45.70

Source: Philippine Statistics Authority, 2015 Census of Population

The table and figure below show the labor force of Iligan City by type of occupation and age group.

Table 2.4-11. Employed Persons by Type of Occupation and Age Group in Iligan City As of April; 2015

Major Occupation Group	Total Employed 15 y.o. & Over	% to Total	Age Group										
			15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60 - 64	65 and over
TOTAL	**127,652**	100	**6,931**	**15,840**	**17,528**	**15,951**	**15,242**	**13,925**	**12,644**	**11,149**	**8,829**	**5,071**	**4,542**
Managers	10,629	8.33	81	427	856	1,101	1,323	1,324	1,379	1,345	1,236	778	779
Professionals	10,989	8.61	30	1,045	2,018	1,671	1,379	1,256	1,142	1,032	834	394	188
Technicians and associate professionals	8,949	7.01	161	941	1,267	1,183	1,166	1,102	944	915	693	336	241
Clerical support workers	7,466	5.85	120	1,210	1,413	1,143	927	690	629	540	497	220	77
Service and sales workers	22,839	17.89	1,599	4,247	3,491	2,719	2,368	2,188	1,973	1,703	1,216	730	605
Skilled agricultural, forestry, and fishery workers	12,931	10.13	492	989	1,242	1,215	1,396	1,329	1,337	1,367	1,186	948	1,430
Craft and related trades workers	14,160	11.09	311	1,278	1,711	1,829	1,837	1,773	1,741	1,471	1,126	601	482
Plant and machine operators and assemblers	11,720	9.18	302	1,038	1,554	1,695	1,805	1,651	1,278	998	800	377	222
Elementary occupations	26,540	20.79	3,187	4,597	3,840	3,266	2,916	2,517	2,141	1,726	1,191	657	502
Armed forces occupations	706	0.55	3	57	121	116	115	92	71	46	45	25	15
Not reported	723	0.57	645	11	15	13	10	3	9	6	5	5	1

Source: Philippine Statistics Authority, 2015 Census of Population

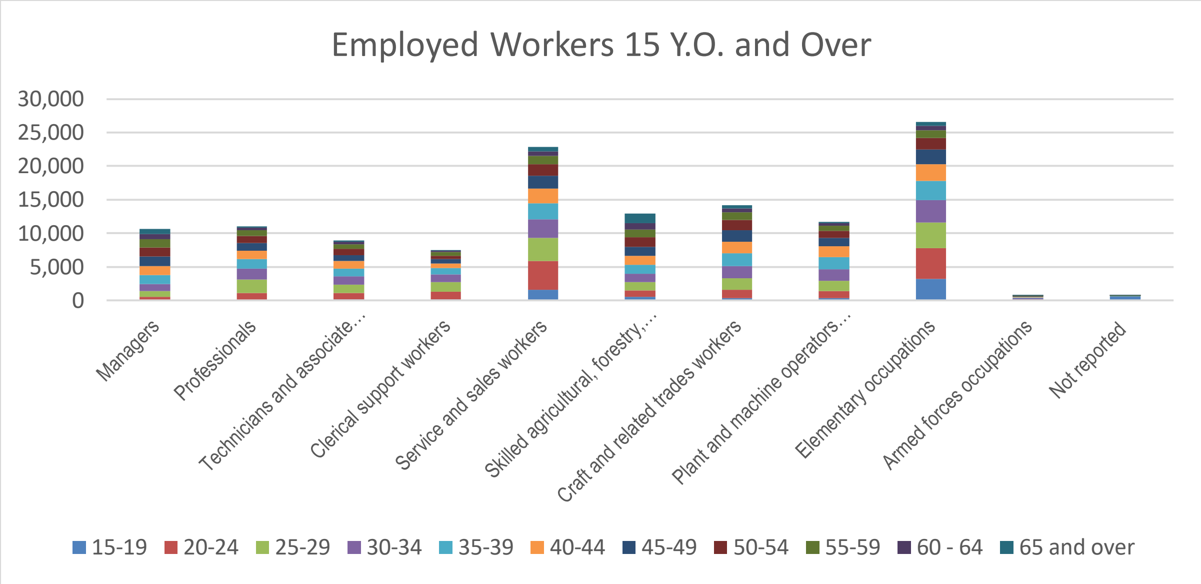


Figure 2.4-4. Employed Persons by Type of Occupation; As of April 2015

2.4.1 Displacement of People, Livelihood and Properties

At present and in the next 5 years, there will be no displacement of people in the quarry areas. As mining progresses into the final pit limits, there exists the probability that some households could be displaced. Before that happens, the Company shall conduct stakeholder engagements to plan with them the acceptable compensation and relocation plans. The relocation area shall be within the barangay where they are currently located. Moreover, the Proponent shall ensure that they will maintain easy access to their livelihood or employment. Also, additional livelihood opportunities will be offered to those who will be affected.

For the Cement Plant, the whole complex is privately owned by RCMI and thus, no displacement of people will occur.

2.4.1.1 Displacement / Disturbance of Properties

For the Cement Plant, the whole complex is privately owned by RCMI and thus, no displacement/disturbance of properties is expected.

On the other hand, the quarries are all within the three (3) MPSAs and the Company is likewise the surface owner of all the active/disturbed areas. For future expansion, however, there could be portions of the untouched areas that belong to other landowners. In this case, the Proponent will be conducting negotiations with these landowners for the purchase or lease of the land. RCMI shall ensure that just compensation will be observed for both the land and any developments thereat.

2.4.1.2 Change / Conflict in Land Ownership

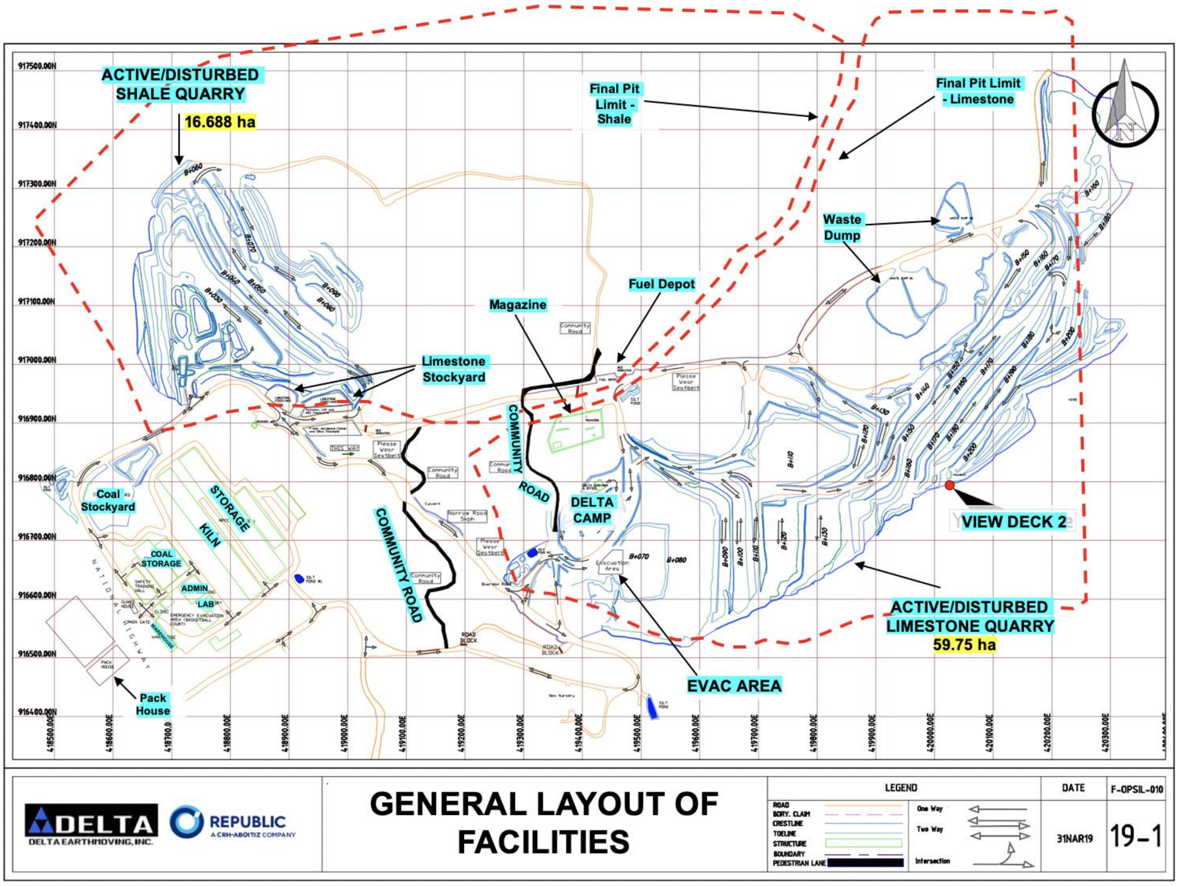
In the case of the Plant Complex, the ownership has been established in the original ECC and the same land is to be used, and therefore, there is no conflict on the ownership of land.

In the case of the quarry project, the entitlement to underground is embedded in the MPSA. For future expansion into undisturbed areas, several portions have already been purchased by the Company while the rest are being negotiated.

2.4.1.3 Change / Conflict in Right of Way

There are no existing nor prospective issues related to the above, the access roads, as differentiated from the haul roads, are not public roads and therefore there are no issues on the right of way.

The haul roads from quarry to the crusher are within the active quarry areas except for 2 instances wherein the haul road crosses the community (public) roads. Nevertheless, there are no issues because access to these very small portions of the community roads has long been agreed with the LGUs as well as the host communities. RCMI likewise bears the maintenance costs of these roads.



2.4.1.4 Impact on Public Access

There are no existing nor prospective issues related to the above. Public roads are involved during delivery of construction materials and products; however the public road is the national highway, which is already being used. There are no issues on the use of the highway nor associated traffic concerns arising from the delivery of construction materials and products. (Figure 2.4-1 shown again below.)

In the quarry, the haul roads cross the community roads in two instances. There are no issues because the Company's haul trucks only passes through these roads and do not impede the access of the communities.

Figure 2.4-1. Google Earth Map of the Access Ways

2.4.2 In–Migration/ Proliferation of Informal Settlers

The project area is in a private property in which presently there are no informal settlers and moreover the proponent has control on future influx of informal settlers, if any. Under present project activities, which also apply to the future expansion project, there will be no in-migration because during the construction, the workers will not stay or migrate to the project site. During operation, the workers and employees need not migrate because they can stay at their present residences. There will be no need residents from other barangays or municipalities to migrate to the project site.

2.4.3 Cultural/Lifestyle change (especially on Indigenous Peoples (IPs), if there's any)

Demographic data on Indigenous People (if any) and existing Cultural / Lifestyle that may be significantly affected

There will be no proliferation of informal settlers or property that will be displaced nor disturbed or cultural/lifestyle change since there are neither informal settlers nor IPs within the proposed project site. Temporary in-migration may take place but only for a short period of time because these may compose the technical team that will undertake the engineering and design requirements and construction requirements under the Contractor's responsibility. Also, even if new employees will be hired, in-migration will not take place because target employees are qualified residents of the area who have their own houses to live in.

2.4.4 Impacts on Physical Cultural Resources

This item is not germane to the project in the absence of physical cultural resources at or within the impact areas. The site and the vicinities are not in the protected areas.

2.4.5 Threat to Delivery of Basic Services /Resource Competition

2.4.5.1 Water Supply

The plant will not dig additional deep wells for its water supply. The process and the mining operation are dry in nature. Water requirements are for the plant and the sprinkling of dusty roads and areas, which are taken from the 2 existing deep wells. Domestic water will be supplied from local concessioner while drinking water will be from purchased bottled water, which is the case of drinking purposes.

In the existing set-up, the water requirements for the project is 703.3 m^3/day. This shall be increased to 3,100 m^3/day for the proposed increase in quarry and plant production rates.

2.4.5.2 Power Supply

Power supply will be from dedicated source such as the electrical utility and thus will not compete with other users principally the communities and other industrial commercial users.

2.4.5.3 Communications

Use of radio for implant services will be made, as well as mobile telecommunication system and therefore there are no communication with communities and other industrial commercial users.

2.4.6. Threat to Public Health and Safety

Public health issues could arise if there are significant hazardous substances being used. However as discussed on the **Section 4** "ERA" there are no hazardous substances that are used for the project except for small quantities of chemicals/materials.

Regarding public safety, as also discussed in **Section 4** "ERA" there are also no major public safety issues associated to the project.

The common sickness that the Community around the Plant site are not caused by the plant operations, it is mainly common fever, colds and gastrointestinal diseases.

2.4.6.1 Peace and Order / Crime

To ensure the peace and order in the vicinity of the project site, the PNP, Purok President, Barangay Official/Council, CMO, and PA will help to achieve the following:

- Increase police visibility
- Increase PNP manpower and of its auxiliary forces
- Provision of adequate facilities
- Ensure the existence of the Philippines Army in Brgy. Ma. Cristina and in the city proper
- Request transfer of Camp Edilberto Evangelista to Iligan
- Continuous IEC Program to raise public awareness and solicit cooperation
- Strict monitoring of new residents/faces in the purok and barangay levels
- Development of Iligan-Lanao del Norte- Lanao del Sur Cultural Growth Triangle

2.4.7. Generation of Local Benefits from the Project *Enhancement of employment and livelihood opportunities. Increased business opportunities and associated economic activities. Increased revenue of LGUs*

This expansion of industrial activity, particularly cement manufacturing, and therefore industrial output, will also translate into increased income for the government.

Major benefits for the host LGUs and community shall also come from the company and suppliers' payments of various taxes (real property and business), permits, and non-tax revenues. These all redound to the citizens in the form of necessary infrastructure, government facilities, social services, better compensation for local government employees, capacity building/training projects for workers, farmers, projects for PWDs, women, youth and children, and improvement of governance.

New or additional investment naturally comes with a corresponding manpower complement and a small number of regular technical staff will be added during the operations phase.

For the proposed expansion, five hundred (1,000) workers during the construction phase will be needed.

The existing manpower for operations of RCMI totals to 166 for both the plant and the quarries while its quarrying Contractor (Delta Earthmovers) maintains 68 personnel. During the operations phase of the proposed expansion, the number of workers shall increase to 184 for RCMI and as may be determined for Delta.

Project-related activities could also mean increased business for local suppliers of construction equipment and building materials, transport of goods and service, food, and various services. These all convert to more income for the private sector, more employed locals, decreased poverty rate, and increased government revenue.

2.4.8. Traffic Generation

<u>Baseline/Existing Transportation/Traffic Situation in Iligan City</u>

2.4.8.1 Transportation Network
2.4.8.1.1 External Linkages

The city is linked to other cities and municipalities and provinces through a National Highway. This Highway runs close to the coastline of Iligan Bay and connects to the towns of Misamis Oriental, Cagayan de Oro City, Bukidnon, Davao and to as far as the provinces of Surigao on the northward direction. Southward, the highway branches off into two main directions; one branch leads to the southern town of Lanao del Norte, along the coastline of Panguil Bay, then to Pagadian and Zamboanga. The second branch bends towards Marawi City and to the municipalities of Lanao del Sur and then to Cotabato interconnecting Davao.

The coastal highway is currently serving an increasing number of inter-city travels. Previous traffic counts conducted by the DPWH in 1994, which is observed almost at the same level of traffic distribution, revealed that 40% of vehicles enter and leave through the national highway in the direction of Cagayan de Oro, 32% to Lanao del Norte, Misamis Occidental and Zamboanga while 28% in the direction of Marawi City and Lanao del Norte. Land-based traffic are increasing in both directions. The completed widening of some segments of the national highway within the corridor is not sufficient to solve future traffic congestions, especially the portion which runs across the Central Business District (CBD).

Vehicular movements are largely limited to within the plant/quarry site and from the site to the pier, hence no traffic situation is anticipated with the expansion project.

Presently, traffic is not a concern for the existing operation of the Company**.**

2.4.9 Public Perception Survey

The Preliminary Perception Survey was conducted from January 12-14 2019 with a total of 177 respondents, to assess the socio economic situation of the communities that are to be affected by the proposed expansion project, particularly **Barangays Kiwalan, Dalipuga, Acmac, Bonbonon** and **Bunawan,** which is the closest to the site. The tables below present the summary of the Perception Survey conducted for the Proposed Expansion Project.

- ***Sex Distribution -*** The respondents were composed of 42.94% males and 57.06% females.

Table 2.4-17. Impact Barangays: Sex Distribution

Barangay	Male		Female		No Answer		Total No. of HH surveyed
	# of HH	%	# of HH	%	# of HH	%	

Barangay	Male		Female		No Answer		Total No. of HH surveyed
	# of HH	%	# of HH	%	# of HH	%	
Kiwalan	29	36.71	50	63.29	0	0	79
Dalipuga	28	75.68	9	24.32	0	0	37
Acmac	7	35	13	65	0	0	20
Bonbonon	8	40	12	60	0	0	20
Bunawan	4	19.05	17	80.95	0	0	21
Total	**76**	**42.94**	**101**	**57.06**	**0**	**0**	**177**

Data Source: EIA Perception Survey 2019

- ***Civil Status -*** Data coming from the EIA survey are used to present baseline condition of the impact barangays residents where majority or 71.75% of the respondents are married (or 127 out of 177 respondents) followed by single in 12.99% and the rest are widower, separated and lived in.

Table 2.4-18. Impact Barangays: Civil Status

Barangay	Single		Married		Widower		Separated		Atbp. (Lived in)		Total No. of HH surveyed
	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	
Kiwalan	5	10.42	28	58.33	5	10.42	1	2.08	9	18.75	48
Dalipuga	5	7.35	56	82.35	4	5.88	3	4.41	0	0	68
Acmac	6	30	13	65	1	5	0	0	0	0	20
Bonbonon	4	20	15	75	0	0	0	0	1	5	20
Bunawan	3	14.29	15	71.43	1	4.76	0	0	2	9.52	21
Total	**23**	**12.99**	**127**	**71.75**	**11**	**6.21**	**4**	**2.26**	**12**	**6.78**	**177**

Data Source: EIA Perception Survey 2019

- ***Religion -*** **Table 2.4-19** shows that 87.57% of the total respondents interviewed are Roman Catholic followed by 2.26% which are Protestant.

Table 2.4-19. Impact Barangays: Religious Affiliation

Barangay	Catholic		Protestant		Islam		INC		Others		Total No. of HH surveyed
	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	
Kiwalan	45	93.75	1	2.08	1	2.08	0	0	1	2.08	48
Dalipuga	62	91.18	3	4.41	0	0	0	0	3	4.41	68
Acmac	20	100	0	0	0	0	0	0	0	0	20
Bonbonon	15	75	0	0	0	0	0	0	5	25	20
Bunawan	13	61.90	0	0	0	0	0	0	8	38.10	21
Total	**155**	**87.57**	**4**	**2.26**	**1**	**0.56**	**0**	**0**	**17**	**9.60**	**177**

Data Source: EIA Perception Survey 2019

Ethnicity -The City's dialect is mostly Cebuano language. Table presented below that 85.88% of the total respondents in the impact barangays are Cebuano. Others are Hiligaynon and Tagalog.

Table 2.4-20. Impact Barangays: Ethnicity

Barangay	Tagalog		Cebuano		Hiligaynon		Waray		Others		Total No. of HH surveyed
	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	
Kiwalan	1	2.08	47	97.92	0	0	0	0	0	0	48
Dalipuga	4	5.88	61	89..71	3	0	0	0	0	0	68
Acmac	5	25	9	45	4	20	0	0	2	10	20
Bonbonon	2	10	14	70	2	10	0	0	2	10	20
Bunawan	0	0	21	100	0	0	0	0	0	0	21
Total	**12**	**6.78**	**152**	**85.88**	**9**	**5.08**	**0**	**0**	**4**	**2.26**	**177**

Data Source: EIA Perception Survey 2019

Income, Livelihood and Employment - The main source of income of the respondents is mostly Contractual Job/Sub contractor, family business and through other source of income. On the other hand 65.54% of the respondents stated that the husband is the primary earner in the household while 13.56% has the wife as the primary earner. See **Table 2.4-21** and **2.4-22.**

In terms of monthly income, most of the respondents or 40.11% are earning between Php 5,001-Php 10,000, while respondents earning Php 1,001-Php 5,000 make up 27.12% followed by 18.64% earning Php 10,001- Php 20,000 and Php 21,000 above.

Table 2.4-20. Impact Barangays: Main Source of Livelihood of Respondents

Barangay	Fishing/Pagsasaka		Regular Private/Govt Employee		Contractual Job/Sub-Contractor		Vendor/Family Business		Others		Total No. of HH surveyed
	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	
Kiwalan	1	2.08	0	0	22	45.83	10	20.83	15	31.25	48
Dalipuga	4	5.88	14	20.59	21	30.88	13	19.12	16	23.53	68
Acmac	2	10	9	45	1	5	5	25	3	15	20
Bonbonon	3	15	10	50	0	0	5	25	2	10	20
Bunawan	5	23.81	3	14.29	5	23.81	2	9.52	6	28.57	21
Total	**15**	**8.47**	**36**	**20.34**	**49**	**27.68**	**35**	**19.77**	**42**	**23.73**	**177**

Data Source: EIA Perception Survey 2019

Table 2.4-21. Impact Barangays: Primary Earner

Barangay	Husband		Wife		Son		Daughter		Others		Total No. of HH surveyed
	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	
Kiwalan	33	68.75	8	16.67	2	4.17	0	0	5	10.42	48
Dalipuga	44	64.71	9	13.24	10	14.71	0	0	5	7.35	68
Acmac	11	55	1	5	0	0	1	5	7	35	20
Bonbonon	14	70	4	20	0	0	0	0	2	10	20
Bunawan	14	66.67	2	9.52	0	0	2	9.52	3	14.29	21
Total	**116**	**65.54**	**24**	**13.56**	**12**	**6.78**	**3**	**1.70**	**22**	**12.43**	**177**

Data Source: EIA Perception Survey 2019

Table 2.4-22. Impact Barangays: Monthly Income of the Respondents

Barangay	P1,000 below		P1,001-P5,000		P5,001-10,000		P10,001-20,000		P20,001 Above		Others/No Answer		Total No. of HH surveyed
	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	
Kiwalan	0	0	11	22.92	26	54.17	10	20.83	0	0	1	2.08	48
Dalipuga	4	5.88	23	33.82	27	39.71	10	14.71	4	5.88	0	0	68
Acmac	1	5	3	15	3	15	3	15	6	30	4	20	20
Bonbonon	0	0	5	25	6	30	7	35	0	0	2	10	20
Bunawan	0	0	6	28.57	9	42.86	3	14.29	1	4.76	2	9.52	21
Total	**5**	**2.82**	**48**	**27.12**	**71**	**40.11**	**33**	**18.64**	**11**	**6.21**	**9**	**5.08**	**177**

Data Source: EIA Perception Survey 2019

- ***Educational Attainment* - Table 2.4-23** shows that the largest percentage or 58.19% of the respondents are high school graduates followed by 18.08% elementary graduates, 14.12% college graduates and 9.04% vocational graduates.

Table 2.4-23. Impact Barangays: Educational Attainment

Barangay	Wala (None)		Elementary		High School		Vocational		College		Total No. of HH surveyed
	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	
Kiwalan	0	0	14	29.17	25	52.08	4	8.33	5	10.42	48
Dalipuga	0	0	12	17.65	46	67.65	7	10.29	3	4.41	68
Acmac	0	0	2	10	4	20	2	10	12	60	20
Bonbonon	0	0	2	10	14	70	0	0	4	20	20
Bunawan	1	4.76	2	9.52	14	66.67	3	14.29	1	4.76	21
Total	**1**	**0.56**	**32**	**18.08**	**103**	**58.19**	**16**	**9.04**	**25**	**14.12**	**177**

Data Source: EIA Perception Survey 2019

Health

Sickness in the Family – Based on the survey conducted, 30.30% of the household respondents have experienced one (1) sick family member for the past five years. 15.76% of the household respondents have experienced three (3) sick family members for the past five years (**Table 2.4-25**). Common sickness in the barangay as indicated by the household respondents are fever, cold, gastrointestinal disease, skin disease and heart disease (**Table 2.4-26**).

Where do they consult? – Based from the result of the conducted survey, 28.25% of the household respondents opted to consult in Government Hospital while 30.51% opted to consult in Barangay Health Center.

See **Table 2.4-27** on Where They Consult, for the survey data.

Table 2.4-25. Number of Family Member Who Got Sick for the Past 5 Years

Barangay	1		2		3		4		5		NO ANSWER		Total No. of HH surveyed
	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	
Kiwalan	21	43.75	5	10.42	4	8.33	0	0	0	0	18	37.5	48
Dalipuga	12	21.43	10	17.86	15	26.79	7	12.5	6	10.71	6	10.71	56
Acmac	5	25	3	15	0	0	0	0	0	0	12	60	20
Bonbonon	7	35	7	35	1	5	1	5	0	0	4	20	20
Bunawan	5	23.81	4	19.05	6	28.57	0	0	1	4.76	5	23.81	21
Total	**50**	**30.30**	**29**	**17.58**	**26**	**15.76**	**8**	**4.85**	**7**	**4.24**	**45**	**27.27**	**165**

Data Source: EIA Perception Survey 2019

Table 2.4-26. Common Illness in the Community

Barangay	Gastrointestinal Disease		Cold		Fever		Others		No Answer		Total No. of HH surveyed
	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	
Kiwalan	2	4.17	16	33.33	9	18.75	1	2.08	20	41.67	48
Dalipuga	1	1.47	29	42.65	17	25	5	7.35	16	23.53	68
Acmac	0	0	4	20	2	10	3	15	11	55	20
Bonbonon	1	5	10	50	9	45	0	0	0	0	20
Bunawan	1	4.76	13	61.91	3	14.29	0	0	4	19.05	21
Total	**5**	**2.82**	**72**	**40.68**	**40**	**22.60**	**9**	**5.08**	**51**	**28.81**	**177**

Data Source: EIA Perception Survey 2019

Table 2.4-27. Place of Treatment for illness of respondents

Barangay	House		Barangay Health Center		Government Hospital		Private Clinic		Herbalist		Others		No Answer		Total No. of HH surveyed
	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	
Kiwalan	0	0	25	52.08	4	8.33	1	2.08	0	0	1	2.08	17	35.42	48
Dalipuga	0	0	18	26.47	29	42.65	2	2.94	0	0	3	4.41	16	23.53	68
Acmac	0	0	1	5	5	25	5	25	0	0	0	0	9	45	20
Bonbonon	4	20	6	30	7	35	3	15	0	0	0	0	0	0	20
Bunawan	5	23.81	4	19.05	5	23.81	0	0	2	9.52	0	0	5	23.81	21
Total	**9**	**5.08**	**54**	**30.51**	**50**	**28.25**	**11**	**6.21**	**2**	**1.13**	**4**	**2.26**	**47**	**26.55**	**177**

Data Source: EIA Perception Survey 2019

Perception of the Community

- **Knowledge About the Proposed Project**

Table 2.4-28 shows the frequency of the respondents who answered that they had prior knowledge and idea about the Proposed Increase in Clinker, Cement and Quarry Production Project. Out of the 177 respondents, 124 or 70.06% of them answered Yes, while 41 or 23.16% answered No and the remaining 12 or 6.78% had no responses.

Table 2.4-28. Household Knowledge about the Proposed Project

Barangay	Yes		No		No Answer		Total No. of HH surveyed
	# of HH	%	# of HH	%	# of HH	%	
Kiwalan	48	100	0	0	0	0	48
Dalipuga	38	55.88	28	41.18	2	2.94	68
Acmac	14	70	3	15	3	15	20
Bonbonon	12	60	4	20	4	20	20
Bunawan	12	57.14	6	28.57	3	14.29	21
Total	**124**	**70.06**	**41**	**23.16**	**12**	**6.78**	**177**

Data Source: EIA Perception Survey 2019

Majority of the respondents answered that their source of information about the Proposed Increase in Clinker, Cement and Quarry Production Project was learned from the Barangay with a frequency of 111 or 65.68% while 16respondents or 9.47% answered that they heard the project from their Neighbor, 5 respondents or 2.96% answered that they heard the project through IEC by Proponent and the remaining 35 respondents or 20.71% had no responses. See **Table 2.4-29.**

Table 2.4-29. Household Source of Information about the Proposed Project

Barangay	Neighbor		Barangay		Proponent's IEC		Media		No Answer		Total No. of HH surveyed
	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	
Kiwalan	0	0	48	100	0	0	0	0	0	0	48
Dalipuga	8	13.33	28	46.67	5	8.33	2	3.33	17	28.33	60
Acmac	0	0	14	70	0	0	0	0	6	30	20
Bonbonon	0	0	14	70	0	0	0	0	6	30	20
Bunawan	8	38.1	7	33.33	0	0	0	0	6	28.57	21
Total	**16**	**9.47**	**111**	**65.68**	**5**	**2.96**	**2**	**1.18**	**35**	**20.71**	**169**

Data Source: EIA Perception Survey 2019

<u>Perceived Impacts</u>

The respondents were asked on their view on the possible beneficial and adverse impacts of the proposed increase in clinker, cement, and quarry production. As far as the perceived benefits is concerned, top answers are on livelihood and business opportunities, improvement of roads and other infrastructure, additional tax, good service of the government and water services. On the other hand, perceived adverse impacts are traffic, water pollution and death of marine species.

Table 2.4-30. Beneficial Impacts of the Proposed Increase in Clinker, Cement and Quarry Production

Answers	1. Livelihood and business opportunities
	2. Improvement of roads and other infrastructure
	3. Land taxes
	4. Improvement of government services
	5. Improvement of water services

Data Source: EIA Perception Survey 2019

Table 2.4-31. Adverse Impacts of the Proposed Increase in Clinker, Cement and Quarry Production

Answers	1. Increased traffic
	2. Flooding
	3. Health and safety hazard
	4. Air, water and land pollution
	5. Generation of wastes
	6. Loss of plants, trees and other infrastructure
	7. Loss of existing livelihood

Data Source: EIA Perception Survey 2019

ENHANCED PERCEPTION SURVEY

The discussions below are based on the households perception survey conducted and the summary is presented in the tables.

Age Distribution, by Sex. Majority of the respondents of the 5 barangays are females (**Table 2.4-32**).

Table 2.4-32. Impact Barangays: Gender distribution in Iligan City

Barangay	Female		Male		Total No. of HH surveyed
	# of HH	%	# of HH	%	
Dalipuga	106	74.13	37	25.87	143
Kiwalan	126	86.30	20	13.70	146
Bonbonon	50	66.67	25	33.33	75
Bunawan	35	50.00	35	50.00	70
Acmac	45	59.21	31	40.79	76
Total	**362**	**70.98**	**148**	**20.02**	**510**

Data Source: EIA Perception Survey 2019

Table 2.4-33. Impact Barangays: Age Distribution

Barangay	15-20		21-30		31-40		41-50		51-60		61-70		71 Above		No Answer		Total No. of HH surveyed
	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	
Dalipuga	6	5.08	19	16.01	43	36.44	29	24.58	20	16.95	7	5.93	3	2.54	16	13.56	118
Kiwalan	8	7.21	27	24.32	25	22.52	41	36.94	28	25.23	7	6.31	1	0.90	9	8.11	111
Bonbonon	5	6.67	31	41.33	19	25.33	6	8.00	9	12.00	2	2.667	2	2.67	1	1.33	75
Bunawan	0	0.00	24	34.29	20	28.57	6	8.57	12	17.14	6	8.571	2	2.86	0	0.00	70
Acmac	1	1.35	11	14.86	5	6.76	6	8.11	4	5.41	4	5.405	0	0.00	43	58.11	74

Data Source: EIA Perception Survey 2019

- ***Civil Status***

Table 2.4-34. Impact Barangays: Civil Status

Barangay	Dalaga/Binata		May Asawa		Byuda/Byudo		Hiwalay		Live-In		Others		No Answer		Total No. of HH surveyed
	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	
Dalipuga	39	11.37	201	58.60	60	17.49	30	8.75	0	0	8	2.33	5	1.46	343
Kiwalan	72	20.40	197	55.81	35	9.92	23	6.52	5	1.42	13	3.68	8	2.27	353
Bonbonon	3	12.00	14	56.00	4	16.00	2	8.00	0	0	2	8.00	0	0.00	25
Bunawan	14	12.39	82	72.57	12	10.62	4	3.54	0	0	1	0.88	0	0.00	113
Acmac	15	23.08	39	60.00	5	7.69	6	9.23	0	0	0	0.00	0	0.00	65

- ***Educational Characteristics and Literacy.*** About 51.93% (or 188 out of the 362 respondents) are in secondary high school level, 21.82% (79) are in primary education level followed by 14.09% (51) in tertiary education. Only 2 respondents (0.55%) opted not to answer while 5.80% have undergone vocational trainings.

Table 2.4-36. Impact Barangays: Educational Attainment in Iligan City

Barangay	None		Elementary		High School		Vocational		College		Post Graduate		No Answer		Total No. of HH surveyed
	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	
Dalipuga	0	0	8	11.59	36	52.17	3	4.35	15	21.74	7	10.14	0	0	69
Kiwalan	0	0	14	18.92	44	59.46	4	5.41	10	13.51	2	2.70	0	0	74
Bonbonon	2	2.67	32	42.67	29	38.67	2	2.67	7	9.33	3	4	0	0	75
Bunawan	0	0	14	20.00	43	61.43	9	12.86	4	5.71	0	0	0	0	70
Acmac	4	5.41	11	14.86	36	48.65	3	4.05	15	20.27	3	4.05	2	2.70	74
Total	**6**	**1.66**	**79**	**21.82**	**188**	**51.93**	**21**	**5.80**	**51**	**14.09**	**15**	**4.14**	**2**	**0.55**	**362**

Data Source: EIA Perception Survey 2019

Socio-Cultural Profile

- ***Place of Birth and Origin.*** Most of the respondents of barangays San Rafael II, III and IV were born outside the barangay/municipality while 31% of the total respondents of Barangay San Rafael III were born within the barangay/municipality. It can be noted that majority of the respondents are Tagalog. See **Tables 2.4-37** to **2.4-40.**

Table 2.4-37. Impact Barangays: Birth Place

Barangay	Born Outside the Municipality		Born Within the Municipality		No Answer		Total No. of HH surveyed
	# of HH	%	# of HH	%	# of HH	%	
Dalipuga	29	42.03	19	27.54	21	30.43	69
Kiwalan	13	17.57	58	78.38	3	4.05	74
Bonbonon	52	69.33	0	0.00	23	30.67	75
Bunawan	43	61.43	0	0.00	27	38.57	70
Acmac	18	24.32	48	64.86	8	10.81	74
Total	**155**	**42.82**	**125**	**34.53**	**82**	**22.65**	**362**

Data Source: EIA Perception Survey 2019

Table 2.4-38. Impact Barangays: Years of Stay in the City

Barangay	Since Birth		1-10		11-20		21-30		31-40		41-50		51-60		61-above		No Answer		Total No. of HH surveyed
	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	
Dalipuga	4	5.80	12	17.39	14	20.29	9	13.04	4	5.80	4	5.80	1	1.45	0	0.00	21	30.43	69
Kiwalan	0	0.00	2	2.70	4	5.41	16	21.62	13	17.57	21	28.38	12	16.22	2	2.70	4	5.41	74
Bonbonon	16	21.33	20	26.67	10	13.33	11	14.67	10	13.33	2	2.67	2	2.67	2	2.67	2	2.67	75
Bunawan	0	0	10	14.29	8	11.43	18	25.71	19	27.14	5	7.14	5	7.14	5	7.14	0	0.00	70
Acmac	25	33.78	2	2.70	9	12.16	13	17.57	14	18.92	2	2.70	2	2.70	0	0.00	7	9.46	74
Total	**45**	**12.43**	**46**	**12.71**	**45**	**12.43**	**67**	**18.51**	**60**	**16.57**	**34**	**9.39**	**22**	**6.08**	**9**	**2.49**	**34**	**9.39**	**362**

Data Source: EIA Perception Survey 2019

Table 2.4-39. Impact Barangays: Ethnicity

Barangay	Tagalog		Visayan		Ilocano		Kapampangan		Bicolano		Others		No Answer		Total No. of HH surveyed
	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	
Dalipuga	0	0	69	100	0	0	0	0	0	0	0	0	0	0	69
Kiwalan	2	2.70	72	97.30	0	0	0	0	0	0	0	0	0	0	74
Bonbonon	8	10.67	45	60	0	0	0	0	0	0	21	28	1	1.33	75
Bunawan	17	24.29	53	75.71	0	0	0	0	0	0	0	0	0	0.00	70
Acmac	1	1.35	71	95.95	0	0	0	0	0	0	0	0	2	2.70	74
Total	**28**	**7.73**	**310**	**85.64**	**0**	**0**	**0**	**0**	**0**	**0**	**21**	**5.80**	**3**	**0.83**	**362**

Data Source: EIA Perception Survey 2019

Table 2.4-40. Impact Barangays: Dialect

Barangay	Tagalog	Cebuano	Hiligaynon	Waray	Bicolano	Iloko	Kapampangan	Others	No Answer	Total No. of

	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	HH surveyed
Dalipuga	0	0	69	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	69
Kiwalan	3	4.05	71	95.95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	74
Bonbonon	18	24.00	33	44	0	0	0	0	0	0	1	1.33	0	0	20	26.67	3	4.00	75
Bunawan	17	24.29	53	75.71	0	0	0	0	0	0	0	0	0	0	0	0	0	0	70
Acmac	0	0	74	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	74
Total	**38**	**10.50**	**300**	**82.87**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0.28**	**0**	**0**	**20**	**5.52**	**3**	**0.83**	**362**

Data Source: EIA Perception Survey 2019

- ***Religious Affiliations.*** Results of the survey indicated that 78.45% or 284 of the respondents are Roman Catholics followed by Protestant and the INC and affiliates of the Islam, as presented in table below:

Table 2.4-41. Impact Barangays: Religion

Barangay	Roman Catholic		Protestant		Aglipayan		INC		Islam		Christian		Others		No Answer		Total No. of HH surveyed
	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	
Dalipuga	48	69.57	5	7.23	8	11.59	0	0	1	1.45	0	0	6	8.70	1	1.45	69
Kiwalan	71	95.95	1	1.35	0	0	1	1.35	0	0	0	0	1	1.35	0	0	74
Bonbonon	38	50.67	0	0	0	0	0	0	29	38.67	0	0	8	10.67	0	0	75
Bunawan	54	77.14	0	0	1	1.43	0	0	0	0	0	0	15	21.43	0	0	70
Acmac	73	98.65	0	0	0	0	1	1.35	0	0	0	0	0	0	0	0	74
Total	**284**	**78.45**	**6**	**1.66**	**9**	**2.49**	**2**	**0.55**	**30**	**8.29**	**0**	**0**	**30**	**8.29**	**1**	**0.28**	**362**

Data Source: EIA Perception Survey 2019

Socio-economic Profile

Sources of Income, Income Levels and Poverty Incidence. Sources of income of the respondents are generally from employment. Most of the respondents are Jeepney driver, security guard, sales clerk, sales lady, vendor, sari-sari store vendor, cashier, bank teller and entrepreneur.

In terms of average monthly income of the households, 7.73% of the total respondents have average household monthly income ranging from below Php 1,000, 25.69% earn from Php 5,000-9,999, 37.57% earning from Php 1,000-4,999, 6.63% earning Php 10,000-14,999, 2.76% earning Php 15,999-19,999, 3.87% earning Php 20,000 – 25,000 above and the remaining 13.54% opted not to answer the question, as shown in Table below.

Tables 2.4-42 and **2.4-43** presents the results on source of income and monthly income, respectively. **Table 2.4-44** stated that the husband is the primary earner in the household.

Table 2.4-42. Impact Barangays: Occupation

Barangay	Pagsasaka		Pangingisda		Empleyado		Kontrakwal		Nagtitinda/ Nagbebenta		Sariling Negosyo ng Pamilya		May OFW na Kamag-anak		Iba pa		No Answer		Total No. of HH surveyed
	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	
Dalipuga	1	1.45	2	2.90	23	33.33	20	28.99	5	7.25	2	2.90	1	1.45	1	1.45	14	20.29	69
Kiwalan	0	0	0	0	3	4.05	44	59.46	9	12.16	2	2.70	0	0	3	4.05	13	17.57	74
Bonbonon	25	33.33	0	0	15	20	3	4	8	10.67	3	4	5	6.67	9	12	7	9.33	75
Bunawan	45	64.29	1	1.43	14	20	2	2.86	0	0	2	2.86	0	0	6	8.57	0	0	70
Acmac	1	1.35	2	2.70	3	4.05	27	36.49	1	1.35	4	5.41	19	25.68	0	0	17	22.97	74
Total	**72**	**19.89**	**5**	**1.38**	**58**	**16.02**	**96**	**26.52**	**23**	**6.35**	**13**	**3.59**	**25**	**6.91**	**19**	**5.25**	**51**	**14.09**	**362**

Data Source: EIA Perception Survey 2019

Table 2.4-43. Impact Barangays: Monthly Income

Barangay	Below 1000		1000-4999		5000-9999		10000-14999		15999-19999		20000-24999		20000-24999		No Answer		Total No. of HH surveyed
	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	
Dalipuga	2	2.90	16	23.19	17	24.64	9	13.04	2	2.90	3	4.35	5	7.25	15	21.74	69
Kiwalan	10	13.51	22	29.73	17	22.97	0	0.00	4	5.41	2	2.70	0	0.00	19	25.68	74
Bonbonon	10	13.33	30	40.00	28	37.33	4	5.33	0	0.00	0	0.00	1	1.33	2	2.67	75
Bunawan	0	0.00	43	61.43	15	21.43	2	2.86	2	2.86	0	0.00	2	2.86	6	8.57	70
Acmac	6	8.11	25	33.78	16	21.62	9	12.16	2	2.70	3	4.05	6	8.11	7	9.46	74
Total	**28**	**7.73**	**136**	**37.57**	**93**	**25.69**	**24**	**6.63**	**10**	**2.76**	**8**	**2.21**	**14**	**3.87**	**49**	**13.54**	**362**

Data Source: EIA Perception Survey 2019

Table 2.4-44. Impact Barangays: Primary Earner in the Family

Barangay	Asawang Lalake		Asawang Babae		Anak na Lalaki		Anak na Babae		Lalaking Kamag-anak		Babaeng Kamag-anak		Iba pa		No Answer		Total No. of HH surveyed
	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	
Dalipuga	40	57.97	17	24.64	2	2.90	5	7.25	0	0	0	0.00	1	1.45	4	5.80	69
Kiwalan	43	58.11	12	16.22	0	0.00	1	1.35	0	0	0	0.00	1	1.35	17	22.97	74
Bonbonon	46	61.33	19	25.33	0	0.00	3	4.00	0	0	0	0.00	4	5.33	3	4.00	75
Bunawan	54	77.14	1	1.43	0	0.00	1	1.43	0	0	1	1.43	0	0.00	13	18.57	70
Acmac	36	48.65	10	13.51	1	1.35	0	0.00	1	1.35	6	8.11	1	1.35	19	25.68	74
Total	**219**	**60.49**	**59**	**16.29**	**3**	**0.83**	**10**	**2.76**	**1**	**0.28**	**7**	**1.93**	**7**	**1.93**	**56**	**15.47**	**362**

Data Source: EIA Perception Survey 2019

Community Services

Water – Based on the survey, an accounted 32.04% of households use *"sariling patubigan"* for source of water supply. Although 9.39% of the total respondents opted not to answer, it can also be noted that 12.15% of the respondents use deepwell 10.49% use other sources of water supply.

Table 2.4-45. Impact Barangays: Source of Water Supply

Barangay	Sariling patubigan		Nakikiigib		Deep well		Artesian Well		Shallow Well		Dug Well		Ilog/Sapa/Batis		Bottled Water/Distilled		Others		No Answer		Total No. of HH surveyed
	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	
Dalipuga	17	24.64	5	7.25	14	20.29	1	1.45	0	0	0	0	0	0	4	5.80	5	7.25	23	33.33	69
Kiwalan	48	64.86	18	24.32	2	2.70	1	1.35	0	0	1	1.35	0	0	0	0	1	1.35	3	4.05	74
Bonbonon	7	9.33	31	41.33	6	8.00	0	0	17	22.67	2	2.67	0	0	11	14.67	0	0	1	1.33	75
Bunawan	36	51.43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	32	45.71	2	2.86	70
Acmac	8	10.81	30	40.54	22	29.73	5	6.76	0	0	0	0	0	0	4	5.41	0	0	5	6.76	74
Total	**116**	**32.04**	**84**	**23.20**	**44**	**12.15**	**7**	**1.93**	**17**	**4.70**	**3**	**0.83**	**0**	**0**	**19**	**5.25**	**38**	**10.49**	**34**	**9.39**	**362**

Data Source: EIA Perception Survey 2019

Power – Majority of the households in the 5 barangays have their own legal power connection while those without total to 3.59%, most of which come from Barangay Acmac with 6.76% of the households. Data on Source of Electricity of respondents can be seen in **Table 2.4-46** below.

Table 2.4-46. Impact Barangays: Availability of Electricity

Barangay	Oo		Wala		No Answer		Total No. of HH surveyed
	# of HH	%	# of HH	%	# of HH	%	
Dalipuga	62	89.86	0	0.00	7	10.14	69
Kiwalan	70	94.59	4	5.41	0	0.00	74
Bonbonon	74	98.67	1	1.33	0	0.00	75
Bunawan	66	94.29	3	4.29	1	1.43	70
Acmac	63	85.14	5	6.76	6	8.11	74
Total	**335**	**92.54**	**13**	**3.59**	**14**	**3.87**	**362**

Data Source: EIA Perception Survey 2019

Availability of Comfort Rooms – It can be noted that majority of the household respondents have their own comfort room.

Table 2.4-47. Impact Barangays: Availability of Comfort Rooms

Barangay	Meron		Wala		No Answer		Total No. of HH surveyed
	# of HH	%	# of HH	%	# of HH	%	
Dalipuga	57	82.61	3	4.35	9	13.04	69
Kiwalan	70	94.59	1	1.35	3	4.05	74
Bonbonon	60	80.00	13	17.33	2	2.67	75
Bunawan	58	82.86	9	12.86	3	4.29	70
Acmac	68	91.89	0	0.00	6	8.11	74
Total	**313**	**86.46**	**26**	**7.18**	**23**	**6.35**	**364**

Data Source: EIA Perception Survey 2019

Solid Waste Disposal – Majority of the respondents stated that solid wastes are being collected once a week. See **Tables 2.4-48** and **2.4-49**.

Table 2.4-48. Impact Barangays: Availability of Garbage Collection

Barangay	May nangungulekta		Hukay sa loob ng bakuran		Tinatapon sa ilog		Sinusunog		Iba pa		No answer		Total No. of HH surveyed
	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	
Dalipuga	62	89.86	0	0	0	0	0	0	0	0	7	10.14	69
Kiwalan	31	41.89	38	51.35	0	0	4	5.41	0	0	1	1.35	74
Bonbonon	5	6.67	34	45.33	1	1.33	30	40	1	1.33	4	5.33	75
Bunawan	0	0	36	51.43	2	2.86	11	15.71	21	30	0	0	70
Acmac	15	20.27	48	64.86	0	0	2	2.70	3	4.05	6	8.11	74
Total													**362**

Data Source: EIA Perception Survey 2019

Table 2.4-49. Impact Barangays: Schedule of Garbage Collection

Barangay	Araw-araw		2-3 beses kada lingo		Isang beses sa isang lingo		Regular		Iba pa		No answer		Total No. of HH surveyed
	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	
Dalipuga	0	0	4	5.79	49	71.01	1	1.45	0	0	15	21.74	69
Kiwalan	42	56.76	0	0	30	40.54	1	1.35	1	1.35	0	0	74
Bonbon	20	26.67	24	32	5	6.67	25	33.33	0	0	1	1.33	75
Bunawan	5	7.14	25	35.71	20	28.57	19	27.14	1	1.43	0	0	70
Acmac	7	9.46	26	35.14	27	36.49	4	5.40	4	5.41	6	8.11	74
Total	**74**	**20.44**	**79**	**21.82**	**131**	**36.19**	**50**	**13.81**	**6**	**1.66**	**22**	**6.08**	**362**

Data Source: EIA Perception Survey 2019

Health

- ***Sickness in the Family***

Table 2.4-50. Impact Barangays: History of having sick family members for the past 3 years

Barangay	Oo		Hindi		No Answer		Total
	# of HH	%	# of HH	%	# of HH	%	# of HH surveyed
Dalipuga	39	56.52	15	21.74	15	21.74	69
Kiwalan	24	32.43	48	64.86	2	2.70	74
Bonbon	64	85.33	10	13.33	1	1.33	75
Bunawan	34	48.57	36	51.43	0	0.00	70
Acmac	49	66.22	18	24.32	7	9.46	74

Data Source: EIA Perception Survey 2019

Table 2.4-51. Impact Barangays: Year of having Sick family members

Barangay	2019		2018		2017		No Answer		TOTAL # of HH surveyed
	# of HH	%	# of HH	%	# of HH	%	# of HH	%	
Dalipuga	0	0.00	0	0.00	0	0.00	69	100.00	69
Kiwalan	0	0.00	0	0.00	0	0.00	74	100.00	74
Bonbon	0	0.00	0	0.00	0	0.00	75	100.00	75
Bunawan	0	0.00	0	0.00	0	0.00	70	100.00	70
Acmac	0	0.00	0	0.00	0	0.00	74	100.00	74

Data Source: EIA Perception Survey 2019

Table 2.4-52. Impact Barangays: Number of family members who got sick in Iligan

Barangay	1		2		3		4		5		Higit pa		No Answer		Total # of HH surveyed
	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	
Dalipuga	15	21.74	7	10.14	3	4.35	0	0.00	0	0.00	5	7.25	39	56.52	69
Kiwalan	15	20.27	9	12.16	1	1.35	1	1.35	0	0.00	0	0.00	48	64.86	74
Bonbon	24	32.00	31	41.33	2	2.67	4	5.33	3	4.00	1	1.33	10	13.33	75
Bunawan	24	34.29	9	12.86	1	1.43	0	0.00	0	0.00	0	0.00	36	51.43	70
Acmac	36	48.65	8	10.81	0	0.00	0	0.00	0	0.00	0	0.00	30	40.54	74

Data Source: EIA Perception Survey 2019

Table 2.4-53. Impact Barangays: Type of Diseases

Barangay	Gastrointestinal Diseases		Pag ubo/sipon		Lagnat		Skin Disease		Upper Respiratory Diseases		Hereditary Diseases		Heart Diseases		Cancer		Others		No Answer		Total # of HH surveyed
	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	
Dalipuga	2	2.90	41	59.42	6	8.70	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	1	1.45	19	27.54	69
Kiwalan	0	0.00	6	8.11	13	17.57	1	1.35	1	1.35	0	0.00	1	1.35	0	0.00	3	4.05	49	66.22	74
Bonbon	0	0.00	29	38.67	30	40.00	1	1.33	0	0.00	0	0.00	0	0.00	1	1.33	5	6.67	9	12.00	75
Bunawan	0	0.00	15	21.43	9	12.86	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	10	14.29	36	51.43	70
Acmac	0	0.00	23	31.08	19	25.68	0	0.00	0	0.00	1	1.35	0	0.00	0	0.00	1	1.35	30	40.54	74

Data Source: EIA Perception Survey 2019

- ***Where do they Consult When Sick***

Table 2.4-54. Impact Barangays: Place of Treatment

Barangay	Bahay		Barangay Health Center		Government Hospital		Private Clinic		Herbalist/ Traditional Medicine		Iba pa		No Answer		Total # of HH surveyed
	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	
Dalipuga	3	4.35	20	28.99	24	34.78	6	8.70	0	0.00	0	0.00	16	23.19	69
Kiwalan	7	9.46	28	37.84	8	10.81	2	2.70	0	0.00	0	0.00	29	39.19	74
Bonbon	3	4.00	40	53.33	20	26.67	3	4.00	0	0.00	1	1.33	8	10.67	75
Bunawan	0	0.00	9	12.86	8	11.43	10	14.29	7	10.00	0	0.00	36	51.43	70
Acmac	1	1.35	41	55.41	19	25.68	3	4.05	1	1.35	1	1.35	8	10.81	74

Data Source: EIA Perception Survey 2019

Perception of the Community

- **Knowledge About the Proposed Project**

Table 2.4-55. Impact Barangays: Knowledge about the Project

Barangay	Oo		hindi		No Answer		Total # of HH surveyed
	# of HH	%	# of HH	%	# of HH	%	
Dalipuga	55	79.71	7	10.14	7	10.14	69
Kiwalan	70	94.59	3	4.05	1	1.35	74
Bonbon	51	68.00	21	28.00	3	4.00	75
Bunawan	5	7.14	29	41.43	36	51.43	70
Acmac	68	91.89	0	0.00	6	8.11	74

Data Source: EIA Perception Survey 2019

Table 2.4-56. Impact Barangays: Source of Knowledge about the Project

Barangay	Kapitbahay		Barangay		IEC ng may ari ng proyekto		Media		Iba pa		No Answer		Total # of HH surveyed
	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	
Dalipuga	0	0.00	50	72.46	0	0.00	1	1.45	1	1.45	17	24.64	69
Kiwalan	0	0.00	71	95.95	0	0.00	0	0.00	0	0.00	3	4.05	74
Bonbon	8	10.67	40	53.33	0	0.00	1	1.33	1	1.33	25	33.33	75
Bunawan	2	2.86	2	2.86	0	0.00	0	0.00	0	0.00	66	94.29	70
Acmac	0	0.00	70	94.59	1	1.35	0	0.00	0	0.00	3	4.05	74

Data Source: EIA Perception Survey 2019

- **Perceived Impacts**

Table 2.4-57. Impact Barangays: Benefits of the Project

Barangay	Pag-unlad ng serbisyo ng tubig		Kabuhayan at negosyo		Buwis sa kalupaan		Pagpapaayos ng kalsada at imprastraktura		Pag-aayos ng serbisyo ng gobyerno		Iba pa		No Answer		Total # of HH surveyed
	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	
Dalipuga	2	2.90	29	42.03	1	1.45	11	15.94	5	7.25	0	0.00	21	30.43	69
Kiwalan	6	8.11	61	82.43	0	0.00	4	5.41	1	1.35	0	0.00	2	2.70	74
Bonbon	11	14.67	29	38.67	4	5.33	5	6.67	2	2.67	0	0.00	24	32.00	75
Bunawan	0	0.00	2	2.86	0	0.00	0	0.00	0	0.00	0	0.00	68	97.14	70
Acmac	17	22.97	23	31.08	6	8.11	0	0.00	23	31.08	1	1.35	4	5.41	74

Data Source: EIA Perception Survey 2019

Table 2.4-58. Impact Barangays: Bad Effects of the Project

Barangay	Kalusugan at seguridad		Pagkaubos ng puno at halaman		Epekto sa hangin at lupa		Pagdagdag ng basura		Paglala ng trapiko		Iba pa		No Answer		Total # of HH surveyed
	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	# of HH	%	
Dalipuga	6	8.70	0	0.00	21	30.43	0	0.00	0	0.00	0	0.00	42	60.87	69
Kiwalan	70	94.59	1	1.35	1	1.35	0	0.00	0	0.00	0	0.00	2	2.70	74
Bonbon	50	66.67	0	0.00	7	9.33	0	0.00	0	0.00	2	2.67	16	21.33	75
Bunawan	3	4.29	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	67	95.71	70
Acmac	64	86.49	0	0.00	3	4.05	0	0.00	2	2.70	1	1.35	4	5.41	74

Data Source: EIA Perception Survey 2019

Perceptions and Attitude Towards the Project

Public participation was observed through the Pre-Public Scoping IEC, the Public Scoping proper and perception surveys.

A matrix summary of issues/suggestions raised during the public scoping in **Barangay Kiwalan Covered Court** last 20 February 2019 is shown in **Table 2.4-59.**

Table 2.4-59. Matrix Summary of Issues and Concerns Raised in the Public Scoping

EIA Module	Issues/Suggestions Raised by Stakeholder	Sector or Representative Who Raised the Issue/ Suggestion	Proponent's Response
Land	Kung mag increase ang inyong clinker ug quarry production mo increase/expand pud ba ang inyong land area na sakupon sa inyo project?	**City Engineering Office - Iligan**	Dili mi mag expand sa among land area, within lang ang expansion na among plano buhaton sa among existing na land ug current MPSA.
	Maapil ba ang property ni Datu Sarep sa expansion sa quarry area? I-relocate ba si Datu Sarep sa lain na lugar?	**Brgy Captain Omar Cader - Bonbonon**	Walay expansion sa land area ang motaas lang ang kadaghanon sa limestone na iquarry sulod ra gyapon sa Republic Cement MPSA area.
	Is the Plant Area titled? Where is the specific location of the expansion Are there school affected?	**DEP ED Region 10**	Will be expanding on the same area. No school will be affected nor located within the quarry area or near the quarry area.
Water	Naa bay effect ang expansion project sa water quality sa dagat?	**Committee on Health**	Part siya sa scope sa technical study
Air	Panalagsa naay abog sa among lugar ug naa pud uban na bata nagsakit	**Purok President**	Apil siya sa study na among pagkabuhaton ug I present pud ang result sa public hearing puhon
	Unsay epekto sapag increase ug capacity sa hangin ug yuta ug unsa ang mga preventive measures?	**Brgy Captain Omar Cader - Bonbonon**	Noted among iapil sa study ug matubag imong concern puhon sa public hearing
	Worry on Air pollution impact to our students. Air should be measured not only in the existing area but to the nearest vicinities. Do you have an estimated range of emission? Include also Hazardous waste immitted	**DEP ED REGION 10**	Noted. It is included in the study
People	Advantageous sa mga barangays ug mga katawhan ang proposed expansion project?	**Committee on Health**	Advantageous sa mga barangay ug sa mga katawhan ang proposed expansion project ky mutaas pud ang pundo sa SDMP sa host barangay ug mudaghan pud ang makatrabaho
	Ang 5 pillars sa SDMP focus lang specific barangay or para sa tanang barangay?	**Committee on Health**	Ang SDMP para sa host community ang para sa uban na barangay na dili sakop naa mi programa na ginatawag na CSR (corporate social responsibility).
Others	Ingon ninyo na mag increase mo ug clinker production, apil ba sa increase ang importation sa clinker? ug possible ba na modaghan ang mga dagkong barko sa kadagatan na pwedeng hinungdan ug safety issue.	**Purok 8 President Dhito Macatol**	Mao ng mag increase mi clinker capacity para mabawasan kung dili mawala ang importation sa clinker para kami na mismo ang magproduce sa among kaugalingon na clinker.
	Dapat iconsider pud ang noise sap ag conduct sa study na possible mahitabo pag mag increase na ug capacity	**Committee on Health**	Apil siya sa study na pagabuhaton

SECTION 3.0. IMPACT MANAGEMENT PLAN (IMP)

3.1 IMPACT MANAGEMENT PLAN

The IMP herein discussed is consistent with the EPEP.

The current Impact Management Plan of RCMI and the additional potential impacts from the expansion project are herein identified.

- **PRE-CONSTRUCTION**

Inasmuch as only non-destructive survey activities are conducted and the securing of necessary clearances and permits are undertaken during this phase there are no identified impacts. There are no settlers and no land use issues are associated with the project.

- **CONSTRUCTION**

Land

Construction will all be within the Cement Plant Complex where there are no forests nor wildlife and no trees to be cut as the facility is already existing. The existing plant is already cleared of vegetation except for the landscaping. No faunal species are present.

During the construction phase, land clearing could disturb the floral and faunal species at the project site and impact areas. This could result to vegetation loss and movement and/or loss of wildlife species arising from the loss of habitat and source of food.

Site clearing and earthmoving could give rise to potential soil erosion and siltation around the site. There could also be land/soil contamination if improper waste management and disposal occurs..

Uses of heavy-duty machines and equipment can result to accidental oil spills and contamination of soil/land.

As mitigating measures, the proponent must ensure to avoid cutting trees especially endangered species that may be affected. Tree balling, if feasible, revegetation and enhancement of buffer zone and the construction/installation of culverts at selected portions of the quarry area access for ground vertebrate to migrate and cross through.

Also proper training of vehicle operators especially on spill prevention and containment will be observed.

Water

The project expansion of the quarry areas could add to the generation of silt and sedimentation. This in turn could also increase the potential for water contamination on Iligan Bay, e.g. by transport of sediments which could alter the turbidity and Total Suspended Solids (TSS) of the water. Domestic waste water generation could also lead to increase in BOD loading and coliform level.

The construction work areas have proper toilet facilities for the workers, e.g. portable toilets ("portalets") for use even on temporary basis. Wastes from the portalets are disposed outside of the project through the engagement of an accredited Disposal Entity.

No significant quantities of liquid hazardous wastes will be generated. Spent chemicals from the laboratory will be collected and disposed complying with the IRR of RA 6969.

Air

The construction phase of the project could contribute to air pollution. Fugitive dust particles will be generated during excavation and transport of materials and wastes. One of the preventive options the trucking contractor could observe is to cover the haul trucks with for example, tarpaulins. Further, the wetting of the access/haul roads would significantly prevent dust generation from the road/ground.

People

The residents of the near barangays will be given work/employment opportunities, if they are qualified.

The construction company shall employ a Safety Engineer to oversee health hazards over the personnel all throughout the construction phase. First aid kit shall be made available at all times at the project site. Mitigation will include observance of safety practices and training of construction workers.

- **OPERATIONS PHASE**

Land

Impacts will involve the quarrying operation. Land forms will be altered and ore will naturally be extracted irreversibly from the ground. The quarrying activities will be implemented strictly in accordance with the clearances from and commitments to the Mines and Geosciences Bureau (MGB)
Water

The potential main concern during this phase is sedimentation and siltation from the stockpiles which could potentially migrate to Iligan Bay. However, the national road between the sites and the Bay serves as an effective buffer to prevent such impact.

Waste water including potential oil spillages are duly recognized in the plant facilities. In plant waste water treatment facilities as now existing will be enhanced, if necessary, and continued to be employed.

Air

Quarrying and the transport by land of ore could give rise to fugitive dusts. Coal used for heating purposes would also generate CO_2 during its combustion.

The Environmentally Sensitive Receptors (ESRs) are, however, distant from the site of activities as shown in the Air Dispersion Modeling Report on Section 2.3.

People

Workers will be needed during the operation phase. Opportunities of work and business partnerships, which could include the small establishments, are considered at this stage.

Safety and health risk also matters during operation phase; the possibility of accidents cannot be minimized. However, the safety records of the Company reflect that this concern could be effectively managed.
Workers must be compelled to wear at all times during working hours the provided Personal Protective Equipment (PPE). The Company's Organization shall include a Pollution Control Officer/Safety Engineer to oversee health and environmental hazards /concerns.

The Impacts Management Plan is provided in **Table 3-1.**

Table 3-1 The Impacts Management Plan (IMP)

Project Phase / Environmental Aspect	Environmental Component Likely to be Affected	Potential Impact	Options for Prevention or Mitigation* or Enhancement	Responsible Entity	Cost	Guarantee / Financial Arrangements
I- PRE CONSTRUCTION PHASE: No activities that would result in significant impacts.						
II- CONSTRUCTION PHASE						
Site Clearing, Removal of vegetative cover, Excavation	Land	Potential disturbance of the floral and faunal species.	Construction will all be within the Cement Plant Complex where there are no forests nor wildlife and no trees to be cut as the facility is already existing. The existing plant is already cleared of vegetation except for the landscaping. No faunal species are present. Avoid landscaped areas as much as possible. In case there are few trees to be affected, secure tree cutting permit and compliance on the replacement of removed vegetation (1:50)	Project Proponent / Contractor	1 MPhp and part of Contractor's Scope of Work	Contractor's Approved Purchased Order (PO)
	Land	Loss of vegetation, Movement and/or loss of wildlife species aggravated by the loss of habitat and food for survival	- Re-vegetation and enhancement of buffer zone. - For the Cement Plant Complex, there are no trees to be cut as the facility is already existing. Moreover, the proposed expansion or construction of additional plant facilities is to be done within the existing plant, which is already cleared of vegetation except for the landscaping. No faunal species are present.	Project Proponent / Contractor		
	Water	Potential impact to Iligan Bay due to soil erosion, siltation, and flow of storm water runoff.	- Maintain appropriate setback distances from Iligan Bay for all construction activities that might increase storm water runoff or cause erosion or sedimentation. - Appropriate dumping of soil wastes located into the Mine Waste Dumpsite for temporary storage equipped with siltation ponds. This soil will be used again during road paving and compaction in the future especially at quarry area. - If possible, avoid working outdoors during wet and rainy conditions. - Provision of adequate drainage system to accommodate peak runoff that could contaminate the nearby water bodies and degrade the area. - Install temporary drainage ditches and sediment traps/pond around the construction area to pump out runoff caused by heavy rainfall.	Project Proponent / Contractor		

Project Phase / Environmental Aspect	Environmental Component Likely to be Affected	Potential Impact	Options for Prevention or Mitigation* or Enhancement	Responsible Entity	Cost	Guarantee / Financial Arrangements
	Land	Soil/Land Contamination Due to Improper Waste and/or Garbage Disposal.	- Provide area to stockpile construction wastes before hauling. - Provide proper solid waste disposal. - Implement waste segregation. - Practice good housekeeping.	Project Proponent / Contractor		
Use of heavy vehicles and construction equipment / Use of heavy equipment to transport materials	Land	Potential contamination of soil and nearby water bodies due to accidental spills or releases of fuel or lubricating oils	- The same measures cited above (in the case of soil management) for the management of oils/leaks will be implemented. - Daily monitoring of hydraulic system including the hose which is the main source of any vehicular leaks. - Use dipping pan in case a leak is observed. Equipment with leaks are not authorized to resume unless resolved.	Project Proponent / Contractor	part of Contractor's Scope of Work (Included in 18BPhp Budget)	Contractor's Approved Purchased Order (PO)
	Air	Potential Impacts to Air Quality due to dust emissions	- Covering haulage trucks to control dust emissions before traveling on public roads.- Spray water at least twice a day on unpaved access roads, haulage roads, stockpiles and dust generating areas. - Enforce speed limits (20km/h) to reduce airborne fugitive dust from the vehicular traffic. - Revegetate disturbed areas after disturbance and implement maintenance to ensure growth.	Project Proponent / Contractor		
	Air	Possible increase of noise level (Nuisance)	- Provide silencers and mufflers to minimize noise. - Construction activities should be done only during daytime. - Proper maintenance of the equipment and vehicles.	Project Proponent / Contractor		

Project Phase / Environmental Aspect	Environmental Component Likely to be Affected	Potential Impact	Options for Prevention or Mitigation* or Enhancement	Responsible Entity	Cost	Guarantee / Financial Arrangements
Delivery/ Transport of construction materials	Land / People	Potential damage to Barangay Roads/Right-of-Way Issues	- Rehabilitation of roads that will be damaged will be integral to the responsibilities of the Proponent as well as its Contractor/s. - Right-of-way issues, if any, will have to be resolved first by the Proponent. - Absolutely no activity in any area of conflict unless issue is resolved. - Construction raw materials and additional equipment shall be delivered by suppliers to the plant site through the National Highway, which is a public road, and by sea through RCMI's own port. Hence, no significant RROW issues are foreseen. - Access roads were constructed by RCMI for use of residents living near the plant and/or quarries.	Project Proponent / Contractor	N/A	
	People	Traffic Congestion	- Limit in the use of certain roads specifically for the project. - Programmed dispatch of construction vehicles.	Project Proponent / Contractor		
Equipment refueling, maintenance or operation	Land	Potential contamination of soil and nearby water bodies due to accidental spills or releases of fuel or lubricating oils	- Proper maintenance and regular inspection of vehicles and construction equipment. - Designation of a motorpool wherein refueling and maintenance works will be done and in which area sump pits for oil leaks will be provided. - Facilities for recovery of leaks and storage in drums will be provided. - Collection of used oils in containers for disposal by third party (minimum 6 months and maximum of 1 year) - Proper training of vehicle operators especially on spill prevention and containment.	Project Proponent / Contractor	part of Contractor's Scope of Work (Included in 18BPhp Budget)	Contractor's Approved Purchased Order (PO)
Movement of Workers	Water	Potential increase on BOD_5 loading and coliform level of nearby water body (Iligan Bay) due to generation of wastes by workers.	- Provide temporary facilities ("portalets") for workers. - Strictly impose on the contractors and its workers to observe proper waste disposal and proper sanitation. - Sanitation including the sludge collection of the portalets will be weekly or twice a week (depend on the actual usage/volume of sludge). 3rd party sludge transporter should be registered/authorized by DOH and EMB. - Conduct Quarterly Effluent Monitoring	Project Proponent / Contractor	Php 27,000 / quarter	AEPEP
	People	In-migration because of increased business and livelihood opportunities	Prioritizing the hiring of construction workers to local residents and those in the impact areas of the project.	Project Proponent	N/A	

Project Phase / Environmental Aspect	Environmental Component Likely to be Affected	Potential Impact	Options for Prevention or Mitigation* or Enhancement	Responsible Entity	Cost	Guarantee / Financial Arrangements
	People	Increase in indirect revenues	- Local qualified contractors will be given priority. - Positive impact.	Project Proponent	N/A	
	People	Competition in the use of resources, principally water availability.	No competition of water resource during this phase as the water requirements for construction is minimal and can be sourced from RCMI's existing deepwell. The domestic water as well as drinking water supply for the workers shall be sourced from the local concessionaire.	Project Proponent	N/A	
	People	Physical injuries arising from accidents such as: - Being hit by falling weak structures - Being overrun by heavy equipment	- Daily toolbox meeting should be strictly imposed. - Workers must be compelled to wear at all times during working hours (usually 8hours) the Provided Personal Protective Equipment (PPE). - The construction company shall have a Safety Engineer to oversee health hazards over the personnel all throughout the construction phase. - First aid kit shall be made available at all times at the project site. - Observance of safety practices and training of construction workers. - Established Emergency Preparedness and Response Program including regular emergency drills. - Good housekeeping practices.	Project Proponent / Contractor	Part of PhP 10MPhp /year S&H costs	Contractor's scope of work
	People	Occurrence of sickness & diseases in workers and community.	There are no specific elements of the project during the construction phase that may cause sicknesses and diseases that can spread to the communities.	Project Proponent / Contractor	Part of PhP 10M/year S&H costs	Contractor's scope of work
Operations Phase						
QUARRIES						
Quarry Operations	Land	Change in geology / Depletion of Ore	- Comply with development plan - Progressive rehabilitation and re-vegetation of mined out quarries and planting in idle lots - Utilize the recovered topsoil that was stored in waste dump for future rehabilitation and re-vegetation.	Project Proponent / Contractor	Php 185,400	AEPEP

Project Phase / Environmental Aspect	Environmental Component Likely to be Affected	Potential Impact	Options for Prevention or Mitigation* or Enhancement	Responsible Entity	Cost	Guarantee / Financial Arrangements
	Land	Change in topography/ landform	- The area will be re-contoured and stabilized during rehabilitation. - Proper benching and installation of bench drainage to prevent soil erosion. - Installation of coconet and planting of creeping vines to improve the slope stability. - Avoidance of very steep slopes whenever necessary and practical. - Compliance to the Final Mine Rehabilitation and Decommissioning Plan (FMRDP). The progressive nature of quarrying, which is inherent with the project, provides the major mitigation measures. Progressive rehabilitation and enhancement work such as:· • Providing for green areas, tree planting, • Installation of drainage and sewerage system and other activities should be expected to leverage to a certain degree the adverse effects.	Project Proponent / Contractor	Php 225,400	AEPEP
	Land	Potential Rockslides/ Landslides / Mass Movement	- Maintaining slope stability by proper engineering measures. - Reduction of cut slopes by terracing - Prevention of increase in internal water pressure by vegetation cover - - Adequate drainage control	Project Proponent / Contractor	Php 194,800	AEPEP
	Land / Water	Potential inducement of flooding	- Installation and proper maintenance of drainage system. - Water and silt in settling ponds monitored. Silt content should not exceed 50% of its capacity. - Desilting is done regularly, and more frequent or as needed during rainy season.	Project Proponent / Contractor	Php 96,800	AEPEP

Project Phase / Environmental Aspect	Environmental Component Likely to be Affected	Potential Impact	Options for Prevention or Mitigation* or Enhancement	Responsible Entity	Cost	Guarantee / Financial Arrangements
	Water	Potential impact to water quality of nearby creeks and Iligan Bay due to erosion, siltation, and flow of storm water runoff.	- Unnecessary removal of overburden and vegetative cover is avoided. - As much as possible, all major clearing and stripping of the overburden shall start at the dry season - The stripped topsoil are being handled properly - Waste materials coming from the overburden were not dumped on natural drainage ways. Established dumpsite in strategic locations are far from the drainage ways. - Provision of adequate drainage system to accommodate peak runoff that could contaminate the nearby water bodies and degrade the area. - Drainage system around bare areas are designed to direct runoff water to settling ponds and capture the sediments. There are 9 ponds in the quarries, each w/ capacity of 2,000 m^3. - 1 settling pond to be added in the limestone area for the proposed increase in production rate. - Regular de-silting of the sedimentation ponds are employed quarterly but more frequently or as needed during rainy season. This is done when silt level reaches 50% of pond capacity. Freeboard marker installed. - Erosion control measures such as slope stabilization. - Proper benching and installation of bench drainage to prevent soil erosion. - Installation of coconet and planting of creeping vines to improve the slope stability. - Avoidance of very steep slopes whenever necessary and practical. - Maintain appropriate setback distances from water bodies for all quarrying activities that might increase storm water runoff or cause erosion or sedimentation. - Quarterly Monitoring of Effluent	Project Proponent / Contractor	Php 301,800	AEPEP
	Air	Potential impact to Air Quality due to dust and noise emission	**EXISTING** - Proper maintenance of the quarry equipment are imposed to reduce dust and noise. - Watering of unpaved roads done twice a day **ADDITIONAL MEASURES** - Control measures outside the facility especially the quarry area is recommended such as periodic watering of roads, minimizing generation and	Project Proponent / Contractor	Php 277,700	AEPEP

Project Phase / Environmental Aspect	Environmental Component Likely to be Affected	Potential Impact	Options for Prevention or Mitigation* or Enhancement	Responsible Entity	Cost	Guarantee / Financial Arrangements
			resuspension of dust particles. Area source dust abatement such as water sprinkling and planting vegetations as green buffer zone in the cement manufacturing operation is also recommended to control dust resuspension.			
	Water	Disruption of groundwater / aquifer	- Based on geo-hydrological study, clastics and limestone can be quarried provided that a minimum of 10m of cover on top of the aquifer is maintained to serve as protection. - Deep-ripping of compacted soil surfaces. - Avoiding the penetration of aquifers below the limestone deposits. Quarrying conducted above the natural springs w/ buffer of at least 50m. The final pit bottom will be at +60 masl for limestone and at +30 masl for shale, which are both above the level of known aquifers/springs. - Controlled blasting employed all the time - Conducted geo-resistivity study	Project Proponent / Contractor	Part of Quarry Contractors Scope	Contractor's Approved Purchased Order (PO)
	People	Increase in manpower/ employment opportunities and increase in average income	Positive impact, thus, no mitigation **Existing manpower:** RCMI: 166 for both the plant and the quarries. Quarrying - Delta Earthmovers – 68 Other Contractors: 745 **Proposed expansion:** Construction phase for additional plant facilities: 1,000 RCMI: 184 (additional 18) Quarrying - Delta Earthmovers – 68 (same) Other Contractors: 745 (same)	Project Proponent / Contractor	N/A	
	People	Increase in the income of the national as well as local government units	Positive impact, thus, no mitigation	Project Proponent	N/A	

Project Phase / Environmental Aspect	Environmental Component Likely to be Affected	Potential Impact	Options for Prevention or Mitigation* or Enhancement	Responsible Entity	Cost	Guarantee / Financial Arrangements
	Land	Soil/Land Contamination due to improper disposal of earth/land spoils.	- Provide temporary stockpile for overburden and store it at designated mine waste dumpsite equipped with siltation ponds. - Proper maintenance of the mine waste dumpsite in terms of slope stability, sufficient drainage, temporary vegetative cover, etc. - The stored mine wastes shall be used as backfill materials during the rehabilitation of mined-out areas and other earthworks such as in road maintenance, berms, etc. - Practice good housekeeping.	Project Proponent / Contractor	Php 270,000	AEPEP
Use of heavy vehicles and mining equipment in quarrying/ hauling	Water	Potential oil leaks/spills, which may impact on the quality of the nearby water bodies	The same measures cited above (in the case of soil management) for the management of oils/leaks will be implemented.	Project Proponent / Contractor	NA	
Land Clearing	Land	Removal of the overburden, loss of topsoil	Only areas that are identified to be quarried are to be cleared. - Comply with development plan - Progressive rehabilitation and re-vegetation of mined out quarries and planting in idle lots - Utilize the recovered topsoil that was stored in waste dump for future rehabilitation and re-vegetation. - Topsoil will be replaced during progressive rehabilitation. Existing Active Disturbed Areas: 76.438 ha Additional Areas to be Cleared: 81.432 Total Area: 157.87 ha Topsoil to be backfilled is 0.5 meters thick X 1,313,837.27 m^2 = 656,919 m^3 *Note: For the area to be backfilled using topsoil, the total area is only 131.3837 hectares since we only considered to backfill the benches (bench widths) and we excluded other areas for backfilling such as slopes and drainage canals per bench.*	Project Proponent / Contractor	Php 301,800	AEPEP

Project Phase / Environmental Aspect	Environmental Component Likely to be Affected	Potential Impact	Options for Prevention or Mitigation* or Enhancement	Responsible Entity	Cost	Guarantee / Financial Arrangements
	Land	Major disturbance of the mini forest cover with impacts on the terrestrial ecology - Loss of flora and fauna	- Avoidance of tree cutting or disturbance to the extent possible especially when endangered species may be affected. - Progressive rehabilitation, re-vegetation, and enhancement of mined-out quarries, idle lots, and buffer zone. - Vegetation loss will be replaced in the progressive rehabilitation program at 1:50 cut and plant ratio. - Additional Area to be Cleared for Expansion Project = 81.432 ha; - Additional trees to be cut = 8,150 to 12, 215 (100-150 trees/hectare cleared) - Expanded National Greening Program, Mangrove Rehabilitation Project and Mine Forest Program in the quarries, plant, as well as areas outside the project site. - Utilize the recovered topsoil that was stored in waste dump for future rehabilitation and re-vegetation. - As an example, overburden that was stripped from shale quarry at AQL 41(5) was delivered directly to the southern portion to be used for re-soiling at elevation 40msl. Similar procedure to be practiced prospectively. - Establishment/maintenance of at least one plant nursery. - Consultant forester will be hired when the rehabilitation starts - Construction/installation of culverts at selected portions of the mine access for ground vertebrate to migrate and cross through. - Conduct annual biodiversity monitoring/assessment Prior to land clearing operations within the mine expansion area, the proponent will conduct tree inventory following FMB Technical Bulletin and in coordination with DENR-CENRO, which will be the basis for application of Special Tree Cutting and/ or Earthballing Permit. Once the STCP is issued by the DENR, the Proponent shall abide by all the conditionalities as set forth in said STCP, particularly the tree replacement following the guidelines under DENR Memo Order No. 2012-02 dated November 05, 2012 in order to replace standing trees affected by the clearing operations. In the case of coconuts, cutting permit shall be secured from PCA.	Project Proponent / Contractor	Php 211,600	AEPEP

Project Phase / Environmental Aspect	Environmental Component Likely to be Affected	Potential Impact	Options for Prevention or Mitigation* or Enhancement	Responsible Entity	Cost	Guarantee / Financial Arrangements
			The Proponent will include discussions on wildlife conservation in compliance to RA 9147 and its IRR based on the results of Terrestrial Ecology assessment and shall be incorporated in the formulation of the EMP and EMoP. This can be done or implemented under Annual Environmental Protection and Enhancement Program (AEPEP) Results of the biodiversity assessment conducted by IIT will be incorporated in the discussions on biodiversity parameters during project operation vs. baseline data as contained in the EIS. *Note: TB 2016-04 of 02 December 2016 is duly noted. This refers to the conduct of Protected Area Suitability Assessment (PASA), and therefore apparently not relevant to the Project since it is not sited as an E-NIPAS area.*			
BLASTING	Land / Water	Possible damage to caves no. 5 and 9 (Matu-ug Cave) and disruption of the groundwater resource contained in No. 9, which is tapped by the City's water district..	- Caves No. 5 and No. 9 are located in other parcels of MPSA-104, which are outside of the quarry areas. - Absolutely no blasting near caves - Blasting done in 80% of limestone, and none in shale quarrying	Project Proponent / Contractor	Part of Contractor's Scope	Contractor's Approved Purchased Order (PO)
	Land	Physical injuries or damage to property due to fly rocks.	- All residents are periodically informed of blasting schedule. Notices sent to the barangay, PNP & MGB 3 days before blasting. Siren provided at the quarry and nearby residential areas. - Blasting is concentrated to hard limestone deposits only and is limited to day time.	Project Proponent / Contractor		
	Land	Ground vibration	- Controlled blasting method employed. - Blasting pattern planned beforehand and ground vibration is measured, recorded and reported to MGB	Project Proponent / Contractor		
	Water	Disruption quantity and quality of aquifers (esp. shallow water wells).	- Controlled blasting is adopted - Blasting pattern planned beforehand and ground vibration is measured, recorded and reported to MGB	Project Proponent / Contractor		

Project Phase / Environmental Aspect	Environmental Component Likely to be Affected	Potential Impact	Options for Prevention or Mitigation* or Enhancement	Responsible Entity	Cost	Guarantee / Financial Arrangements
	Air	Potential impact to Air Quality due to dust and noise emission	- Controlled blasting is adopted - Blasting pattern planned beforehand and ground vibration is measured, recorded and reported to MGB	Project Proponent / Contractor		
	Land / Water	Risk of contamination of soil and water from hazardous wastes	- Plant implemented strictly on hazardous waste management program. - Administer proper storage and handling of hazardous wastes. The plant has a Hazardous Waste facility where hazardous waste are temporary stored and managed. - Secondary containment was constructed to prohibit oil/chemical spill, which may lead water/soil/and groundwater contamination - Properly categorize wastes for disposal and further treatment - Allocate staging area to accommodate waste treaters and disposal contractors - Ensure that personnel and equipment needed for oil spill response are always ready.	Project Proponent / Contractor	Php 67,200	MOA from Hazwaste Treater and Transporter
STOCKPILING	Land / Water	Potential Erosion and Siltation	- Properly stockpile and dispose the materials generated from the quarry, silt from settling ponds, and other wastes in permanent, stabilized areas away from any water body and drainage systems maintained in safe and non-polluting conditions. - All topsoil are properly stockpiled upslope and away from other spoils materials. - Strictly effect stabilization and erosion control of the affected side slopes of the roads and nearby gullies and creeks within the project site, as well as the siltation ponds. - All stockpiled soils and spoils were stabilized with temporary vegetation i.e., grasses or plants with good root systems. - Installed sediment traps and drainage ways.	Project Proponent / Contractor	Php 101,200	AEPEP
	Water	Contamination of groundwater due to leaching of stockpile	- Ensure no contamination of groundwater by thorough soil compaction not allowing coal to enter the groundwater instead will be driven to the stockpile siltation ponds. - During rainy season, open coal stockpile should be covered by tarpaulin but not during dry season as it will cause smoldering. - The floor of stockyard is designed as to have curbing along the periphery. This shall prevent the runoff from heaped materials directly running over soil surface.	Project Proponent / Contractor	Php 108,000	AEPEP

Project Phase / Environmental Aspect	Environmental Component Likely to be Affected	Potential Impact	Options for Prevention or Mitigation* or Enhancement	Responsible Entity	Cost	Guarantee / Financial Arrangements
			- Conduct annual groundwater sampling/ monitoring			
HAULING (Including use of heavy vehicles and mining equipment)	Air	Potential impact to Air Quality due to dust and noise emission	- Conducted at least twice (2) a day water spraying along access roads, haul roads, and stockpiles especially during dry season. - Imposed speed limit to 20 kph to minimize airborne dust and ground vibration especially passing thru barangay proper. - Installation of mufflers and other noise suppressor to all vehicle and heavy equipment. - Imposed restriction of hours of activities especially from Site 2. - Regular maintenance of vehicle and heavy equipment as per PMS checklist - Regulated the use of road passing barangay proper- Covering of dump truck using tarpaulin to control dust emissions. - Load limit capacity are strictly implemented and required for hauling contractor. - Regular removal of spillages on haul roads. - Revegetate disturbed areas as soon as possible.	Project Proponent / Contractor	Php 608,600	AEPEP
	Water	Contamination of Iligan bay from fugitive dust during transfer of raw materials	- Same measures as above. - Provide and maintain sufficient drainage along roads and around stockpiles.	Project Proponent / Contractor	Php 92,000	AEPEP
	Air	Increase in noise level	- Mining activities will be done essentially during daytime only - Provide silencers and mufflers to minimize noise - Proper maintenance of the equipment and vehicles - Planting trees that could serve as sound buffers. - Establishment of 20-meter buffer zone of different species combination of plants including shrubs, small and medium-sized trees.	Project Proponent / Contractor	Php 11,200	AEPEP

Project Phase / Environmental Aspect	Environmental Component Likely to be Affected	Potential Impact	Options for Prevention or Mitigation* or Enhancement	Responsible Entity	Cost	Guarantee / Financial Arrangements
Movement of Workers	Water	Impact to water quality of nearby water body (Iligan Bay) in terms of increase in BOD loading and coliform level due to wastewater/sewage generation by workers.	- Provide temporary facilities ("portalets") for workers. - Strictly impose on the contractors and its workers to observe proper waste disposal and proper sanitation. - Sanitation including the sludge collection of the portalets will be weekly or twice a week (depend on the actual usage/volume of sludge). 3rd party sludge transporter should be registered/authorized by DOH and EMB. - Conduct Quarterly Effluent Monitoring	Project Proponent / Contractor	Php 108,000	AEPEP
	Land	Soil/Land Contamination due to improper disposal of solid wastes generated by mining workers	- Implement waste segregation. - Provide proper solid waste disposal system. - Practice good housekeeping.	Project Proponent / Contractor	NA	
CEMENT PLANT						
CEMENT PLANT OPERATIONS (Crushing, Burning, Clinkering, Finish Milling, Packing)	Air	Potential impact to Air Quality due to dust and noise emission	- Conducted daily water spraying and road sweeping on unpaved and cemented roads at Packhouse area.- Installation of exhaust mufflers on vehicles. - Dust collection equipment (rotary drum dryer, bag filter, electrostatic precipitator, etc) installed in all parts of the Cement Plant, Finish Mill and Packhouse) - Landscaping around the buildings/plant to act as dust and noise buffer. - Incorporating noise criteria in the specifications and selection of equipment - Use of effective noise attenuating materials for the plant structure and walling - Planting of the appropriate vegetation as buffer **FOR THE PROPOSED EXPANSION**, a whole new array of dust collecting equipment shall be added to the existing Air Pollution Control Facilities and Devices (See Tables ES-1 and 1-7)	Project Proponent	Php 800,000	EMP

Project Phase / Environmental Aspect	Environmental Component Likely to be Affected	Potential Impact	Options for Prevention or Mitigation* or Enhancement	Responsible Entity	Cost	Guarantee / Financial Arrangements
	Air	Potential impact to Air Quality due to Ambient Emissions (Particulates, NOx, SO_2, CO)	- Replacement and maintenance of Air Pollution Control Facility and Devices as per PMS checklist - Conducts tree planting along plant vicinity to provide a buffer zone. This is part of NGP and MFP project implementation and accomplishment. - Conducts at least twice a day water spraying along quarry road especially during dry season to suppress dust emission. - Mechanical road sweeper with vacuum was utilized to clean the material spillages. This is to reduce manual sweeping, which might result to fugitive dust. - Covering of dump truck using tarpaulin to address the material spillage during transport. - Daily checklist for the mobile equipment is employed including the smoke belching monitoring. - Conducts quarterly monitoring of ambient air at the designated sampling areas. - Turned the idle areas into landscape areas to address fugitive dust when windblown.	Project Proponent	Php 200,000 (New APCD is part of Contractors Scope)	EMP
	Air	Potential impact to Air Quality due to Source Stack Emissions (Particulates)	- Conducted tree planting along plant vicinity to provide a buffer zone. This is part of NGP and MFP project implementation and accomplishment. - Conducted annual stack sampling monitoring for the smoke stack specified at Permit to Operate. - Installed CEMS/COMS at kiln stack and conducted quarterly CGA and annual RATA. - Cement plant shutdown if Electrostatic Precipitator (ESP) fails to work in 20 minutes. **FOR THE PROPOSED EXPANSION**: Replacement/modernization and Maintenance of Air Pollution Control Facilities and Air Pollution Control Devices as per PMS checklist in all areas of the Cement Plant, Finish Mill, Packhouse and other sections of the Plant Complex).	Project Proponent	Php 3,800,000	EMP

Project Phase / Environmental Aspect	Environmental Component Likely to be Affected	Potential Impact	Options for Prevention or Mitigation* or Enhancement	Responsible Entity	Cost	Guarantee / Financial Arrangements
	Air	Potential impact to Air Quality due to GHG Emission	- Monthly and Annual monitoring of GHG specifically CO2 emission using cement sustainability initiative (CSI) standard format. - Initiated NGP and MFP for the CO2 sequestration program. - The plant uses alternative raw material such as fly-ash and other cementitious materials to reduce the clinker consumption and thus reduce the CO2 emission.	Project Proponent	Cost part of quarry NGP program	AEPEP
	Air	Air quality pollution from TSP and PM10 from non-regulated sources (vents, silos, finish mills, fugitive sources)	- Proper operation and following the PMS of dust collectors - Regular compacting of unpaved access roads - Utilize the mechanical road sweeper with vacuum - Formulation and implementation of a motor vehicle maintenance program, including emissions testing - Regular checking and following the PMS for conveyor systems and vents	Project Proponent	Php 800,000	EMP
	Air	Potential impact to Air Quality due to Ambient Noise emission	- Conducts quarterly monitoring of noise pollution at designated sampling areas. - Strictly imposed maintenance of major and auxiliary equipment to reduce maintenance related noise pollution. - Conducted tree planting along plant vicinity to provide a buffer zone. This is part of NGP and MFP project implementation and accomplishment. - Installed wall cladding and enclosure of major equipment to contain the noise.	Project Proponent	Included in Php 200,000	EMP
	Land / Water	Potential contamination of soil and water and creation of foul odor due to solid waste generation	- As an ISO 14000:2015 accredited company, the Plant has rigid solid waste management program. - Trash bins are properly labelled and daily collection was implemented. - Implements on-site waste segregation - The plant has a Material Recovery Facility - Metal scraps and glass/bottles are stored in scrapyard located near the MRF. Periodically sold to scrap buyers. - The scrapyard is located near the MRF and Hazardous Waste Storage - Recyclable bins (Earth Shape) were installed at designated areas. Also donated the Earth Bins to the Barangay, MGB and EMB X. - Daily collection of biodegradable wastes and disposed in compost pits - Residual wastes are disposed daily to Iligan City MRF for a charge of Php 200/m^2.	Project Proponent	Php 180,000	EMP

Project Phase / Environmental Aspect	Environmental Component Likely to be Affected	Potential Impact	Options for Prevention or Mitigation* or Enhancement	Responsible Entity	Cost	Guarantee / Financial Arrangements
	Land / Water	Potential contamination of soil and water due to hazardous waste generation	- Strictly implements hazardous waste management program. - Trash bins are properly labelled and weekly collection was implemented. - The plant has Hazardous Waste facility where hazardous waste are temporary stored and managed. - Secondary containment was constructed to prohibit oil/chemical spill which may lead water/soil/and ground water contamination - Co-processing in the Cement Kiln to use acceptable wastes as alternative fuel & raw material. - Generated/disposed quantity for each type of hazardous wastes is monitored, recorded and reported.	Project Proponent	Php 200,000	EMP
	Water	Pollution of surface water and groundwater	- Quarterly monitoring of static water level of wells. - Conducted quarterly effluent sampling and monitoring. - Installation of oil-water separator in the waterway/canal for the oil & grease. - Constructed mini wastewater treatment for the canteen effluent and fish pond as indicator of good effluent quality.	Project Proponent	Php 360,000	EMP
	Water	Siltation of water bodies	- Daily sweeping of dust and cement spillages on roads using mechanical road sweeper. - Provided adequate drainage with proper maintenance at Packhouse area & pier facilities. - Avoidance of spillage of materials during loading and unloading to/from barge.	Project Proponent		
	Land / Water	Potential contamination of soil and nearby water bodies due to oil spill from vessels and mobile equipment	- Proper disposal of used oil from vessel and from mobile equipment at Packhouse area. - Installed oil water separator at all canal outfalls from Packhouse and Motorpool of Packhouse Contractor - Nearest water bodies, except Iligan Bay, not in impact areas.	Project Proponent	Included in Quarry Cost	AEPEP
	Water	Potential contamination of nearby water bodies with oil and grease and pollutants from	- Installed oil and water separator at all canal outfalls. - Drainage system is well-maintained and monitored. - Immediate clean-up and remediation in case of accidental spill.	Project Proponent	Included in Quarry Cost	AEPEP

Project Phase / Environmental Aspect	Environmental Component Likely to be Affected	Potential Impact	Options for Prevention or Mitigation* or Enhancement	Responsible Entity	Cost	Guarantee / Financial Arrangements
		runoff from the cement plant				
	Land / Water	Potential contamination of soil and water and foul odor due to Solid Waste Generation	- Strict implementation of solid waste management. - Implements solid waste segregation at Packhouse area & pier facilities.		Included in Php 160,000	EMP
	Air	Contribution to climate change from greenhouse gas emission	- Continue current GHG inventory program - Continue the NGP and MFP initiatives	Project Proponent	Cost part of quarry NGP program	AEPEP
	People	In-migration	Prioritizing the hiring of workers to local residents and those in the impact areas of the project. Local qualified contractors will be given priority as well.	Project Proponent	N/A	

Project Phase / Environmental Aspect	Environmental Component Likely to be Affected	Potential Impact	Options for Prevention or Mitigation* or Enhancement	Responsible Entity	Cost	Guarantee / Financial Arrangements
	People	Competition in the use of resources, principally on water availability	- Water use competition is not expected to be significant. - Contractors may draw water from the nearby water bodies and store this in water tanks for use during this phase and for domestic purposes. - Water extraction is within the allocation limits set in the Conditional Water Permits issued by NWRB. - Water pipelines were provided with water meter - Domestic water will be supplied from local concessionaires while drinking water will be from purchased bottled water, which is the case for drinking purposes. **FOR EXISTING SET-UP**, the water requirements for the project is 703.3 m3/day. **FOR PROPOSED EXPANSION**: This shall be increased to 3,100 m3/day for the proposed increase in quarry and plant production rates. This is taken from the 2 existing deep wells with rated discharge of 385 gpm or 87.6 m3/hr. No additional deep wells to be constructed. The process and the mining operation are dry in nature. Water requirements are for the plant and the sprinkling of dusty roads and areas.	Project Proponent	N/A	
Delivery of Raw Materials	People	Possible traffic congestion	Deemed not significant, no major truck movements in public roads. Nevertheless, measures are: - Limit in the use of certain roads specifically for the project. - Programmed dispatch of vehicles.	Project Proponent	NA	

Project Phase / Environmental Aspect	Environmental Component Likely to be Affected	Potential Impact	Options for Prevention or Mitigation* or Enhancement	Responsible Entity	Cost	Guarantee / Financial Arrangements
Cement Plant Operations (burning, clinkering, finish milling, packing)	People	Occupational Safety and Health hazards for workers frequently exposed to process units or facilities of Cement Plant complex	- Provision of proper sanitation and medical facilities to workers - Properly dispose of wastes at allocated disposal sites- Implement safety protocols at all times - Workers compelled to wear at all times during working hours the provided Personal Protective Equipment (PPE). - Observance of safety practices and training of workers. - Annual physical exam conducted for all employees. Results are submitted to DOH as a requirement to issuance of annual Sanitary Permit. - Annual IMS/ISO Surveillance audit is conducted by 3rd Party for ISO 14001:2015 and ISO 9001:2015 certification as well as recertification of OHSAS 18001:2007. - Implements various H&S programs such as: Hearing Conservation, PTB, Hypertension Management, Ergonomics, and Family Planning programs. - Free medical consultation, services, and medical treatment for employees in the clinic which is manned by a full-time nurse and occupational physician. - For hospitalization, RCMI has accredited hospitals in the vicinity of Iligan, Cagayan de Oro and Cebu for the benefit of the employees and their family members.	Project Proponent	Part of PhP 10M/year S&H costs	
	People	Physical injuries arising from accidents such as being hit by falling weak structures, being overrun by heavy equipment may be considered as attendant to plant works	- The Company Organization includes a Pollution Control Officer/Safety Engineer to oversee health and environmental hazards /concerns. - First aid kit shall be made available at all times at the project site. - Provide preventive measures for potential fire and explosion hazards	Project Proponent	Part of PhP 10M/year S&H costs	
	People	Potential impact to health of nearby residents/community.	- Conduct of community health services with the host community. - Conduct of community safety trainings on health awareness, emergency preparedness, road safety, and quarry safety. - Provides emergency transport for the community using the Company's ambulance.	Project Proponent	Part of PhP 10M/year S&H costs	

Project Phase / Environmental Aspect	Environmental Component Likely to be Affected	Potential Impact	Options for Prevention or Mitigation* or Enhancement	Responsible Entity	Cost	Guarantee / Financial Arrangements
			- Provides medical/financial assistance to host communities.			

Table 3-2. Major expenses for the Impact Management Plan
Basis : The 2019 Annual Environmental Protection and Enhancement Plan (AEPEP)

RCMI AEPEP ACTIVITIES	FINANCIAL BUDGET (2019)				
	1Q	2Q	3Q	4Q	TOTAL
Land Resource					
1.1 Tree Planting & Maintenance of Reforestation Area					
Tree Planting	12,900.00	0.00	21,600.00	12,900.00	**47,400.00**
Re-planting (refo area survey & conduct of re-planting)	12,900.00	12,900.00	12,900.00	12,900.00	**51,600.00**
Grasscutting	21,600.00	21,600.00	21,600.00	21,600.00	**86,400.00**
Mulching & Fertilizer Application	6,400.00	6,400.00	6,400.00	6,400.00	**25,600.00**
Maintenance of Seeding Nursery	77,900.00	77,900.00	77,900.00	77,900.00	**311,600.00**
1.2 Purchase of Seedlings from Community					
Non-fruit bearing seedlings (assorted)	-	10,000.00	-	-	**10,000.00**
Fruit-bearing seedlings (assorted)	-	15,000.00		15,000.00	**30,000.00**
1.3 Purchase of Fertilizer	600.00	-			**600.00**
1.4 Maintenance of Stockpile	21,400.00	24,100.00	26,500.00	26,500.00	**101,200.00**
1.5 Road Maintenance	21,400.00	21,400.00	25,400.00	25,400.0	**93,600.00**
1.6 Repair of Quarry Signage	3,750.00	3,750.00	3,750.00	3,750.00	**15,000.00**
1.7 Plant wide Grass Cutting	38,900.00	38,900.00	38,900.00	38,900.00	**155,600.00**
2. Water Resource and Quality					
2.1 Maintenance of Waste Dump					
Pushing of waste materials at plant & quarry waste Dump and desilting of Slide silt trap	25,365.32	25,365.32	25,365.32	25,365.32	**101,461.28**
Repair of Waste Dump Signage	1,300.00	-	1,300.00	-	**2,600.00**
2.2 Settling Pond Maintenance					

RCMI AEPEP ACTIVITIES	FINANCIAL BUDGET (2019)				
	1Q	2Q	3Q	4Q	TOTAL
Desilting / Hauling of Silts	16,000.00	16,000.00	30,000.00	30,000.00	**92,000.00**
Maintenance of Silt Pond signage	-	3,900.00	-	900.00	**4,800.00**
2.3 Plant wide Canal Clean-up	10,800.00	10,800.00	10,800.00	10,800.00	**43,200.00**
2.4 Third-Party Water Quality Testing					
Ground water quality & wastewater testing	27,000.00	27,000.00	27,000.00	27,000.00	**108,000.00**
2.5 Solid Waste					
Garbage Disposal Fees	16,800.00	16,800.00	16,800.00	16,800.00	**67,200.00**
3. Noise & Vibration					
Noise Level sampling by third-party service provider	2,800.00	2,800.00	2,800.00	2,800.00	**11,200.00**
4. Air Quality					
4.1 Maintenance of Air Pollution Control Facilities (Dust Collectors)	-	-	-	-	**0.00**
4.2 Self-Environmental Monitoring Activity (third party)					
Ambient Air Sampling & Analysis	30,800.00	12,950.00	12,950.00	12,950.00	**69,650.00**
Source Emission Sampling & Analysis	100,800.00	-	35,638.40		**136,438.40**
4.3 Road Sweeping	74,800.00	74,800.00	74,800.00	74,800.00	**299,200.00**
4.4 Road Water Spraying	202,900.00	202,900.00	101,400.00	101,400.00	**608,600.00**
5. Conservation Values					
Year-3 Mangrove Reforestation & Rehabilitation Project	35,000.00	35,000.00	35,000.00	35,000.00	**140,000.00**
6. Environmental Research					
Hydrogeological Study	317,416.10	-	-	-	**317,416.10**
7. Others (e.g. trainings/workshops/conferences/linkages/MMT/MRFC etc.)					
Environmental Related Trainings/Seminar	-	20,000.00	-	-	**20,000.00**
Environment IEC	-	-	-	40,000.00	**40,000.00**
TOTAL	**1,082,231.42**	**680,265.32**	**608,803.72**	**619,065.32**	**2,990,365.78**

SECTION 4.0 ENVIRONMENTAL RISK ASSESSMENT (ERA)

Introduction

"Risk" is defined as something and event or episode that creates or suggests a hazard. Risk Assessment is the overall process of risk analysis and risk evaluation. The measures that will address these risks are also given due attention.

In contrast to "impacts" risk-related events may not be common occurrences while "impacts" are normal consequences of a project or an activity.

Risk Analysis is the systematic use of available information to determine how often specified events may occur and the magnitude of their consequences. It is the systematic approach for describing and/or calculating risk. It involves the identification of undesired events, and the causes of consequences of these events.

Risk Evaluation is the process used to determine risk management priorities by comparing the level of risk against predetermined standards, target risk levels or other criteria.

In risk assessment, the words *Hazards* and *Risks* are often used and it is necessary to be clear on these terms. In this document, a hazard is anything that has the potential to cause harm and risk is how likely it is that a hazard will cause actual harm.

During the risk assessment, hazards are evaluated in terms of the likelihood that a problem may occur and the damage it would cause if such an event did occur. Adequate mine safety and emergency preparedness require consideration of all the possible hazards that could be encountered. Some hazards, however, are more likely to cause problems than others at a given time and some would result in greater damage than others. These differences are identified by conducting a risk analysis. The outcome of the analysis can be used to target resources at the types of events that are most likely to occur and/or are most destructive. Emergency situations that are very likely to happen and would do considerable damage to people and property should be targeted for immediate remediation. Plans should be made for effective response if remediation isn't possible. Potential situations less likely to happen or with less severe consequences are identified for attention after the more serious hazards have been addressed.

The level of coverage and type of document required shall first be determined based on Annex 2-7e of RPM for DAO 2003-30.

4.1 GENERAL GUIDELINES

Based on DAO 2003-30

The procedures and guidelines defined by Annex 2-7e of DAO 2003-30 is used, the major aspects being the following:

ERA is the use of universally accepted and scientific methods to assess the risks associated with a project. It focuses on determining the and probability of occurrence of accidents and their magnitude (e.g., failure of containment or exposure to hazardous materials or situations.);

An ERA is not an entirely separate assessment but deals with the further analysis of hazards identified in the EIA. It builds upon the EIA such that risks are impacts where the likelihood of occurrence and magnitude of consequences are uncertain.

The ERA, within the context of Philippine EIS System, is concerned primarily with safety risks (characterized by low probability, high consequence, accidental nature and acute effects [human safety focus]). In contrast, geological risks are covered by the EGGAR requirement under the MGB while health risks (characterized by high probability, low consequence, ongoing or continuing exposure and chronic human health effects) are assessed in the *environmental health impact assessment* under the DOH mandate.

Quality Policy

Quality is indirectly related to Safety and Risk Management because the protocol for quality impinges on safety and risk management.

Republic Cement Mindanao, Inc., as a responsible producer of consistent quality cement is committed to:

- Comply with applicable environment, health and safety legislations, relevant codes of practice, and other regulations to which the company subscribes;
- Continually improve its environmental, health and safety performance in preventing and eliminating pollution, injury or ill health, and significant damage to property; and
- Contribute to long-term economic, environmental and social sustainability.

To pursue its environment, health and safety policy, **Republic Cement Mindanao, Inc**. shall:

- Assign environment, health and safety responsibility throughout the company,
- Implement environment, health and safety management systems at its offices and plant site, quarry and mining claim area,
- Set objectives and targets to reduce environment, health and safety aspects/hazards that may have significant impact to people, property and the environment,
- Train and encourage all persons working for or on behalf of the company to achieve high standards of environment, health and safety performance,
- Integrate environment, health and safety considerations into business decision-making at all levels,
- Communicate openly to all persons working under the control of the organization, suppliers, customers, the public, the government and its related agencies, non-government organizations (NGO's) and its stockholders on environment, health and safety issues, and
- Review this policy annually to ensure its continuing usefulness in improving environment, health and safety performance.

EMERGENCY RESPONSE AND PREPAREDNESS PLAN (ADDITIONAL DETAILS AT END OF THIS SECTION)

The Emergency Response Plan (ERP) shall apply emergency situation that may arise within Republic Cement Mindanao, Inc. or its property. The ERP also applies to potential emergencies that may escalate and pose a threat to the life of the personnel, the property of the company and the surrounding environment. The ERP will be activated in the event of emergency arising from the plant area and quarry area.

The management measures/mitigation to prevent hazards from occurring are embedded in the ERP and in Annex 4.1

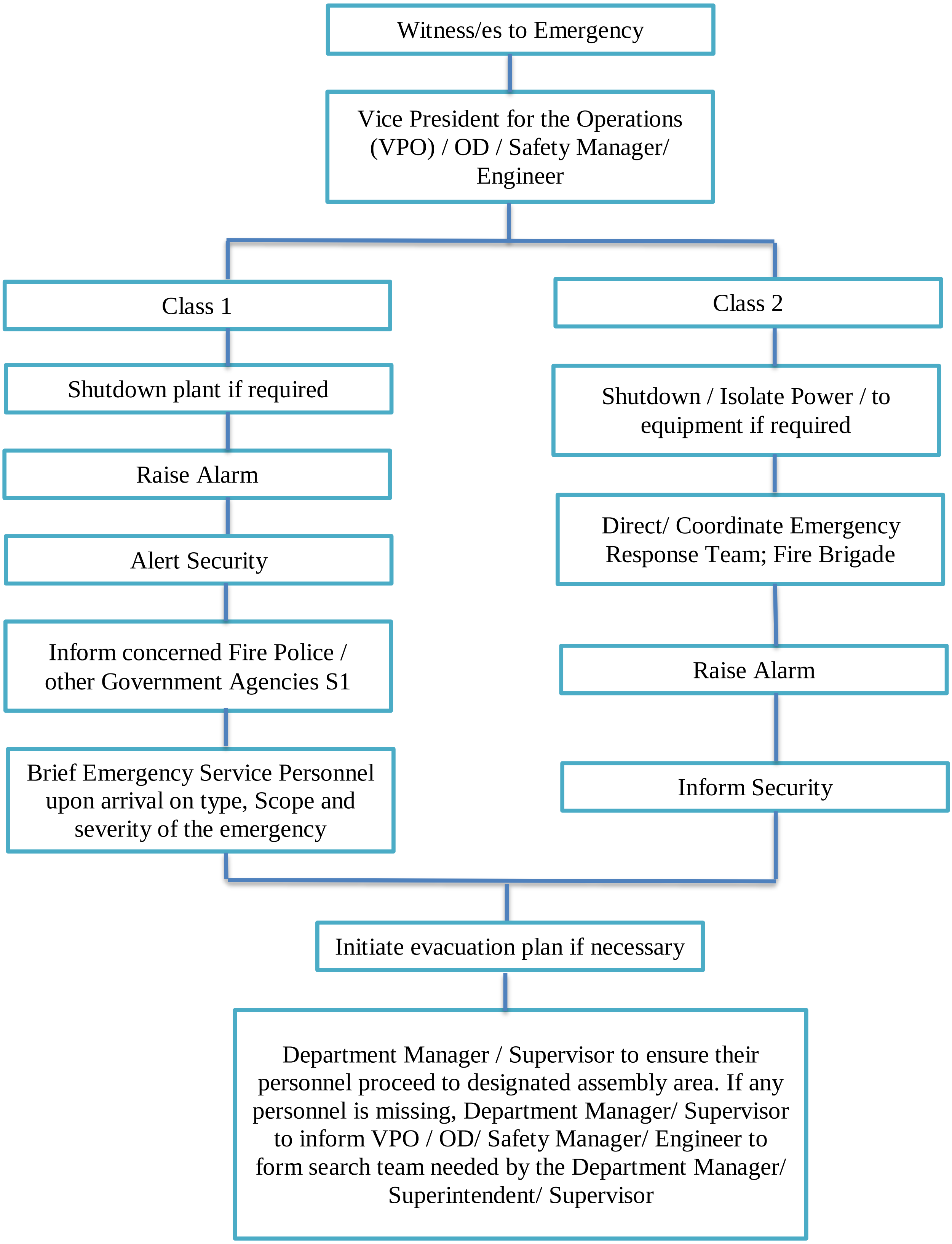


Figure 4-1. Line of Communication during Emergency

A clearly-defined evacuation such as illustrated in Table 4-1 must be in place ahead of disaster situations. Such plan will preempt accidents and other personnel-related concerns in cases of emergencies.

Table 4-1. Evacuation Plan

Evacuation Plan No.	Area/ Sections	Guidelines/ Instructions
1	• Crusher • Vibrating Screens	• Crusher and Vibrating Screen personnel are to assemble in the front of the Crusher section • They shall leave their post by foot • Vehicles shall be parked in such way so as not to obstruct the road • The ferrying of personnel by vehicles to a more secure area (except the injured) is strictly prohibited. • Personnel leaving their post shall do so in an orderly manner. Do not push, run or panic • The respective Dept. Head/ supt. / supervisor shall report their department/ section attendance to the HRA Department later and shall be head of the group
2	• Substation • Dryer • Material Storage • Cooling Tower	• Substation, Dryer, OHC and Cooling Tower personnel are ti assemble in front of the Dryer Smoke Stack • The ferrying of personnel by vehicles to a more secure area (except the injured) is strictly prohibited. • Personnel leaving their post shall do so in an orderly manner. Do not push, run or panic • The respective Dept. Head/ supt. / supervisor shall report their department/ section attendance to the HRA Department later and shall be head of the group
3	• Raw Mill • Blending Silo • Kiln/Preheater/Cooler	• Raw mill, Blending Silo and Kiln/ Preheater/ Cooler personnel are to assemble in the front of the Raw Mic Silo. • The ferrying of personnel by vehicles to a more secure area (except the injured) is strictly prohibited. • Personnel leaving their post shall do so in an orderly manner. Do not push, run or panic • The respective Dept. Head/ supt. / supervisor shall report their department/ section attendance to the HRA Department later and shall be head of the group
4	• Coal Plant • Finishing Grinding Mill • Machine Shop • Electrical Shop • Instrumentation Shop • Civil Shop • Preventive Maintenance	• Coal Plant, Finishing Grinding Mill, Machine Shop, Electrical Shop, Instrumentation Shop, Civil Shop, Preventive Maintenance are to assemble in front/ near Bunker Fuel Oil Day Tank. • The ferrying of personnel by vehicles to a more secure area (except the injured) is strictly prohibited. • Personnel leaving their post shall do so in an orderly manner. Do not push, run or panic • The respective Dept. Head/ supt. / supervisor shall report their department/ section attendance to the HRA Department later and shall be head of the group
5	• Manufacturing Building (Includes the following Offices : HRA / QMS / EMS / MIS /accounting & Finance) • Motorpool • Material Management/Warehouse • Coop/Canteen/Clinic	• Manufacturing Building, Motorpool, Material Management/Warehouse, Coop/Canteen/Clinic Occupants are to assemble at the company's Basketball Court • • The ferrying of personnel by vehicles to a more secure area (except the injured) is strictly prohibited. • Personnel leaving their post shall do so in an orderly manner. Do not push, run or panic • The respective Dept. Head/ supt. / supervisor shall report their department/ section attendance to the HRA Department later and shall be head of the group
6	• Packhouse	• Packhouse Personnel are to assemble in front of the Cement Silos, facing the national highway. • The ferrying of personnel by vehicles to a more secure area (except the injured) is strictly prohibited. • Personnel leaving their post shall do so in an orderly manner. Do not push, run or panic • The respective Dept. Head/ supt. / supervisor shall report their department/ section attendance to the HRA Department later and shall be head of the group

Environmental Risk Assessment Per Guidelines of the RPM

4.2 LEVELS OF COVERAGE AND SCOPING REQUIREMENTS

4.2.1 The requirement for the conduct of ERA is defined at three (3) levels:

Level 2 – for facilities that will use, manufacture, process or store hazardous materials in excess of **Level 2** threshold inventory shall be required to conduct a Quantitative Risk Assessment (QRA) and prepare an Emergency/Contingency Plan based on the results of the QRA.

Level 1 – for facilities that will use, manufacture, process or store hazardous materials in excess of **Level 1** threshold inventory shall be required to prepare an Emergency/Contingency Plan based on the worst case scenario. The Plan shall be based on a Hazard Analysis study.

Risk screening level – specific facilities or the use of certain processes shall require the conduct of a risk screening study even if the projected or estimated inventory does not reach the threshold levels.

Projects or undertakings categorized as Level 2 shall be required to conduct a Quantitative Risk Assessment **(QRA)** and prepare an Emergency/Contingency Plan based on the results of the QRA. While projects or undertakings categorized as Level 1 shall be required to prepare an Emergency/Contingency Plan based on the worst case scenario (as a result of a Hazard Analysis study.)

The process for the determination of the need for a QRA is shown in **Figure 4-2**.

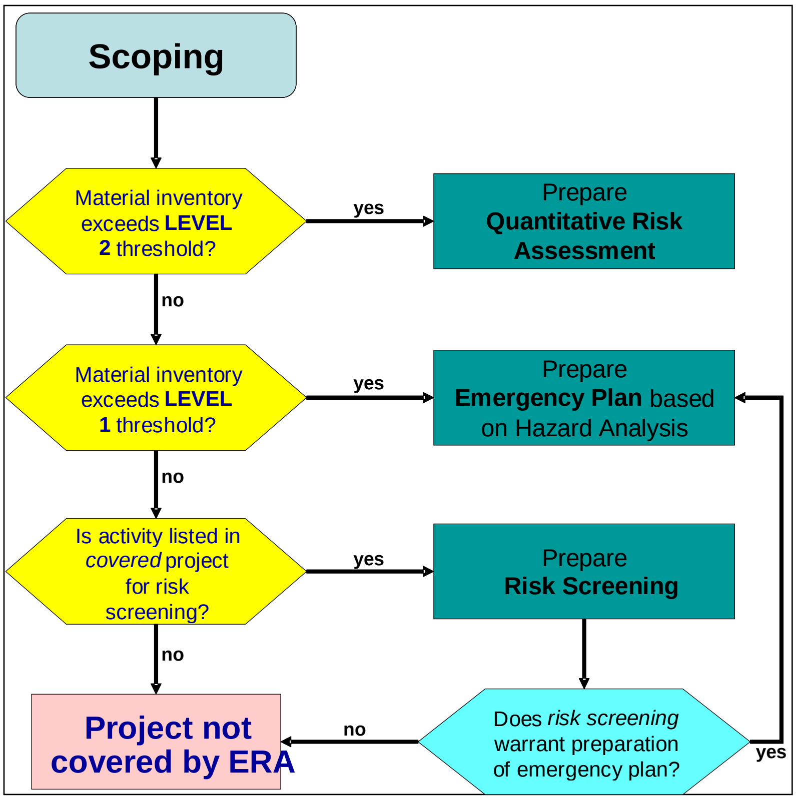


Figure 4-2. Process for Determination of Need for an ERA

4.3. TECHNICAL GUIDELINES FOR THE CONDUCT OF ENVIRONMENTAL RISK ASSESSMENT

4.3.1 Determination of Risk Levels

Levels of Coverage and Requirements

Risk Screening Level. The following activities are required to undertake a risk screening exercise:

1) Facilities for the production or processing of organic or inorganic chemicals using:
    a) alkylation
    b) amination by ammonolysis
    c) carbonylation
    d) condensation
    e) dehydrogenation
    f) esterification
    g) halogenation and manufacture of halogens
    h) hydrogenation
    i) hydrolysis
    j) oxidation
    k) polymerization
    l) sulphonation
    m) desulphurization, manufacture and transformation of sulphur-containing compounds
    n) nitration and manufacture of nitrogen-containing compounds
    o) manufacture of phosphorus-containing compounds
    p) formulation of pesticides and of pharmaceutical products distillation
    q) extraction
    r) salvation

2) Installations for distillation, refining or other processing of petroleum products.
3) Installations for the total or partial disposal of solid or liquid substances by incineration or chemical decomposition.
4) Installations for the production or processing of energy gases, for example, LPG, LNG, SNG.
5) Installations for the dry distillation of coal or lignite.
6) Installations for the production of metals or non-metals by a wet process or by means of electrical energy.
7) Installations for the loading/unloading of hazardous materials as defined by RA 6969 (or DAO 29)

Assessment

Description of the hazards, both immediate (acute effects) and delayed (chronic effects) for man and the environment posed by the release of toxic substance, as applicable

The Project does not fall in any of the above classifications 1-7 which are set forth in RPM Annex 2-7e.

Moreover, the operation of the original project which dates back to more than one decade has not resulted in experiences that have exposed the environment and people to hazards with acute effects or with chronic effects.

Moreover, The operation of the original project which dates back to more than one decade has not resulted in experiences that have exposed the environment and people to hazards with acute effects or with chronic effects.

As noted above toxic substances are neither used in raw or process materials nor are produced by the plant or quarry operations. **Table 4-4** indicates the small volumes of hazardous waste

For the Plant Facilities

Category 7 "Installations for the loading/unloading of hazardous materials as defined by RA 6969 (or DAO 29)" is deemed not applicable because no significant amounts of hazardous materials are involved. Spent electronic parts, oil and grease are of minimal quantities.

Category 1 q "extraction" does not apply to the quarrying process which involves the physical extraction of minerals because no organic or inorganic chemicals are produced or processed.

Levels 1 and Level 2 Threshold Inventory. The following threshold levels shall be used to determine whether a proposed project or undertaking shall be required to prepare a QRA and/or an emergency/contingency plan:

Table 4-2. Threshold Inventory Levels for QRA

CATEGORY	LEVEL 1 (tons)	LEVEL 2 (tons)
Explosives	10	50
Flammable substances	5,000	50,000
Highly flammable substances	50	200
Extremely flammable substances	10	50
Oxidizing substances	50	200
Toxic substances (low)	50	200
Toxic substances (medium)	10	50
Toxic substances (high)	5	20
Toxic substances (very high)	0.2	1
Toxic substances (extreme)	0.001	0.1
Unclassified (Type A)	100	500
Unclassified (Type B)	50	200

Definition of different categories of hazardous materials:

Table 4-3. Summary Table of Hazardous Materials Categories

Category	Definition
A. Explosives (Reactivity)	1. A substance or preparation which creates the risk of an explosion by shock, friction, fire, or other sources of ignition.
	2. A pyrotechnic substance (or mixture of substances) designed to produce heat, light, sound, gas, or smoke or a combination of such effects through non-detonating self-sustained exothermic chemical reactions.
B. Flammable Substances	1. Flammable substances are substances and preparations having a flash point equal to or greater than 21*C and less than or equal to 55*C, capable of supporting combustion.
(Highly flammable and extremely	2. Highly flammable substances are substances and preparations which may become hot and finally catch fire in contact with air at ambient temperature

Category	Definition
flammable substances)	without any input of energy, or substances which have a flash point lower than 55*C and which remain liquid under pressure, where particular processing conditions, such as high pressure or high temperature, may create major-accident hazards.
	3. Extremely flammable substances are liquid substances and preparations which have a flash point lower than 0*C and the boiling point (or, in the case of a boiling range, the initial boiling point) of which at normal pressure is less than or equal to 35*C; gaseous substances and preparations which are flammable when in contact with air at ambient temperature and pressure, whether or not kept in the gaseous or liquid state under pressure; or, liquid substances or preparations maintained at a temperature above their boiling point.
C. Oxidizing substances	Substances which give rise to highly exothermic reaction when in contact with other substances, particularly flammable substances.
D. Toxic Substances	Low, medium, high, very high and extreme toxicity of substances or preparation are classified as follows:
	1. A substance shall be considered as a liquid if vapor pressure is less than 1 bar at 20*C.
	2. A substance shall be considered as a gas if vapor pressure is greater than 1 bar at 20*C.
	3. The sum of (a) and (b) as provided in Tables 2 and 3 shall determine the toxicity class as contained in Table 1.
E. Unclassified Substances	Substances or preparations that react violently with water (Type A), and substances or preparations which release or liberate toxic gas in contact with water (Type B).

Stockpiles of Hazardous Materials

Table 4.4.Stockpile volume inventories

Material	Quantity (MT)
Batching Plant Area	
Indo Coal	7,580
Indo Coal LVM	3,850
Malangas	1,410
Old Scrapyard Area	
Rice Hull	123
Petcoke	675
Shale Quarry Pit Bottom Area	
Russian Coal	9,875
Petcoke 1 (near entrance)	4,291
Petcoke 2 (near Gypsum)	1,368
Gypsum	5,858
Crusher Area	
LST Emergency Stockpile	78,205

Material	Quantity (MT)
Paniangan Pozzolan	811
Shale	375
Laydown Area	
Imported Clinker	8,520
Purok 9 Area	
Silica	2,777

It is seen from the above table that the maximum inventory of coal is less than 10,000 MT which is much less than the threshold level of 50,000 MT for flammable substances.

Coal is deemed to fall in the category of flammable materials due to the possibility of spontaneous combustions during coal storage.

Assessment

There are no hazardous substances listed above that are used for the project except for small quantities of chemicals/materials listed below:

- **Diesel Oil**

Diesel oil will be used for own-power generating unit(s) required for various plant services such as in lightings, appliances, kitchen and miscellaneous services in the camp house. It has a flash point of between 52 ^{0}C – 96 ^{0}C and thus regarded as not highly flammable.

- **Small volumes of hazardous substances/wastes**

These include chemicals/reagents to be used if an in-plant laboratory is to be set up. Typical chemicals that fall within the category of hazardous wastes are:

  - Sulfuric Acid
  - Sodium Hydroxide
  - Sodium Chromate

Miscellaneous wastes considered as "hazardous" under R.A. 6969 are the following:

  - Spent lighting fixtures
  - Spent computer parts
  - Spent batteries
  - Oil sludge from motor vehicles
  - Oil sludge from diesel power engines
  -

No significant amounts of combustible or explosive substances are used. LPGs which are combustive and explosive in nature are used for cooking purposes.

4.3.2 Risk Criteria

1. Individual Risk Criteria

a) Individual risk criteria have been developed based on the principle that involuntary risks due to industrial developments should not significantly increase the level of risk to individuals living or working near such industry.

b) *Location Specific Individual Fatality Risk (LSIFR)* is the risk of death to an individual person, if present 24 hours per day (in the open) at a particular location for a whole year. It takes no account of the number of people affected by an event.

c) LSIR is normally represented in the form of risk contours. This is achieved by plotting and connecting all points (locations) of similar individual risk, thus forming risk contours (not dissimilar to isobars on a weather map). These contours can then be overlaid onto a land-use map to show the level of individual risk in the various land-use planning areas.

d) Individual risk criteria may be applied and measures taken to ensure that no single individual living near to a hazardous activity bears an undue level of risk.

2. Societal Risk Criteria

a) The greater public concern for events causing a large number of deaths is best reflected in terms of the societal risk criteria. The establishment of societal risk criteria is recognition that multiple fatality events should be regarded as more serious than events capable of causing only a few fatalities.

b) Another point to be considered is the level of benefit society may derive from an existing or proposed development. Care must be taken to ensure that the local population does not suffer an unfair burden of risk in respect to the benefits of the population at large.

c) Societal risk is another suitable basis for review of hazardous facilities. This has a different emphasis from individual risk. Societal risk measures the number of fatalities caused by a full range of more or less frequent incidents. These are normally presented on a log-log plot of the cumulative frequency of incidents causing N or more fatalities versus the number of fatalities,

d) Societal risk criteria specify levels of societal (group) risk, which must not be exceeded by a particular activity. These should ensure that a hazardous activity does not impose a risk on society that is out of proportion to other types of hazards and with the benefits the activity brings, which individual risk does not address.

The density of population at or near the potential risk site(s) would be primary determinant of societal risks. For this project the relevant factors are:

- The location of houses
- The location of important community centers e.g. schools, churches and markets.

A graph depicting Societal Risks is shown in **Figure 4-3** below.

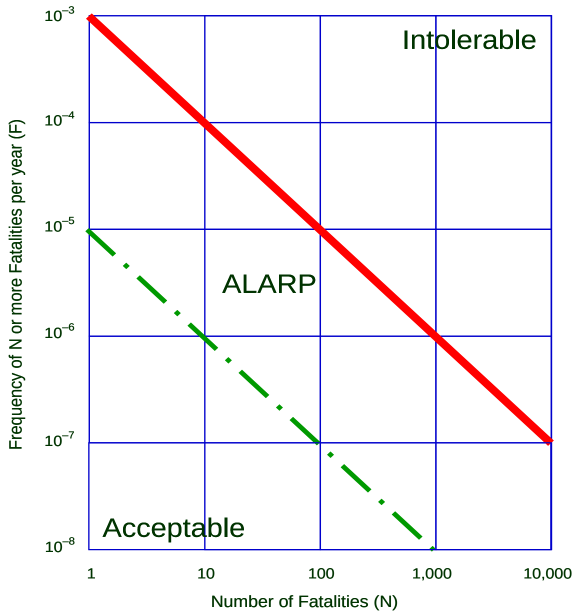


Figure 4-3. Societal Risks *(Source: Annex 2.78 RPM)*

As may be inferred from the above chart acceptable societal risks are those which involve few fatalities occurring infrequently.

Assuming a worst case and unlikely scenario of 5 % fatalities less than 100 fatalities and a frequency of 10^{-7} qualify risks to acceptable level.

4.4 Other Type of Hazards/Risks

4.4.1 Natural Hazards

These include seismic-related hazards, meteorology-related hazards, landslides, etc. which are discussed in **Section 2.1.**of this EIS report.

4.4.2 Physical Risks

Accidents. These could arise from the use of equipment and vehicles during the Construction phase and from mining operations.

Accidents may, however, be prevented through:

- Proper training of construction and mining personnel including contractors;
- Conduct of regular safety drills. Membership of key safety personnel to relevant safety associations.
- Maintenance of equipment and vehicle in good operating conditions;
- Proper construction and operating procedures;
- Use of Protective Equipment such as but not limited to safety helmets and shoes, eye and ear protection devices, laboratory gowns, gloves and other requirements in accordance with international protocol.

- Posting of announcements, regulations and notices at conspicuous places.

Fire. Accidents related thereto may be prevented through

- Proper transport and storage of flammable materials such as LPG used for cooking purposes at the designated places.

- Appropriate restrictions properly communicated such as ban on smoking except at specially designated places, carrying of cigarette lighters/matches.

- Security System. Integral to effective risk management is the institution of security sys which would include (a) personnel (b) procedures and (c) equipment such as CCTVs.

4.5 Quantitative Risk Analysis (QRA)

In the absence of adequate and reliable historical data of industrial accidents in the country for this type of project, quantitative and definitive estimates on risks to the general public cannot be adequately evaluated.

The protocol commonly observed in the Philippine EIS System is based on the "Manual" (IAEA-TECDOC-727) jointly developed by the International Atomic Energy Association, the UNEP, UNIDO and the WHO titled "Manual for the classification and prioritization or risks due to major accidents in process and related industries". shall be used in obtaining indicative or preliminary risk estimates. It is noted that the method prescribed in the manual is based on the use of average values obtained from the investigation of the series of major industrial accidents.

Illustration of Consequence Analysis

The empirical formula is as follows:

$$C_{a,s} = A \times \delta \times f_A \times f_d \times f_m$$

Where:

Ca,s = Number of fatalities/accident in a given area (a) caused by a specific activity (s)

A	=	affected area, hectares
δ	=	population density in defined populated areas, person /ha
f_A	=	correction factor for populated areas
f_m	**=**	correction factor for mitigation effects

The relevance of this formula is that it clearly suggests the significant aspects of risks consequences, i.e.

- The type of activity (e.g. transport of coals within the project site)
- The population, i.e. households near the route of the road transport
- The mitigation measure, e.g. road worthiness of trucks

4.6. Assessment of whether the project location is projected to have extreme climate events for 2020 and 2050 "Precis-modelled" scenarios that could contribute to triggering identified scenarios.

As seen in page 2.3-4 the worst case scenario of 2050 (at which period the mine life has been exceeded) of 0.9 % increase in rainfall over a baseline of 538.4 mm.

The potential scenario that could be triggered is accidents during the transport along the haul road of ore and materials. The safety practice that will be observed is to stop trucking during heavy rainfall events.

4.7 Emergency Preparedness and Response Plans (Including case of accidental release of toxic substances)

Additional Details

The potential scenario that could be triggered is accidents during the transport along the haul road of ore and materials. The safety practice that will be observed is to stop trucking during heavy rainfall events.

The emergency preparedness guidelines provide a framework for Incident Management Teams to manage an emergency and provide MRS Officers with direction in regards to their responsibilities and conduct in an emergency.
In an emergency the senior mine official should establish an Incident Management Team to manage and control the response and intervention. It is likely that the IMT will comprise representatives of mine management and the appropriate Inspector of Mines, Industry Check Inspector and MRS Regional Manager (or delegate). Responsibilities are generally defined as:

i. The Mine/Quarry Operator (or delegate) as per the Emergency Management System (EMS) has statutory responsibility for the management and control of the emergency operation.
ii. The Inspector of Mines has the authority to suspend or limit the intervention where the Inspector deems that persons are being exposed to unacceptable levels of risk.

iii. The Industry Check Inspector can also suspend or limit operations where the Inspector deems that persons are being exposed to unacceptable levels of risk.

iv. The MRS Regional Manager (or delegate) can provide specialist knowledge and expertise on rescue, control, exploration and recovery/restoration techniques and in particular, the deployment of the Mines Rescue Brigade.

As the Mines/Quarry Rescue Board's representative, the MRS Manager (or delegate) maintains full responsibility for the detailed operation of the Mines Rescue Brigade and should ensure that when the Mine Operator (or delegate) requires them to be utilized, the Brigade is deployed in accordance with these Guidelines and sound rescue practice. The MRS Manager (or delegate) should veto deployment of the Mines Rescue Brigade where he deems that persons are being exposed to unacceptable levels of risk, or where the techniques and procedures proposed are not in accordance with these Guidelines and sound rescue practice.

i. In the event of an incident involving the loss of life or lives, Police Officers act as the Coroner's representative and have statutory responsibilities for investigation and interviewing, reporting, and the removal of bodies.

ii. The Local Emergency Management Officer (usually the Regional Police Commander) can also access and resource ancillary equipment from outside the mining industry.

The IMT should consider

The nature of the emergency/incident e.g.:

- Ignition
- Explosion
- Spontaneous combustion
- Fire
- Fall of ground/entrapment
- Fall of ground/wind blast
- Outburst
- Inrush
- Unknown or unidentified?

Static incidents such as a fall of ground, outburst or flash ignition are unlikely to develop into an uncontrolled event and may enable a fast resolution and early intervention.
Dynamic incidents such as fires, spontaneous combustion or explosions may develop into uncontrolled events. They warrant extreme caution and the detailed evaluation of all relevant factors utilizing data that is accurate, reliable (timely, valid location/s, correctly interpreted), and trended.

The intensity of the emergency/ incident

- Blast damage
- Colour and extent of smoke
- Visible flame
- Type and level of gases produced
- Ventilation
- Information from survivors
- Poor visibility

Determination of the nature of the emergency/incident and an evaluation of its intensity will enable an assessment to be made of the:

- Extent of disruption to essential services such as ventilation, mine monitoring, methane drainage
- Degree of confinement to a specific face, heading, panel or district
- Nature and extent of injuries to survivors Potential for escape, rescue or re-entry.

Action Required

What action or response is required to remedy the emergency/incident?

- Escape, rescue or extrication of persons?
- Control of a situation (e.g.; fire fighting, sealing)?
- Exploration and recovery of bodies?
- Exploration and restoration of operations? Surface emergency procedures.

Establishing the desired outcomes provides a framework for determining the type, extent, reliability and accuracy of data required to identify and evaluate potential strategies. It will be a factor in determining acceptable risk levels and also provide a framework for evaluating overall logistics.

Re-entry and exploration within a mine for the recovery of bodies or restoration of operations should be a pre-planned operation using a risk management approach.

The emergency preparedness guidelines provide a framework for Incident Management Teams to manage an emergency and provide MRS Officers with direction in regards to their responsibilities and conduct in an emergency.

In an emergency the senior mine official should establish an Incident Management Team to manage and control the response and intervention. It is likely that the IMT will comprise representatives of mine management and the appropriate Inspector of Mines, Industry Check Inspector and MRS Regional Manager (or delegate). Responsibilities are generally defined as:

The Mine/Quarry Operator (or delegate) as per the Emergency Management System (EMS) has statutory responsibility for the management and control of the emergency operation.

The Inspector of Mines has the authority to suspend or limit the intervention where the Inspector deems that persons are being exposed to unacceptable levels of risk.
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The IMT should consider the following questions:

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Dynamic incidents such as fires, spontaneous combustion or explosions may develop into uncontrolled events. They warrant extreme caution and the detailed evaluation of all relevant factors utilizing data that is accurate, reliable (timely, valid location/s, correctly interpreted), and trended.

Intensity of the emergency/ incident, i.e.;

- Blast damage
- Colour and extent of smoke
- Visible flame
- Type and level of gases produced
- Ventilation
- Information from survivors
- Poor visibility

Determination of the nature of the emergency/incident and an evaluation of its intensity will enable an assessment to be made of the:

- Extent of disruption to essential services such as ventilation, mine monitoring, methane drainage
- Degree of confinement to a specific face, heading, panel or district
- Nature and extent of injuries to survivors Potential for escape, rescue or re-entry.

Action Required, e.g.

- Escape, rescue or extrication of persons?
- Control of a situation (e.g.; firefighting, sealing)?
- Exploration and recovery of bodies?
- Exploration and restoration of operations? Surface emergency procedures.

Establishing the desired outcomes provides a framework for determining the type, extent, reliability and accuracy of data required to identify and evaluate potential strategies. It will be a factor in determining acceptable risk levels and also provide a framework for evaluating overall logistics.

Re-entry and exploration within a mine for the recovery of bodies or restoration of operations should be a pre-planned operation using a risk management approach.

- Description of the hazards, both immediate (acute effects) and delayed (chronic effects) for man and the environment posed by the release of toxic substance, as applicable

The operation of the original project which dates back to more than one decade has not resulted in experiences that have exposed the environment and people to hazards with acute effects or with chronic effects.

As noted above toxic substances are neither used in raw or process materials nor are produced by the plant or quarry operations. **Table 4-4** indicates the small volumes of hazardous wastes.

The management measures/mitigation to prevent said hazards from occurring. These are embedded in the above discussions and in **Annex 4-1**,"Guidelines on Emergency Preparedness and Response".

The emergency preparedness response which includes the case of accidental release of toxic substances is provided in Annex 4-1. It is noted that the heading for this is under the name of Republic Cement Iligan Inc. but the same ERP is applicable to the merged RCMI.

SECTION 5.0. SOCIAL DEVELOPMENT PLAN/FRAMEWORK (SDP) AND IEC FRAMEWORK

5.1 The Social Development Plan (SDP)

The framework herein presented is premised on community development or livelihood programs/activities, projected beneficiaries, partner institutions, timeframe of implementation as well as source and amount allotted per activity/component (**Based on Annex 2-18 of RPM for DAO 2003-03**)

SDMP was consulted with the Barangay which resulted to a program which is practical and current especially for health, education and livelihood. Resources of both proponent and Barangay will be better utilized. Counterpart arrangement, e.g. labor, was also arranged for infrastructure projects. Local socio-cultural needs were also recognized as an important tool to strengthening ties with community, e.g. fiestas, Muslim customs.

Republic Cement Mindanao Inc. (“RCMI”) conducted a 5-year Strategic Planning for the 4th Cycle of the Social Development and Management Program (SDMP) covering the years 2018-2022 over the active operations in Brgy. Kiwalan and Brgy. Dalipuga, City of Iligan and Brgys. Pagawan and Paniangan, Municipality of Manticao. This is incompliance with the requirements of the Mines and Geosciences Bureau (MGB) Region 10 for the approval of the proposed Programs/Projects/ Activities under the 5-Year SDMP.

The SDMP aims to contribute the achievement of progress and prosperity under a sustainable framework of development and promote and enhance the living conditions of the inhabitants through the implementation of relevant company programs, projects, and activities in the host community (Kiwalan, Dalipuga, Pagawan and Paniangan) and neighboring barangays (Bunawan, Bonbonon, Acmac and Sta. Filomena), including the host City of Iligan and Municipality of Manticao.

To aid in the conduct of this planning workshop, Republic Cement engaged the services of Gaia South Inc., a third party consultant.

Provided in **Table 5-1** is the proposed SDP and **Table 5-2** provides the listing of the existing Social Development Projects of RCMI.

See **Annex 5.1** for the 5 Year Strategic Planning Social Development and Management Program (SDMP) for Republic Cement Iligan Inc. (RCMI)

5.1.1 Proposed Enhanced Social Development Plan

Health

On the health sector, the provision of medicines (vitamins, cough, fever, etc.) to residents in the hinterlands will be given emphasis as they know that people living in the far-flung areas have difficulty accessing the needed medicines.

Education

The first priority of the participants together with the inputs of the barangay captain, was to remove the budget allocated for scholarship of elementary students and use the money instead in training of residents to improve their skills and be certified by TESDA. They opined that elementary education is free anyway in the public schools. In the meantime, students who have graduated from high school and are qualified and have the interest to improve on their skills will be selected for TESDA training and certification. After the training, they are capable of looking for jobs and earn for their families.

Their second priority is to continue with the provision of scholarships and school supplies to qualified students in high school and college levels.

Livelihood
The first priority on livelihood projects was on skills development training to better equip the residents for future livelihood undertakings.

The second priority was on providing capitalization and training on mat and wallet making using indigenous materials from the area. This has already been started by the women group and shows promise that is why the FGD participants gave a priority for its support in the SDMP.

Public utilities/infrastructure

Projects to be implemented in congruence with the barangay development plan were given priority in infrastructure projects. To further support this, the barangay will Increase its allotment for labor cost from the barangay funds which in turn will be used as the barangay's counterpart in carrying out infrastructure projects under the SDMP.

Socio-cultural

Projects in support to fiestas, barangay foundation day and other activities related to inspire the promotion of the social and cultural heritage of the barangay will be pursued.

Table 5-1. SDMP Accomplishments from 2012 to 2016 for Barangay Kiwalan

Program/Project/Activities	Actual Cost (PhP)
2012	
Health	
• Provision of essential medicines for Purok 11,14,16 and 17	41,605.54
• Annual Medical/ Dental Mission for Purok 11,14,16 and 17	17,350.00
• Supplemental Feeding for identified Malnourished for Purok 11,14,16 and 17	- (No proposal)
• Annual provision of essential medicines for Purok 12, 13,15, 10, 5 &5A	73,752.85
• Semi-annual provision of essential medicines Sentrong Sigla	48,051.26
• Quarterly provision of medicines for KES and ICEHS	19,287.75
• Acquisition of medical equipment and supplies for BHC	17,647.50
• Annual medical/dental mission	38,054.00
• Supplemental feeding for identified malnourished children	- (No proposal)
• First aid kit for 5 Day Care Centers	- (to be delivered)
Livelihood	
• Hollow Block Making (Fishermen) Training & Capitalization	- (No proposal)
• Banana Chips Processing	- (No proposal)
• Banana Chips Training & Capitalization	-
• Capitalization for Pan de Pinoy, Shakoy, Bukayo, Donut, Pancake, etc.	20,000.00
• Capitalization for Corn Vendors	- (No proposal)
• Capitalization for Gardeners	- (No proposal)
Education	
• Scholarship	
o Elementary Scholars	20,000.00
o High School	30,000.00
o College	95,000.00

Program/Project/Activities	Actual Cost (PhP)
o Lerop	10,000.00
• School Bags and Supplies for Lerop	10,000.00
• School Bags and Supplies for KES	35,000.00
• School Bags and Supplies for ICEHS	25,000.00
• Supplies for DCC for Purok 11	15,915.09
• Kiddie Chairs & Tables for Lerop DCC	- (No proposal)
• RISO Ink for ICEHS	- (No proposal)
Infrastructure	
• Water Development – Purok 11	18,892.61
• Electrification Program	48,710.92
• Computer Unit with Printer for Barangay Hall	24,254.46
• Schools Improvement – Steel Grills & Window glass for ICEHS	- (No proposal)
• Repair of DCC – Purol 11	35,234.48
• Meeting Hall – Purok 16, 5 and 12	9,000.00
• Repair of Health Center	50,958.50
Environment	
• Purchase of 3 units Trisikad for garbage collection	35,000.00
• Rescue equipment- spine board	17,000.00
• Rescue materials/supplies (flashlights, life vest, rope)	12,620.00
• Collapsible Tent	22,187.00
• Rain coats/boots (5pcs. Each) and 2pcs. ax	3,920.00
2013	
Health	
• Semi-Annual Provision of Essential Medicines for Sentrong Sigla	95,970.50
• Provision of Essential Medicines for Purok 11,14, 16, 17	35,694.38
• Quarterly provision of medicines for KES and ICEHS	19,981.25
• Operation Tuli, Medical and Dental	58,060.68
• Supplemental Feeding for Identified Malnourished Children Sentrong Sigla	43,982.64
• Annual Provision of Medicines for Purok 12,14,15,10,5 and 5A	59,996.50
• Acquisition of medical equipment and supplies for BHC	17,964.00
• Supplemental feeding for identified malnourished purok 11,14,16 and 17	25,632.81
Livelihood	
• Capitalization of Pan de Pinoy (c/o Purok 6)	
• Capitalization of Ukay-Ukay Livelihood/Butterfly-Making	14,669.95
• Capitalization on BIGASAN (c/o Macasalong Sarip)	30,080.00
• Capitalization on Farmers and Gardeners Association	- (No proposal)
• Capitalization NAKWAK Assoc. for Livestock Raising (goat)	To be processed
• Capitalization on Lot Purchase for Livelihood Center	- (No proposal)
• Capitalization Fisherman's Association	50,000.00
• Capitalization Women's Association	
o Longganisa Processing	- (No proposal)
o Soap/Fabric Conditioner Making	- (No proposal)
Education	
• Scholarship	
o Elementary Scholars	20,000.00
o High School	30,000.00
o College	214,135.00
o Lerop	10,000.00
• School Bags and Supplies for KES	35,000.00
• School Bags and Supplies for ICEHS	25,000.00
• School Supplies -DCC (Purok 11, Quarry, Gym4)	25,311.00
• School Bags and Supplies for Lerop	30,000.00
• Kiddie Chairs /Tables & other equipment for for DCC	17,360.00
• RISO Ink for ICEHS/Paints for KES	2,265.48

Program/Project/Activities	Actual Cost (PhP)
Infrastructure	
• Water System Development at Purok 11	31,858.00
• Electrification Program	104,951.00
• Improvement of Dancing & Meeting Hall of Purok 17	- (No proposal)
• Purchase of Digital Camera	17,964.00
• Refill toner for Toshiba Xerox Machine	
• Purchase of Aircon for Session Hall	42,550.00
• Improvement of Barangay Hall Premises	49,117.00
• School Improvement-Kiwalan Annex (Grills)	20,587.00
Environment	
• Purchase Motorized Rescue Boat	20,000
• Collapsible tent	To be processed
• Training and seminar on Risk Reduction Management Program	26,192.50
• Training and seminar Barangay Peace Action Team	22,400
• Plastic drums and barrels for barangay solid waste program	22,400
2014	
Health	
• Prov. Of Essential Medicines-P11,14,16&17	50,002.00
• Annual Prov. Of Meds- P12,13,15,10, 5&5A	35,280.00
Livelihood	
• Capitalization-Purok 16 Women	-
• Capitalization-Sarip Livelihood	-
• Capitalization- Farmers & Gardeners Association	-
• Capitalization-Lot purchase for livelihood center	-
• Capitalization-Ornamental Plants-GKMHPLDT	-
Education	
• Scholarship	
o College	182,000.00
o Lerop	10,000.00
• School Supplies – DCC (P11, Quarry, Gym 4)	19,680.00
• School Bags and Supplies - Lerop	20,000.00
Infrastructure	
• Improvement – Water System Devt – P11&14	-
• Improvement of meeting hall-Purok 5 Lerop	-
• Water Development-Purok 5 Lerop	-
2015	
Health	
• Provision of Essential Medicines-P11,14,16&17	59,997.30
• Annual Prov. Of Meds- P12,13,15,10,5&5A	36,543.30
Livelihood	
• Capitalization-Purok 16 Women	10,000.00
• Capitalization-Sarip Livelihood	13,800.00
• Capitalization- Farmers & Gardeners Association	
• Capitalization-Ornamental Plants-GKMHPLDT	
Education	
• Scholarship	
o College	53,300.00
o Lerop	9,020.00
• School Supplies – DCC (P11, Quarry, Gym 4)	20,000.00
• School Bags and Supplies - Lerop	-
Infrastructure	
• Improvement – Water System Development – P11&14	10,560.00
• Improvement of meeting hall-Purok 5 Lerop	10,000.00
• Water Development-Purok 5 Lerop	10,000.00
• KNHS Makeshift School Stage	33,020.00
• Laptop	29,455.30
• Projector	19,633.90
• Acquisition of equipment for TESDA courses	121,367.80
• Purchase of lot for IS resettlement site	-

Program/Project/Activities	Actual Cost (PhP)
Disaster Mgt. & Rescue Equipment	
• Training and Seminar for Risk Reduction Management Program	40,960.00
• Plastic drums& barrels- SWM Program	17,012.00
2016	
Health	
• Supplemental feeding for identified malnourished (P11,14,16&17)	43,509.00
• Annual Prov. Of Meds- P12,13,15,10,5&5A	59,972.25
• Annual Prov. Of Meds- P11,14,16& 17	49,935.50
Livelihood	
• Capitalization-Purok 16 Women	8,900.00
• Capitalization- Farmers & Gardeners Association	30,346.00
• Capitalization-Ornamental Plants-GKMHPLDT	-
• Stakeholder development/documentary services	42,000.00
Education	
• Scholarship	
o6 from 3 Puroks & 2 from Muslim residents	70,000.00
oLerop	94,531.65
• School Supplies – DCC (P11, Quarry, Gym 4)	10,583.00
Infrastructure	
• Rip rapping of GK Creek	281,296.00
• Purchase of Jetmatic pumpset (purok 10)	-
Socio-cultural	
• Assistance to Muslim Community	66,751.50
• Tourism Activities	112,255.00
Barangay Facility	
• Purchase of megaphone	9,000.00
• Purchase of Aircon	50,120.00
Disaster Mgt. & Rescue Equipment	
• Training and seminar on Risk Reduction Management Program	625,489.00

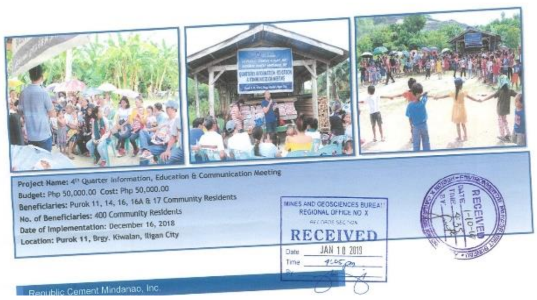
- SDMP was consulted with the Barangay which resulted to a program which is practical and current especially for health, education and livelihood. Resources of both proponent and Barangay will be better utilized. Counterpart arrangement, e.g. labor, was also arranged for infrastructure projects. Local socio-cultural needs were also recognized as an important tool to strengthening ties with community – fiestas, Muslim customs.

5.2 Information, Education and Communication (IEC)

IEC aims to educate and inform both community and stakeholders that may be affected by the companies operation according to the Philippine Law and regulations. It will help both the communities and the Proponent understand each other's perspective on the project and will assist RCMI in undertaking effective programs for the benefit of the communities.

IEC is also based on experience of RCMI and of former RCII which is practical and tested. Lessons learned from this experience are considered for the improved continuing IEC. Below is a snapshot of IEC reported in the CMR for 2018

Among the key lessons exchanged with the stakeholders with participation by the academe dwell on responsible mining



Target sector, key messages, scheme/strategy/methods, Information medium, timelines and frequency, cost (See Annex 2-19 of RPM for DAO 2003-03).

Table 5-5 shows the planned integrated IEC programme for the proposed project

Table 5-2. IEC Program

Target Sector	Major Topic/s of concern in Relation to Project	IEC Scheme/ Strategy/ Method	Information Medium	Indicative Time/ Frequency	Indicative Cost
Barangays Council/association and City Officials	• Disaster Risk Reduction and Management/ Emergency Plan	City wide IEC Emergency Drills Participation by NDRRMC and PHIVOLCS	Visual Actual Drills (Fire, Earthquake, storm surges)	From start of construction Semi-annual or as decided	Part of Project Cost: P1.70 Billion
Barangays and City council members of Iligan	• Project Description • Process Technology • Impacts on environment and health • Risks • Socio-Economic benefits • Socio-Economic impacts particularly to affected residents • Climate Change Mitigation/Adaptation	Group Method Consultations with Stakeholders	Roundtable Discussion Focus Group Discussion / Power Point Presentation Printed Materials Media releases	From start of construction Semi-annual or as decided	Part of Project Cost: P1.70 Billion
Impact Barangay Senior Citizens	• Health and Safety • Locally prevalent diseases	Group Method Consultations	Roundtable Discussions	Before start of construction	Part of Project Cost: P1.70 Billion
General Public	• Safety and Risk Awareness of the Project	Public Discussions	Roundtable Discussions	Before start of construction	Part of Project Cost: P1.70 Billion
Impact Barangay	• Garbage Management • Plastic wastes • Waste Management of the Project	Technical Discussions Printed Materials	Roundtable Discussions	Before start of construction	Part of Project Cost: P1.70 Billion
NGOs and Religious Groups	• Nature of the Proposed Project • Impacts on environment ○ Floods	Group Method Consultations	Focus Group Discussion / Power Point Presentation	Before construction Phase	Part of Project Cost: P1.70 Billion

Target Sector	Major Topic/s of concern in Relation to Project	IEC Scheme/ Strategy/ Method	Information Medium	Indicative Time/ Frequency	Indicative Cost
	○ Liquefaction ○ Erosion ○ Other hazards • Impacts on health • Socio-Economic impacts and benefits to existing establishments	• Send invitations to various barangay council members and impact sectors • Continuous discussion and consultation with the stakeholders to know their issues and concerns	Printed Materials		
Professional society and other concerned local government departments in Iligan	Continuing consultation Environment Impacts of the Project	Group Method	Focus Group Discussion Power Point Presentation	To be determined	Part of Project Cost: P1.70 Billion

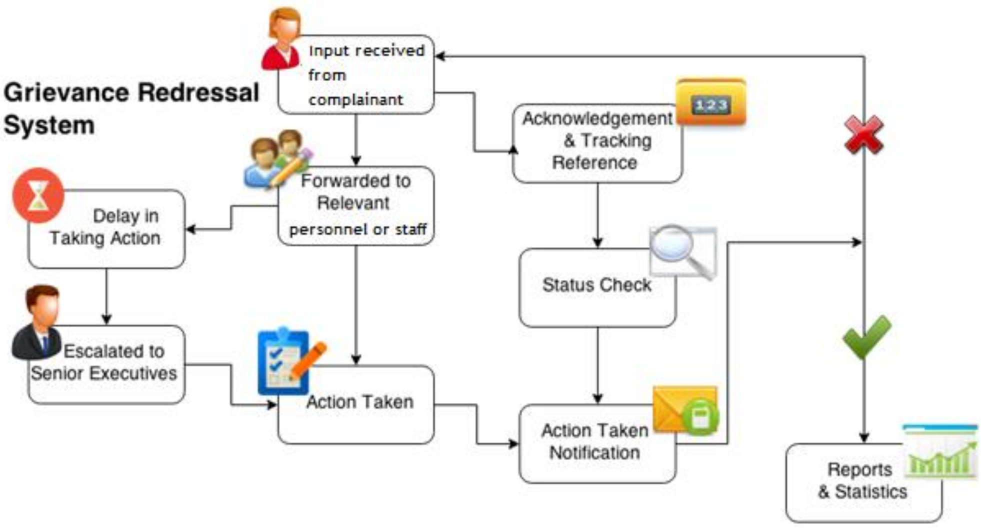
The Grievance Redress Mechanism (GRM)

The Grievance redress mechanism (GRM) is the instrument or procedure by which grievance is ventilated and resolved.

The GRM herein discussed is for the communities and/or stakeholders noting that there is instituted GRM for internal purposes, i.e. for employees of RCMI.

The key elements of the GRM are:

- ✓ Informing stakeholders that there is an instituted GRM
- ✓ Informing stakeholders of the procedure that they can observe
- ✓ Receiving and recording by RCMI of the grievances
- ✓ Forwarding to the responsible personnel
- ✓ Verification of legitimacy of grievance
- ✓ Establishing nature of grievance, e.g. legal, environmental aspect, employment related?
- ✓ Referral to concerned company personnel or executive, e.g. to PCO, to legal, to Human Resource Unit?
- ✓ Discussion of the concerned personnel handling the grievance with Complaint
- ✓ Resolution through negotiation if possible
- ✓ Advising complainant of action
- ✓ Either amicable settlement or further action by complainant to be recognized and respected
- ✓ The timeline from receipt of complaint to the resolution shall be noted. A period for resolution shall be established which will depend on the nature of the complaint.



SECTION 6.0 ENVIRONMENTAL COMPLIANCE MONITORING (ECM)

6.1. Environmental Performance

On the correlation of the results of the Self-Monitoring to the Environmental Compliance Monitoring, this is deemed to be within the mandate of the MMT.

Penalties or sanctions for non-compliance will be as governed by the MOA on the MMT.

Proponent Republic Cement Mindanao, Inc. (RCMI) has to date been complying with the conditions of the ECCs granted it for their original projects, i.e. prior to this planned expansion project.

This is evident from the fact that RCMI have not been issued a Notice of Violation (NOV) relative to its compliances with the ECC.

Table 6-1 summarizes the status of compliances and of the existing operative ECC.

Table 6-1. Compliance Assessment

Condition / Requirement / Commitment	Compliance Status &Summary of	Recommendation	Remarks
Compliance with ECC Conditions	Compliant	N/A	No NOV Operations continuing ISO certified
Compliance with EMP	Compliant	N/A	No NOV ISO certified
Implementation of appropriate & effective environmental impact remedial actions in case of exceedances	No significant exceedances which warrant NOV as evidenced by SMRs and CMRs	Continuing faithful compliances to MMT requirements	ISO Certification
Complaints Management	No registered and valid complaints on the project as to date	Not Applicable	
Realistic and sufficient budget for conducting the environmental monitoring and audit activities	Budget and support from top management	Not Applicable	
Full-time PCO integral to organization		Continuing training of PCO	

6.2. Self-Monitoring Plan *The monitoring plan shall be summarized using Annex 2-20 of RPM for DAO 2003-30 or succeeding issuances as template.*

Provided in **Table 6-2** is the Self-Monitoring Plan as per Annex 2-20 of RPM for DAO 2003-30.

Below is the definition of EQPL-Environmental Quality Performance Level:

Alert or Red Flag	:	Early warning
Action Level	:	Point where management measures must be employed so as not to reach the regulated threshold or limit level, or to reduce deterioration of affected environmental component to pre-impact or optimum environmental quality
Limit Level	:	Regulated threshold of pollutant (standard that must not be exceeded); point where emergency response measures must be employed to reduce pollutants to lower than standard limit.

Proponent opts to have EQPLs formally established post-ECC and based on mutually-agreed upon among Proponent, EMB and other MMT members.

6.3 Existing Environmental Monitoring Plan (EMoP)

The Environmental Monitoring Plan (EMoP) was developed based on the existing monitoring activities of RCMI and was improved on taking into consideration the impacts of the expansion and the results of the impact assessment study.

RCMI implements the following monitoring plan, and submits Self-Monitoring Reports to the DENR EMB Region X on a quarterly basis.

The table below provides information (e.g. specific location of the sampling/ monitoring station). on the environmental monitoring program currently being implemented including monitoring activities on other environmental parameters/aspects (i.e. waste generation, socio-economic, soil quality, reforestation, etc.

Table 6-2. Matrix of Existing Monitoring Plan

Parameter	Location	Frequency	Responsibility	Performance
Water Quality • pH • Temperature • BOD • TSS • Oil & Grease	Provided in **Table 6-3.1**	Quarterly	3rd Party DENR-accredited lab/sampling firm	Passed and Within the Standards
Ambient Air Quality • NO_2 • SO_2 • TSP • Noise	Provided in **Table 6-3.2**	Quarterly	3rd Party DENR-accredited lab/sampling firm	Passed and Within the Standards
Source Emission Air Quality • NO_2 • SO_2 • PM • CO • Heavy Metals • Dioxin & Furans	Provided in **Table 6-3.3**	Annual	3rd Party DENR-accredited lab/sampling firm	Passed and Within the Standards
Soil Quality	Provided in **Table 6-3.4**	Annual	3rd Party DENR-accredited lab/sampling firm	Within the intervention values of the Dutch Intervention Value parameters
OTHERS				
Reforestation **National Greening Program**				Accomplishments in **Table 6-3** below NGP Ongoing
Waste Generation	At designated	Weekly	Thru 3rd party Garbage & TSD entities	No Complaints nor NOVs

Parameter	Location	Frequency	Responsibility	Performance
Socio Economics **SDP**	Not Applicable	Continuing	RCMI SDP Program	**Table 5-1**. SDMP Accomplishments from 2012 to 2016 for Barangay Kiwalan And partially in **Table 6-4** below

Table 6-3. (Also Table 2.1-28) Reforestation Accomplishments

Reforestation Area	No. of Grown Trees	Area Planted (ha)	Year Planted
1	901	0.81	1985
2	1,184	0.47	2000
3	1,186	1.07	1987
4	551	2.7	1981
5	563	0.9	1985
6	149	0.63	1989
7	447	1.61	2002
8	83	0.53	1988
9	285	0.46	1995
10	1,090	1.74	2017
RCMI Buffer Zone	342	1.34	2018
Limestone Quarry & B+240	667	2.71	2019
Near Corehouse	613	1.015	2020
11	170	0.34	1987
12	199	0.4	2000
13	1186	1.07	1987
14	363	0.33	2015 & 2016
15	54	0.06	2017
Refo - 2017 Q1	1,080	1.29	2017
Refo – 2018	887	3.23	2018
Refo – 2019	100	0.25	2019
RCII Buffer Zone	430	0.81	2020
TOTAL	**12,530**	**23.77**	

Table 6-4. SDMP Accomplishments (Partial)

2016	Amount (PhP)
Health	
• Supplemental feeding for identified malnourished (P11,14,16&17)	43,509.00
• Annual Prov. of Medicine- P12,13,15,10,5&5A	59,972.25
• Annual Prov. of Medicine- P11,14,16& 17	49,935.50
Livelihood	
• Capitalization-Purok 16 Women	8,900.00
• Capitalization- Farmers & Gardeners Association	30,346.00
• Capitalization-Ornamental Plants-GKMHPLDT	-
• Stakeholder development/documentary services	42,000.00

2016	Amount (PhP)
Education	
• Scholarship	
- 6 from 3 Puroks & 2 from Muslim residents	70,000.00
- Lerop	94,531.65
• School Supplies – DCC (P11, Quarry, Gym 4)	10,583.00
Infrastructure	
• Riprapping of GK Creek	281,296.00
• Purchase of Jetmatic pumpset (Purok 10)	-
Socio-cultural	
• Assistance to Muslim Community	66,751.50
• Tourism Activities	112,255.00
Barangay Facility	
• Purchase of megaphone	9,000.00
• Purchase of Aircon	50,120.00
Disaster Mgt. & Rescue Equipment	
• Training and seminar on Risk Reduction Management Program	625,489.00

Notes on Table 6-5

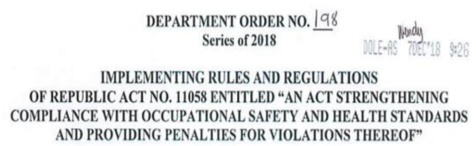
Table includes impact description (e.g .Effluent water quality monitoring, Soil Pollution / Monitoring, Effluent water quality monitoring), frequency (e.g. baseline) and identify the sampling locations/stations

- The range for EQPL values are expressed quantitatively for each parameter being measured and monitored. These values are given in the table below.
- The parameters serve as indicators to provide the condition of the environment during the project implementation and to indicate whether significant changes have been observed as a result of the project these may not necessarily be gleaned from this Table but instead from the SMRs and CMRs in terms of trends over the reporting periods, e.g. every Quarter.
- The parameters and values to be monitored for water applicable to the project are aligned with the General Effluent Standards of DAO 2016-08. The SMRs and CMVRs are compared with the GES of DAO 2016-18.

Table 6-5. Initial Environmental Monitoring Plan (EMoP) with Environmental Quality Performance Levels (EQPLs)

Key Environmental Aspects per Project Phase	Potential Impacts per Envt'l Sector	Parameter to be Monitored	Sampling & Measurement Plan			Lead Person	Annual Estimated Cost	EQPL MANAGEMENT SCHEME					
								EQPL RANGE			MGT MEASURE		
			Method	Frequency	Location			ALERT	ACTION	LIMIT	ALERT	ACTION	LIMIT
PRE-CONSTRUCTION PHASE: The Pre-construction phase in the EPRMP Report covers activities like planning, feasibility study, drawing of plans, surveys, and permit procurement. Earth moving activities, delivery of materials and similar activities include in the Construction Phase.													
CONSTRUCTION PHASE													
Water Component (Water Quality)	Degradation of water quality from domestic wastes of workers, accidental oil spills	BOD	Azide Modification (Dilution Technique)	Quarterly	See Table 6-6 for Water Quality Monitoring Stations	PCO •Consultant	Php 414,000 (surface & groundwater)	35 mg/L	40 mg/L	50 mg/L	Determine Possible source	•Check weather condition during the sampling.	• Conduct resampling and retesting using 3rd party DENR accredited sampling firm
		TSS	Gravimetric (dried at 103-105°C)	Quarterly				56 mg/L	75 mg/L	100 mg/L			
		Fecal Coliform	Multiple Tube Fermentation Technique	Quarterly				300 MPN/100 mL	380 MPN/100 mL	400 MPN/100 mL			
		Oil and grease	Gravimetric (Petroleum Ether Extraction)	Quarterly				2.5 mg/L	3.75 mg/L	5 mg/L			
		Temperature	In situ using temperature meter	Quarterly				> 2.7 °C Change	> 2.8 °C Change	3°C Change			
		pH	In situ using pH meter / Glass electrode	Quarterly				6.6 - 8.1	7.0 - 8.5	6.0-9.5			
Air Component (Air Quality)	Ambient air pollution from fugitive dusts	TSP	USEPA 40 CFR, Part 50, Appendix	Quarterly	See Table 6-7 below for ambient air monitoring stations	PCO	Php 200,000 including Noise	180	190	200 ug/ncm	- ID source of pollutant - Evaluate plant process that emits the pollutant •Monitor	• Corrective action on plant process that emits the pollutant.	Temporary stoppage of polluting source
Air Component (Air Quality)	Noise impacts in receptor areas (AMBIENT)	Sound levels	Sound level measuring device	Quarterly		RCBM PCO	See above (Part of Ambient Air Cost)	70	73	75	- Identification of possible source of noise • Check buffer zones and noise - attenuation measures - Conduct noise modeling	- Corrective action on noise equipment source - Conduct monitoring after corrective action	Temporary stoppage of noise source
People Component	Health & Safety	Injury Statistics	Survey, Incident Reporting	Daily	RCMI– Plant Vicinity	RCMI Safety Officer	Included as part of Operation Budget	**BASED ON DOLE Dept Order 198 Series of 2018 REGULATIONS ON OCCUPATIONAL SAFETY AND HEALTH STANDARDS**					
		Health Statistics	Medical and dental examinations, survey	Annual	RCMI– Plant Vicinity	Medical Clinic	Included as part of Operation Budget						
Land Component	Disturbance of Floral Ecology	No of Trees Cut Critical species	Protocol of CENRO	Based Tree Cutting Permit Tree Inventory as Required by CENRO	At sites of tree cuttings or disturbances	RCMI Forester	To be determined after specific sites of tree cutting established and requirements of CENRO known	To be based on Tree Cutting Permit to be Applied For					
OPERATIONS PHASE													
Water Component (Water Quality)	Water quality degradation from	BOD	Azide Modification (Dilution Technique)	Quarterly	See Table 6-3.1 for Water Quality Monitoring Stations	PCO •Consultant		35 mg/L	40 mg/L	50 mg/L	Determine Possible source	•Check weather condition during the sampling.	• Conduct resampling and retesting using 3rd party DENR accredited sampling firm
		TSS	Gravimetric (dried at 103-105°C)	Quarterly				56 mg/L	75 mg/L	100 mg/L			

	domestic effluents from plant	Fecal Coliform	Multiple Tube Fermentation Technique	Quarterly			Php 414,000 (surface & groundwater)	300 MPN/100 mL	380 MPN/100 mL	400 MPN/100 mL			
	Accidental oil spill	Oil and grease	Gravimetric (Petroleum Ether Extraction)	Quarterly				2.5 mg/L	3.75 mg/L	5 mg/L			
	Sediment/silt movement to Iligan Bay from quarrying	Temperature	In situ using temperature meter	Quarterly				> 2.7 °C Change	> 2.8 °C Change	3°C Change			
		pH	In situ using pH meter / Glass electrode	Quarterly	See Table 6-3.1 for Water Quality Monitoring Stations	PCO	Cost included in Php 414,000	6.6 - 8.1	7.0 - 8.5	6.0-9.5			
Air Component	Ambient air pollution (Kiln stack emissions)	Particulates, CO, SO_2, NO_2	Proper operation and maintenance of the CEMS	Real time	See Table 6-3.3 for source emissions monitoring stations	PCO	Php 480,000	PM: 130 CO: 400 SO2: 1300 NO2: 900	PM: 140 CO: 450 SO2: 1400 NO2: 950	PM: 150 CO: 500 SO2: 1500 NO2: 1000	Check CEMS operations	Implement appropriate corrective action at the CEMS	Corrective action on the kiln system
	Ambient air pollution (Kiln Stack Emission)	PCDDs/PCDF, Sb, As, Cd, Cu, Pb, Hg, Ni, Zn	Source emission tests (S))USEPA Method 3 or 10, USEPA Methods 1 - 5 or 29, USEPA Method 101, USEPA Method 12 (A) Orsat Analyzer or NDIR AAS , Cold vapor technique, or Hg Analyzer	Annual		PCO	Php 700,000	PCDDs/PCDFs: 0.07 Sb: 8 As: 8 Cd: 90 Cu: 8 Pb: 3 Hg: 16 Ni: 180 PzOs: 180 Zn:80	PCDDs/PCDFs: 0.08 Sb: 9 As: 9 Cd:95 Cu: 9 Pb: 4 Hg: 18 Ni: 190 PzOs: 190 Zn:90	PCDDs/PCDFs: 0.1 Sb: 10 As: 10 Cd:100 Cu: 10 Pb: 5 Hg: 20 Ni: 200 PzOs: 200 Zn:100	Evaluate kiln operation	Re-sampling	Corrective action on the kiln system
	Ambient air pollution (Back-up Generator Set)	Particulates, CO, SO_2, NO_2	Source emission tests	Every Two Years		PCO	Php 396,000	PM: 130 CO: 400 SO2: 1300 NO2: 900	PM: 140 CO: 450 SO2: 1400 NO2: 950	PM: 150 CO: 500 SO2: 1500 NOx: 1000	- ID source of pollutant - Evaluate plant process that emits the pollutant	Corrective action on plant process that emits the pollutant.	Temporary stoppage of polluting source
	From inefficiency in operation of APCDs	PM10	High Volume with 10 micron particle-size inlet (A) Gravimetric USEPA 40 CFR, Part 50, Appendix J	Quarterly	See Table 6-7 for Ambient Air Monitoring Stations	PCO	Php 200,000	180	190	200 ug/ncm	- ID source of pollutant - Evaluate plant process that emits the pollutant •Monitor ambient levels at stations • Conduct air dispersion modeling	Corrective action on plant process that emits the pollutant. • Conduct monitoring after corrective action	Temporary stoppage of polluting source
		TSP	(S) 1 hr High Volume-(A) Gravimetric USEPA 40 CFR, Part 50, Appendix B	Quarterly		PCO		280	290	300 ug/ncm	-do-	-do-	-do-

		SO_2	(S) 1hr Gas Bubbler (A) Pararosaniline Method (West and Gaeke Method	Quarterly		PCO		300	320	340 ug/ncm	-do-	-do-	-do-
		NO_2	(S) 1hr Gas Bubbler (A) GriessSaltzman or Chemiluminescence Method	Quarterly		PCO		230	250	260 ug/ncm	-do-	-do-	-do-
	Noise impacts in receptor areas	Sound levels	Hourly sound measurements	Quarterly		PCO	Php 200,000 including Noise	70	73	75	• Identification of possible source of noise	• Corrective action on noise equipment	Temporary stoppage of noise source
											- Check buffer zones and noise - attenuation measures - Conduct noise modeling	source • Conduct monitoring after corrective action	
Monitoring Based on Results of Air Dispersion Modelling													
People Component		Injury Statistics	Survey, Incident Reporting	In regular accident and safety report	RCMI– Plant Vicinity	RCMI Safety Officer	Included as part of Operation Budget	N.A. Part of salaries paid responsible personnel		Based on DOLE protocol and audits of Health and Safety. **Dept Order 198 Series of 2018**  DEPARTMENT ORDER NO. 198 Series of 2018 IMPLEMENTING RULES AND REGULATIONS OF REPUBLIC ACT NO. 11058 ENTITLED "AN ACT STRENGTHENING COMPLIANCE WITH OCCUPATIONAL SAFETY AND HEALTH STANDARDS AND PROVIDING PENALTIES FOR VIOLATIONS THEREOF"			
		Health Statistics	Medical and dental examinations, survey	Based on annual medical check-up of employees	RCMI – Plant Vicinity	Medical Clinic	Included as part of Operation Budget	N.A. Part of salaries paid company health personnel					

The above EQPL ranges are to be confirmed or revised by the MMT and/or by the EMB Monitoring Unit Reg X.

Table 6-6. For Water Quality Monitoring Stations

Location
RCII Drainage Canal - RCMI side
RCMI Drainage Canal - RCII side
Paniangan - Talocao Creek 1
RCII Drainage Canal - Opposite RCII Warehouse
RCMI Silt Pond No. 1
RCMI Silt Pond No. 2
100 m from settling pond

Table 6-7. For Ambient Air Quality Monitoring Stations

Station	Location
1	Purok 9, Sitio Tag-ibo, Brgy. Dalipuga, Iligan City
2	Purok 2, Sitio Tag-ibo, Brgy. Dalipuga, Iligan City
3	Purok 9, Brgy. Kiwalan, Iligan City
4	Purok 10, Matuog, Brgy. Kiwalan, Iligan City
5	Brgy. Acmac, Iligan City
6	Purok 16 Brgy. Kiwalan, Iligan City
7	Purok 9, Brgy. Kiwalan, Iligan City
8	RCII Guest house
9	Pilmico Staffhouse

Table 6-8. For Emission Source Monitoring Stations

Location	Latitude	Longitude
Kiln Main Stack	8°17'16.42'' N	124°15'52.46'' E
Dryer Stack	8°17'16.49'' N	124°15'54.31'' E
AQC Stack	8°17'23.12'' N	124°15'48.89'' E
Coal Mill	8°17'21.84'' N	124°15'48.26'' E
FM1 Stack	8°17'23.35'' N	124°15'48.05'' E
FM2 Stack (PG Stack)	8°17'8.97'' N	124°15'50.94'' E
PHSE 1 Exhaust	8°17'13.72'' N	124°15'44.41'' E
PHSE 2 Stack	8°17'9.98'' N	124°15'47.55'' E

Table 6-9. For Soil Quality Monitoring Stations

Location	Coordinates	
	Latitude	Longitude
RCMI Plant	8°17'21.00"N	124°15'56.00"E
RCMI Plant	8°17'17.00"N	124°15'57.00"E
Access Road	8°17'28.00"N	124°16'0.00"E
Access Road	8°17'30.00"N	124°16'24.00"E
Access Road	8°17'40.00"N	124°15'49.00"E
Access Road	8°17'15.00"N	124°16'11.00"E
Quarry	8°17'34.00"N	124°15'56.00"E
Quarry	8°17'18.00"N	124°16'14.00"E
Quarry	8°17'26.00"N	124°16'26.00"E
Quarry	8°17'40.00"N	124°16'38.00"E

Monitoring Costs: These are based on actual expenses for the sampling and tests by 3rd party registered DENR laboratories and are given in total per set of samples and tests. Individual costs are shown below:

RCMI ACTIVITIES	UNIT OF MEASURE	ACTUAL				
		1Q	2Q	3Q	4Q	Annual
1. Water /Effluent Quality Sampling and Analysis (BOD, TSS, O&G, pH, Temp)	Quarterly	90,000	90,000	90,000	90,000	360,000
2. Ambient Air & Noise Level Sampling and Analysis (TSP,NO2,SO2,PM10)	Quarterly	50,000	50,000	50,000	50,000	200,000
3. Stack Sampling and Analysis (Particulates, SO2, NO2,CO)	Semi-Annual	198,000	-	198,000	-	396,000
4. Stack Sampling and Analysis for Heavy Metals and D&F	Annual	700,000	-	-	-	700,000
5. Soil Sampling	As needed	157,000 (10 samples)				

6.3 Multi-Sectorial Monitoring Framework *Discussion on the necessity of creating a Multi-Partite Monitoring Team (MMT). If deemed necessary, describe the proposed scope of MMT responsibilities and activities and tabulate the list of proposed stakeholder-members of the MMT, basis of selection and proposed role. (See Annex 3-4 of the RPM for DAO 2003-30).*

A Multi-Partite Monitoring Team (MMT) has been organized and is now operative for the original ECCs.

Table 6-10. Existing List of MMT Membership

RCMI – MMT MEMBERS	
Alvin M. Villanueva	MGB Chairman
Hussein Hamdi S. Mohamad	EMB Representative
Paolo D. Abantas	DENR Representative
Ronilo B Baculio	NGO Representative
Grecita L. Catubig	Brgy. Kiwalan
Juvilyn D. Claveria	Brgy Acmac
Nilda C. Hamoy	Brgy Dalipuga
Omar M. Cader	Brgy Bonbonon
Efren C. Semblente	Brgy Bunawan
Rejie O. Manghanoy	LGU Iligan City
Reynaldo B. Casomo	Company Representative
Nisa L. Sampaco	Company Representative

Table 6-11. Proposed List of MMT Members (Note)

RCMI – MMT MEMBERS	
Alvin M. Villanueva	MGB
	DENR CENRO
Ronilo B Baculio	LGU accredited NGO Representative
Grecita L. Catubig	Brgy. Kiwalan
Juvilyn D. Claveria	Brgy Acmac
Nilda C. Hamoy	Brgy Dalipuga
Omar M. Cader	Brgy Bonbonon
Efren C. Semblente	Brgy Bunawan
Rejie O. Manghanoy	LGU Iligan City

Note: Subject to the final MOA on the MMT

6.4 Environmental Guarantee Monitoring Fund Commitments

If with processing, proposed amount of Environmental Guarantee Fund (EGF) and the basis for the estimate following the guidelines in annex 3-6 of RPM for DAO 2003-30

Environmental Monitoring and Guarantee Fund Commitments
Environmental Monitoring Fund (EMF)

The Environmental Monitoring Fund (EMF) is a fund that a Proponent shall commit to establish in support of the activities of the MMT for the compliance monitoring. The EMF will be established as agreed upon and specified in the MOA between DENR-EMB and the Proponent, with conformity of the MMT members.

The EMF shall specifically be used to defray MMT expenses such as:

- Cost of transportation, board and lodging;
- MMT meetings rental of equipment – the Proponent may allow MMT members to use its equipment. If necessary, the EMF may include provisions for the rental of equipment. In cases where the EMF is sufficient to purchase equipment, such equipment may be acquired only when a clear and distinct system of accountability (e.g. possession, custody, storage, use, etc.) has been formulated;
- Documentation (photos, video, etc.)
- Sampling, shipment or transport of samples including laboratory analysis;
- Hiring outside experts or subcontracting of a monitoring work to a neutral party;
- Training of the MMT;
- Preparation of monitoring reports and distribution; and
- Public information campaign/dissemination – to lessen unnecessary expenses, activities related to public information campaign/dissemination shall be undertaken using the existing or local offices/units of the PIA, KBP and similar agencies as well as the public information/affairs office of the local government units.
- Payment of honoraria shall be commensurate to services rendered by the MMT members for actual monitoring activities.

Environmental Guarantee Fund (EGF)

An Environmental Guarantee Fund (EGF) shall be established for the projects that have been determined by EMB to pose a significant public risk or where the project requires rehabilitation or restoration.

Under the existing ECC an EGF has been set for the original Project.

The EGF shall be established for the following purposes:

- The immediate rehabilitation of areas affected by damage to the environment and the resulting deterioration of the environment quality as a direct consequence of project construction, operation
- and abandonment;
- The just compensation of parties and communities affected by the negative impacts of the project;
- The conduct of scientific or research studies related to the project that will aid in the prevention or rehabilitation of accidents and/or environmental damages; and
- For contingency clean-up activities, environmental enhancement measures, damage prevention programs and social equity measures (e.g. livelihood, social development programs) including the necessary IEC and capability building activities related to the project.
- There is no explicit provision under DAO 03-30 requiring valuation of potential impacts that may arise as a result of changes in the use of natural and environmental resources. Impact evaluation is particularly crucial in estimating the EGF to derive estimates on the potential damage that may occur, and the corresponding amount to be set aside through the EGF purposes. Procedures for arriving at such estimates in a more rational and systematic manner will have to be based on experiences that shall have been generated on Philippine examples and other developing countries.
- The amount to be allocated for the EGF shall be determined through negotiations between the Proponent and the EMB and shall be specified in the Memorandum of Agreement (MOA) in consultation with the LGUs (province, municipality, barangay) and NGO/PO representative.
- In case the available fund in the EGF is not sufficient to pay for compensable claims the Proponent will provide additional funds to cover the cost of rehabilitation, restoration or other activities for which the EGF was established. As such, the Proponent will replenish the EGF whenever the amount falls below the 50% of the agreed level.

Written complaints or claims must be filed with the DENR Regional Office with accompanying evidence within one (1) month after damages have occurred, otherwise such complaint or claim will not be entertained. The Proponent shall exercise due diligence and prudence in validating or assessing compensation for such claims. Any claims approved by the MMT and certified by the EMB or the DENR Regional Offices shall be paid to the claimant within 30 days after the receipt of notice by the Proponent.

The MMT arbitrates any disputes between the claimant and the Proponent. Their decision shall be final and executory. For the expansion project the existing MMT, EMF and EGF shall be revised accordingly.

The levels of funds for the EMF and EGF shall be the same as existing.

The Status of Existing EGF as of June 30, 2020

RCF: Php 2,603,138.93
MTF: Php 162,299.50
ETF: Php 178,076.06

The EGF additional amount for the proposed expansion will submitted thru a Memorandum of Agreement (MOA) once the ECC is approved and it should be also approved by the MMT.

Separate MMT and EGF for Quarry and Cement Plant Not deemed practical because (a) There is only one corporate entity responsible (b) Monitoring for quarry and separately for cement plant not practical and (c) Cement Plant has its separate ECC distinct and apart from the EPRMP.

Proposed Amount of the EGF

1. For the CLRF Rehabilitation Cash Fund (RCF) = Php 5,000.000.00
2. Monitoring Trust Fund (MTF) = Php 150, 000.00
3. Environmental Trust Fund (ETF) = Php 50,000.00
4. SDMP fund is anchored to the 1.5% of Direct Milling and Mining Cost

The above will be discussed with the MMT upon its formation taking due note of DAO 2017-15.

SECTION 7.0 DECOMMISSIONING / ABANDONMENT / REHABILITATION POLICY

Statement on proponent's policies to implement the abandonment plan and to formulate and submit procedures for Rehabilitation/Decommissioning/Abandonment within a timeframe to be specified in the ECC.

The policies for the abandonment plan for the expansion project are essentially the same as those for the original project noting that the same type of operations are involved. Moreover, the plant expansion shall be within the existing plant compound while the quarry areas shall be within the existing ones as well; hence, the environmental resources, principally the land, shall have the same features.

RCMI has set a framework for action and setting of objectives that includes plans for decommissioning and rehabilitation of each component of the mining area, including the social plan for the workers, host and neighboring communities, and with appropriate funding mechanism to ensure availability of sufficient funds to implement the plan completely.

Its primary concerns for the decommissioning and closure are to ensure public safety and health, environmentally stable conditions compatible with the surrounding environment are achieved and to minimize environmental impacts caused by mining. The overall objective is to provide a social, economic, and environmentally sustainable development. It is the intention of the Project Proponent that the land and other facilities will be of beneficial use to the host communities after the project closure. The Local Government may likely expect that some facilities will be donated to the barangay/s whereby they can use these for other purposes depending on the agreed plan.

Specifically, this plan is prepared with the following objectives:

- To prevent or eliminate long-term environmental impacts by returning mining-disturbed land to a physically and chemically stable; visually acceptable; productive or self-sustaining condition, taking into consideration the beneficial uses of the land and the surrounding areas and as agreed with the stakeholders; and

- To ensure that alternative livelihood opportunities are established and left behind to the host/neighboring communities.

It is important to note that progressive rehabilitation of mined-out and other idle areas is already ongoing. In fact, the formerly logged over mountainous area within the Company's MPSA is now revegetated with a variety of trees such as Mahogany, Gmelina, Ipil-ipil, Cherries, Acacia, Palomari, Talisay, Bagrass, Balite, Duldol, Tipolo, Indian Tree, Madre de Cacao, Mango, Jackfruit, Avocado, Narra, Tugas, etc. Other areas that were rehabilitated include the buffer zone of creeks, private lots, permit areas and others.

For the Plant Facilities

The decommissioning will simply involve the stoppage of the operation of the facilities, e.g. the clinker production and the disposal of equipment that would no longer be used. There are no perceived adverse residual effects on the environment (land, water and air). The stockpiled coal will be disposed to a third party**.**

For the Quarrying Operations

The approved Integrated Environmental Protection and Enhancement Program (EPEP) and Final Mine Rehabilitation and Decommission Plan (FMRDP) dated March 28, 2018, will be strictly observed see attached **Annex 1-1** While it may be noted that this is for MPSA 031-95-XII, the same guidelines and protocols will be observed for all of the quarrying projects of RCMI.

Final Land Use of the Site and for Each Identified Mine Component

The final pit design will conform to the land use based on the CLUP of Iligan City. Once mined-out, it will be converted into agro-forest land in combination with grazing area in parts. The ongoing progressive rehabilitation shall continue until the end of the MPSA period. Final rehabilitation will then follow during the decommissioning phase. Basically, there will be backfilling of the topsoil which was stripped and stored at the start of quarrying each area. Recontouring will also be done.

Key Aspects of the Decommissioning and Abandonment Phase

Social plan for workers:

Fair and equitable retrenchment packages. By the time of closure, the workers shall have gained sufficient knowledge, skills and experience that shall make them highly employable in similar industries.

A livelihood-training program is also planned for residents so that upon closure, the residents would become self-reliant on their new livelihood activities.

Social plan for the host and neighboring communities:

Continuous implementation of its 5-year Social Development and Management Program (SDMP). During the decommissioning phase, there shall be livelihood programs, educational assistance, health care program, and infrastructure projects. These programs are intended to address the need of the communities even after the closure period.

Buildings that can be utilized, if acceptable, will be donated to either the landowner or LGU.

Decommissioning strategy includes:

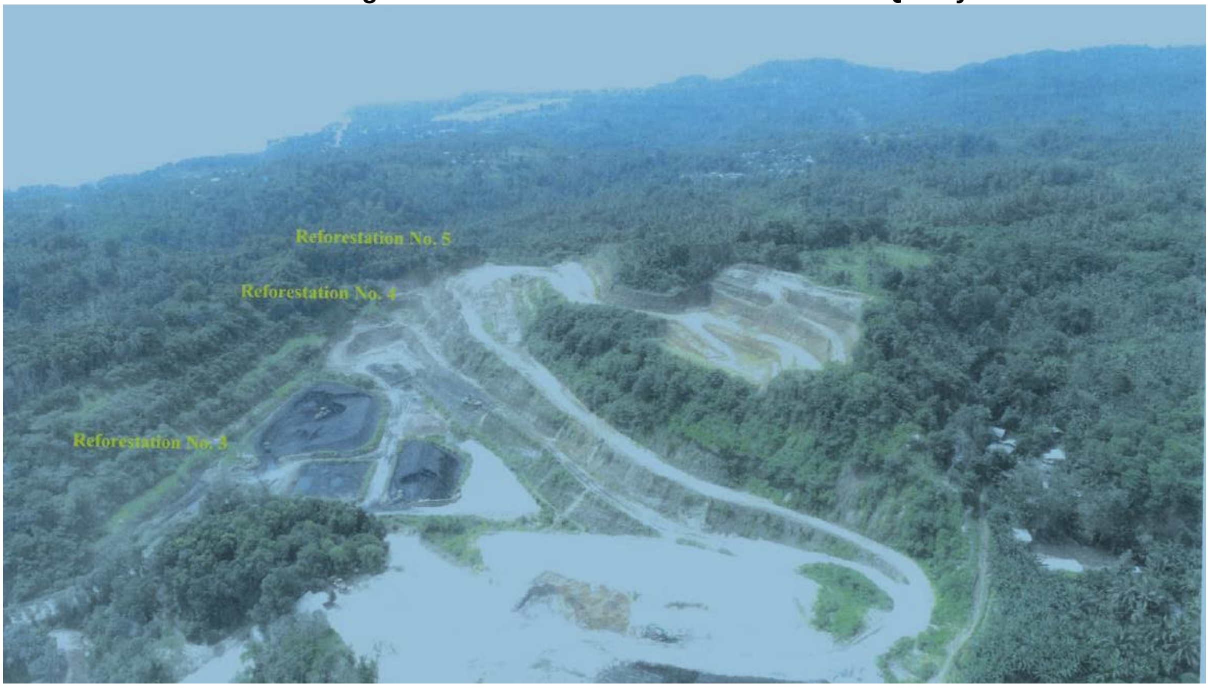
- Formation of the Closure Team and start of IEC campaign;
- Inventory and assessment of conditions of all equipment and facilities;
- Planning and review of decommissioning procedures vis-à-vis the standard operating procedures;
- Cross matching of Company personnel and residents with the decommissioning tasks; with trainings provided if necessary;
- Consultation with stakeholders and strengthening of IEC;
- Site investigation for residual impacts;
- Site remediation if necessary;
- Removal, disposal and cleanup of unused chemicals and wastes;
- Decommissioning of stockyards;
- Decommissioning of solid waste dumps;
- Road closure works for dedicated access to mine sites (if not needed by community);
- Decommissioning of the Project’s water supply and sewage system;
- Continued works on rehabilitation of the mined-out areas;
- Decommissioning of plant, offices and workshops; and
- Post assessment by the Closure Team.

Decommissioning Strategy for Each of the Components

Component	Strategy / Technique	Timing	Measurement for Success
Quarry Pit (benches, pit bottom, catchment berm, haul roads)	Re-contour berm, trim slopes and provide a canal or ditch, place top soil and fertilizer, provide erosion control	Two (2) hectares in a year	Mortality rate, photo documentation of trees, no. of landslides and no. of flooding
Waste Dump	Benching of waste dump every 5 meters, place top soil, ditch directed away from waste dump, riprap weak portion, slopes lowered against angle of repose, 1% grade of waste dump floor to direct water away from the crest line, place fertilizer, plant Madre de cacao, Ipil-ipil and acacia	One (1) year	Mortality rate, photo documentation, no. of landslides and no. of floodings
Ponds & Drainage	Establish drainage away from revegetated areas, maintain direction of flow, plant grasses, regular inspection and replace dead plants, apply fertilizer	One Year for each segment	Mortality rate, photo documentation, no. of landslides and no. of floodings
Infra structures	Demolition of unnecessary structures, if any.	Three (3) years	Removal and clean-up of the area

The Proponent is aiming for land use that is similar or close to the pre-mining state, hence, revegetation thru progressive rehabilitation is the focus of the FMRDP. This is illustrated in **Plate 7-1**. The plantation of carbon dioxide sequestering tree species will be seriously evaluated and implemented when feasible.

Plate 7-1. Image of the Reforestation Area at the Shale Quarry



The major options for rehabilitation are:

Open Pit

Soil backfill, recontouring and reforestation

Catchment Ponds/Drainage System

Soil backfill, recontouring and reforestation; all ponds and drainage in the mining area will be maintained until full rehabilitation of the mined-out parcels.

Haul Roads and Mine Access Roads

If considered useful by the community, the internal roads will be left for their use. If not, these will be replanted with water diversion measures installed.

Infrastructure

Removal of unnecessary structures, re-profiling and revegetation.

Buildings and Equipment

Removal of unnecessary structures, re-profiling and revegetation.

Note that infrastructure, buildings and equipment that are deemed useful to the communities shall be handed over to the hosts.

The parameters to be measured/evaluated after restoration efforts shall include slope stability (stable bench slopes, erosion mitigation applied, proper drainage); water quality (pH level is 6); vegetation (land use compatible with City's plan; no bare surface except for access road; vegetation is a healthy mixture of grasses, shrubs and trees; no pests; weeds do not dominate); and safety (provided with bund walls, safety fences, and warning signs).

These are all detailed in the **Annex 1-2"** The Integrated EPEP and FMRDP". While it may be noted that this is for MPSA 031-95-XII, the same guidelines and protocols will be observed for all of the quarrying projects of RCMI.

SECTION 8.0 INSTITUTIONAL PLAN FOR EMP IMPLEMENTATION

Republic Cement Mindanao (RCMI) will adopt the institutional/organizational plan previously set up for the Republic Group which includes Republic Cement Iligan Inc. (RCII) which has merged with RCMI.
.
All divisions and departments collaborate and work together to achieve all plant objectives in consonance with environmental protection.

The **Plant Manager** is responsible for planning, directing and integrating manufacturing operations, and other related activities to ensure overall delivery of customer service, product quality, safety in operation, environmental and quality management systems, operating efficiency and delivery of budget commitments. The scope covers all activities in the plant from quarrying, to ship loading, production and maintenance, safety, quality control and improvement systems. This job is also responsible for the establishment of succession plan for key positions.

The **Production** Division ensures the proper management of all manufacturing activities and effectively utilizes resources to meet production targets, product quality and delivery schedules.

The **Maintenance** Division ensures machine availability, overall plant efficiency and the consistent enhancement of process capability for the achievement of production targets. It also directs controls and integrates the various short and long term programs for effective repair and troubleshooting maintenance.

The **Finance** team ensures proper management and control of financial assets, cash transactions and the procurement and placement thereof for optimum use, economies of sales, administration and effective response to the needs of the business.

The **Human Resources and Administration** team is responsible in providing effective and efficient delivery of personnel, administrative and general services. The department develops and implements training and development programs to ensure that employees have the skills and competencies required to meet company goals. Employee engagement and labor relations is planned and coordinated through the department.

The **Health and Safety** team is responsible for the formulation and implementation of company polices systems, procedures and the planning of programs relative to health and safety management. Furthermore, this team is responsible for providing the necessary services to the different operating divisions/departments/units of the company relative to health and safety matters.

Figure 8-1 reflects the RCMI's institutional plan which includes the key position of Environmental and Community Relations (COMREL) Manager.

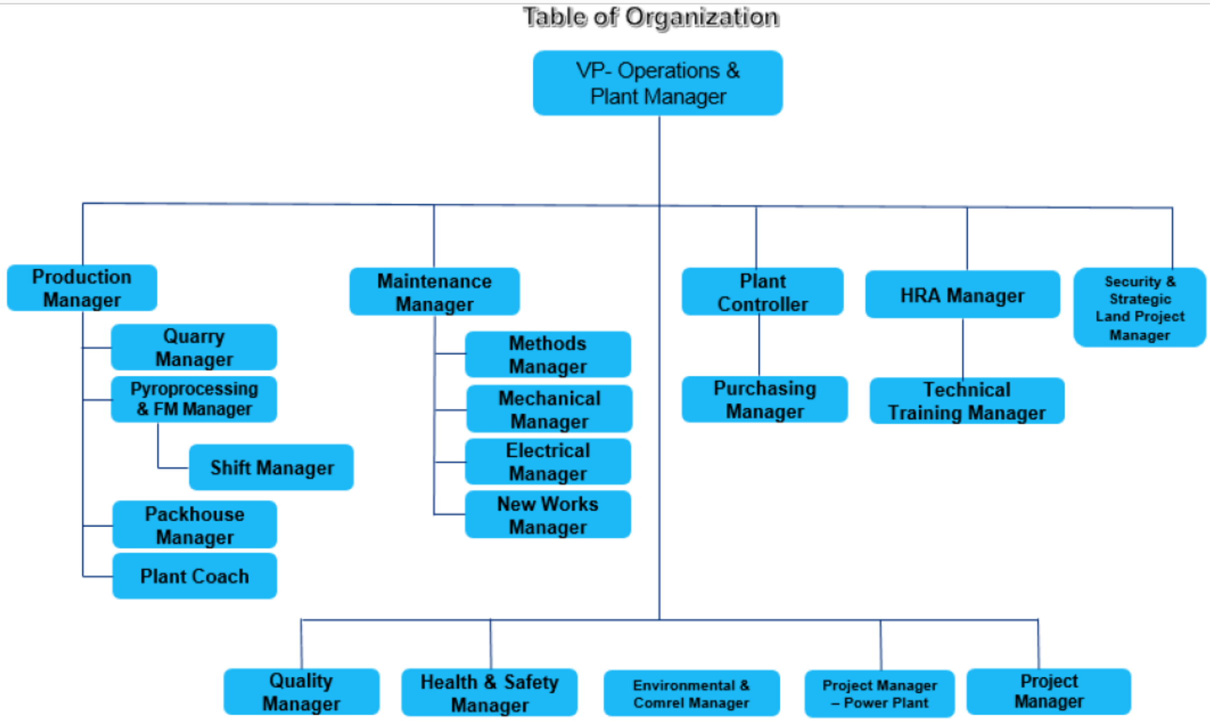


Figure 8-1. The Institutional Plan

Republic Cement Mindanao, Inc. Grievance Mechanism

Objective

To establish a consistent system for receiving, documenting and responding to relevant communication from external source related to company's quality, environment and health and safety performance.

Scope

From receipt of communication up to feedback to the external parties that includes customers complaints.

PROCEDURE	RESPONSIBILITY	DETAILS
Start		
Receive External Communication	All employees	➢ If information is verbal, identifies & informs the responsible person in the organization for the subject in the communication. If in doubt, check with the QMR/ EMR/ HSMR/ IMR. ➢ For written communication, transmits/ forwards to the QMR/ EMR/ HSMR/ IMR
	QMR/ EMR/ HSMR/ IMR	➢ Reviews the content of communication & records it in the External party communication logbook
Determine Action needed	Concerned Personnel	➢ If the action needed will take some time to complete, advise the concerned party
Implement Action	Concerned Personnel/ QFHSAR Process Owner	➢ Renders action upon receipt. ➢ Transmits to QMR/ EMR/ HSMR/ IMR
Review communication process	QMR/ EMR/ HSMR/ IMR	➢ Advises external party od action taken ➢ Gets feedback id subject of communication is adequately addressed, as applicable.
Implement Improvement action	QMR/ EMR/ HSMR/ IMR	➢ Review is done quarterly ➢ Review record of external communications to determined effectiveness.
End	Concerned Personnel	➢ Determines improvement action needed.

Note: External parties- any person or entity nor employed by Republic Cement Mindanao, Inc. (RCMI)

Forms and records generated

1. External party communication logbook
2. External communications
3. Memo on disposition rendered
4. Letter of response
5. Action taken